

What is claimed is:

1. ~~A method, comprising:~~

1. ~~by for use in~~ a user equipment, the method comprising:

5 ~~selecting, while the user equipment is~~ in an inactive or idle state ~~and in re-~~
~~sponse to having uplink data that is to be transmitted, selecting~~
~~which,~~ one of multiple uplink transmission schemes ~~should to~~ be used
to transmit ~~the~~ uplink data, wherein the multiple uplink transmission
10 schemes comprise ~~a regular connection establishment~~ an uplink
transmission scheme performed via a radio resource control, RRC,
setup or resume procedure, a random access based small data trans-
mission, ~~or scheme, and~~ a preconfigured grant based uplink trans-
mission scheme; and
15 performing the selected uplink transmission scheme to transmit the uplink
data.

2. The method according to claim 1, wherein when both the preconfigured
grant based uplink transmission scheme and the random access based
20 small data transmission scheme are configured for the user equipment, ~~and~~
~~wherein:~~

selecting further comprises selecting the random access based small data
transmission scheme in response to a ~~current time being outside a~~
~~time threshold to a time for a~~ grant occasion for the preconfigured
grant based uplink transmission scheme is more than a time thresh-
25 old ahead and performing the selected uplink transmission scheme
further comprises performing the ~~regular connection establish-~~
~~ment~~ RRC setup or resume procedure to transmit ~~the small~~ an amount
of uplink data; or

selecting further comprises selecting the preconfigured grant based uplink
30 transmission scheme in response to a ~~current time being inside the~~
~~time threshold to the time for the~~ grant occasion for the preconfigured

grant based uplink transmission scheme is less than a time threshold ahead and performing the selected uplink transmission scheme further comprises performing the preconfigured grant based uplink transmission scheme using the grant occasion to transmit the ~~small~~ amount of uplink data.

3. — The method according to claim 1 or 2, wherein ~~both the preconfigured grant and small data transmission are configured for the user equipment, but one of the preconfigured grant or small data transmission is to be used by the user equipment, and wherein:~~

~~selecting further comprises selecting whichever one of the preconfigured grant or small data transmission is to be used by the user equipment and performing the selected~~based uplink transmission scheme ~~further comprises performing or the one of the preconfigured grant or ran-~~
dom access based small data transmission ~~that is to be used by the user equipment to transmit the small amount of uplink data.~~

4. — ~~The method according to claim 3, wherein in response to one of the preconfigured grant or small data transmission being configured with a first type of signaling and the other of the preconfigured grant or small data transmission being configured with a second type of signaling, selecting the one of the preconfigured grant or small data transmission that is configured with the first type of signaling as the one of the preconfigured grant or small data transmission that is to be used by the user equipment.~~

5. — ~~The method according to claim 4, wherein the first type of signaling is dedicated signaling and the second type of signaling is broadcast signaling.~~

6. — ~~The method according to claim 4, wherein the first type of signaling is broadcast signaling and the second type of signaling is dedicated signaling.~~

~~7. The method according to claim 1, wherein one of the preconfigured grant scheme or the small data transmission uplink transmission scheme is configured for the user equipment at a time.~~

5 ~~8.3. The method according to any one of claims 1 to 7, wherein one of the pre-~~
~~configured grant or small data transmission~~ is selected and transmission is
performed using the selected one of the preconfigured grant based uplink
transmission scheme or the random access based small data transmission
10 scheme, and the method further comprises releasing by the user equipment
configuration for the one of the preconfigured grant based uplink transmis-
sion scheme or the random access based small data transmission scheme
that was not selected.

15 ~~9.4. The method according to any one of claims 1 to 83, wherein a small data~~
transmission is performed using an early data transmission that uses a ran-
dom access channel procedure.

20 ~~10.5. The method according to any one of claims 1 to 94, wherein the regular con-~~
~~nection establishment~~ RRC setup or resume procedure comprises one or
more of the following: a radio resource control connection setup procedure;
a radio resource control connection resume procedure; or a radio resource
control connection re-establishment procedure.

25 ~~11. The method according to any one of claims 1 to 9, wherein selecting com-~~
~~prises the user equipment selecting to use a small data transmission or pre-~~
~~configured grant in response to the user equipment being allowed to per-~~
~~form radio resource measurements according to one or both of the following~~
~~conditions:~~
a low mobility condition is used for determining whether small data transmis-
30 sion or preconfigured grant or both are allowed; or

~~a cell edge condition is used for determining whether small data transmission or preconfigured grant or both are allowed.~~

5 ~~12. The method according to claim 11, wherein, in response to the user equipment being determined to having a low mobility, the user equipment is allowed to use small data transmission or preconfigured grant or both.~~

10 ~~13. The method according to any one of claims 11 or 12, wherein, in response to the user equipment being determined meet a cell edge condition, the user equipment is allowed to use small data transmission or preconfigured grant or both.~~

15 ~~14. The method according to claim 1, wherein neither a preconfigured grant nor a small data transmission is configured for the user equipment, and wherein: selecting further comprises selecting the regular connection establishment and performing the selected uplink transmission scheme further comprises performing the regular connection establishment to transmit the uplink data.~~

20 ~~15. The method according to claim 1, wherein a preconfigured grant is configured for the user equipment but small data transmission is not configured for the user equipment, and wherein:~~
25 ~~selecting further comprises selecting the regular connection establishment in response to a current time being outside a time threshold to a time for a grant occasion for the preconfigured grant and performing the selected uplink transmission scheme further comprises performing the regular connection establishment to transmit the small amount of uplink data; or~~
30 ~~selecting further comprises selecting the preconfigured grant in response to a current time being inside the time threshold to the time for the grant~~

~~occasion for the preconfigured grant and performing the selected uplink transmission scheme further comprises performing the preconfigured grant using the grant occasion to transmit the small amount of uplink data.~~

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~~16.6.~~ The method according to ~~any one of claims 1 to 155~~, wherein the uplink data is an amount of data that is determined to be small based on implementation in the user equipment or a received threshold based on which the user equipment evaluates to determine whether the amount of data is small.

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~~17.7.~~ The method according to any one of claims 1 to ~~166~~, wherein the selecting is based on received information, and the received information comprises one or both of data amount or time thresholds for one or more of the multiple uplink transmission schemes.

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~~18.8.~~ The method according to claim ~~177~~, wherein the method further comprises receiving the received information via one or both of dedicated signaling or broadcast signaling.

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~~19.9.~~ The method according to claim ~~188~~, wherein the dedicated signaling comprises one or more radio resource control release messages or the broadcast signaling comprises system information block signaling.

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~~20.10.~~ A method, ~~for use in a network node, the method~~ comprising:
sending, ~~from a network node~~ to a user equipment, information configured to allow the user equipment, ~~while the user equipment is in an inactive or idle state~~, to select ~~which~~ one of multiple uplink transmission schemes ~~should to~~ be used to transmit uplink data, wherein the multiple uplink transmission schemes comprise ~~a regular connection establishment, an uplink transmission scheme performed via a radio resource control, RRC, setup or resume procedure, a random access~~

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based small data transmission, ~~or~~and a preconfigured grant based
uplink transmission scheme; and
receiving by the network the uplink data transmitted by the user equipment
using the selected uplink transmission scheme.

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~~21.— The method according to claim 20, wherein the network node does not con-
figure both the small data transmission and preconfigured grant for the user
equipment at substantially a same time.~~

10 ~~22.— The method according to claim 20, wherein sending the information com-
prises configuring one of the preconfigured grant or small data transmission
with a first type of signaling and the other of the preconfigured grant or small
data transmission being configured with a second type of signaling.~~

15 ~~23.— The method according to claim 22, wherein the first type of signaling is dedi-
cated signaling and the second type of signaling is broadcast signaling.~~

~~24.— The method according to claim 22, wherein the first type of signaling is
broadcast signaling and the second type of signaling is dedicated signaling.~~

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25-11. ~~The method according to any one of claims 20 to 24~~10, wherein receiving
comprises receiving a small data transmission that uses an early data trans-
mission that uses a random access channel procedure.

25 26-12. The method according to ~~any one of claims 20 to 25~~claim 10 or 11, wherein
the ~~regular connection establishment~~RRC setup or resume procedure com-
prises one or more of the following: a radio resource control connection
setup procedure; a radio resource control connection resume procedure; or
a radio resource control connection re-establishment procedure.

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27.13. The method according to any one of claims ~~20 to 26~~10-12, wherein the sent information comprises one or both of data amount or time threshold for one or more of the multiple uplink transmission schemes.

5 28.14. The method according to claim ~~27~~13, wherein the sending the information further comprises sending the information via one or both of dedicated signaling or broadcast signaling.

10 29.15. The method according to claim ~~28~~14, wherein the dedicated signaling comprises one or more radio resource control release messages or the broadcast signaling comprises system information block signaling.

~~30. — A computer program, comprising code for performing the methods of any one of claims 1 to 29, when the computer program is run on a computer.~~

15 ~~31. — The computer program according to claim 30, wherein the computer program is a computer program product comprising a computer readable medium bearing computer program code embodied therein for use with the computer.~~

20 ~~32. — The computer program according to claim 30, wherein the computer program is directly loadable into an internal memory of the computer.~~

16. — An apparatus comprising A user equipment comprising:

25 ~~33. — means for performing:~~
~~by a~~selecting, while the user equipment is in an inactive or idle state ~~and in~~
~~response to having uplink data that is to be transmitted, selecting~~
~~which,~~ one of multiple uplink transmission schemes ~~should to~~ be used
to transmit ~~the~~ uplink data, wherein the multiple uplink transmission
30 schemes comprise an uplink transmission scheme performed via a
~~regular connection establishment~~radio resource control, RRC, setup

or resume signaling based uplink transmission scheme, a random access based small data transmission, ~~or scheme, and~~ a preconfigured grant based small data transmission scheme; and
means for performing the selected uplink transmission scheme to transmit the uplink data.

34.17. The ~~apparatus~~ user equipment according to claim ~~33~~ 16, wherein both the preconfigured grant based uplink transmission scheme and the random access based small data transmission scheme are configured for the user equipment, and wherein:

selecting further comprises selecting the random access based small data transmission scheme in response to ~~a current time being outside a time threshold to a time for~~ a grant occasion for the preconfigured grant based uplink transmission scheme is more than a time threshold ahead and performing the selected uplink transmission scheme further comprises performing the ~~regular connection establishment~~ RRC setup or resume procedure to transmit ~~the small~~ an amount of the uplink data; or

selecting further comprises selecting the preconfigured grant based uplink transmission scheme in response to a ~~current time being inside the time threshold to the time for the~~ grant occasion for the preconfigured grant based uplink transmission scheme is less than a time threshold ahead and performing the selected uplink transmission scheme further comprises performing the preconfigured grant based uplink transmission scheme using the grant occasion to transmit the ~~small~~ amount of the uplink data.

35.—The ~~apparatus~~user equipment according to claim ~~33~~16 or 17, wherein ~~both~~one of the preconfigured grant and small data transmission are configured for the user equipment, but one of the preconfigured grant or small data transmission is to be used by the user equipment, and wherein: selecting further comprises selecting whichever one of the preconfigured grant or small data transmission is to be used by the user equipment and performing the selected uplink transmission scheme further comprises performing the one of the preconfigured grant or small data transmission that is to be used by the user equipment to transmit the small amount of uplink data.

36.—The apparatus according to claim 35, wherein in response to one of the preconfigured grant or small data transmission being configured with a first type of signaling and the other of the preconfigured grant or small data transmission being configured with a second type of signaling, selecting the one of the preconfigured grant or small data transmission that is configured with the first type of signaling as the one of the preconfigured grant or small data based uplink transmission that is to be used by the user equipment.

37.—The apparatus according to claim 36, wherein the first type of signaling is dedicated signaling and the second type of signaling is broadcast signaling.

38.—The apparatus according to claim 36, wherein the first type of signaling is broadcast signaling and the second type of signaling is dedicated signaling.

39.—The apparatus according to claim 33, wherein one of the preconfigured grant scheme or the random access based small data transmission uplink transmission scheme is configured for the user equipment at a time.

- 5 ~~40.18.~~ The ~~apparatus according to any one of claims 33 to 39, wherein one of the preconfigured grant or small data transmission is selected and transmission~~scheme is performed using the selected one of the preconfigured grant based uplink transmission scheme or the random access based small data transmission scheme, and the apparatus further comprises means for releasing by the user equipment configuration for the one of the preconfigured grant based uplink transmission scheme or the random access based small data transmission scheme that was not selected.
- 10 ~~41.19.~~ The ~~apparatus~~user equipment according to any one of claims ~~33 to 40~~16-18, wherein a small data transmission is performed using an early data transmission that uses a random access channel procedure.
- 15 ~~42.20.~~ The ~~apparatus~~user equipment according to any one of claims ~~33 to 41~~16-19, wherein the ~~regular connection establishment~~RRC setup or resume procedure comprises one or more of the following: a radio resource control connection setup procedure; a radio resource control connection resume procedure; or a radio resource control connection re-establishment procedure.
- 20 ~~43.~~ — The ~~apparatus according to any one of claims 33 to 41, wherein selecting comprises the user equipment selecting to use a small data transmission or preconfigured grant in response to the user equipment being allowed to perform radio resource measurements according to one or both of the following conditions:~~
- 25 ~~a low mobility condition is used for determining whether small data transmission or preconfigured grant or both are allowed; or~~
~~a cell edge condition is used for determining whether small data transmission or preconfigured grant or both are allowed.~~

44. ~~The apparatus according to claim 43, wherein, in response to the user equipment being determined to having a low mobility, the user equipment is allowed to use small data transmission or preconfigured grant or both.~~

45. ~~The apparatus according to any one of claims 43 or 44, wherein, in response to the user equipment being determined meet a cell edge condition, the user equipment is allowed to use small data transmission or preconfigured grant or both.~~

46.21. ~~The apparatus according to claim 3316, wherein neither at the preconfigured grant based uplink transmission scheme nor at the random access based small data transmission scheme is configured for the user equipment, and wherein:~~

~~selecting further comprises selecting the regular connection establishment RRC setup or resume procedure and performing the selected uplink transmission scheme further comprises performing the regular connection establishment RRC setup or resume procedure to transmit the uplink data.~~

47.22. ~~The apparatus user equipment according to claim 3316, wherein at the preconfigured grant based uplink transmission scheme is configured for the user equipment but the random access based small data transmission scheme is not configured for the user equipment, and wherein:~~

~~selecting further comprises selecting the regular connection establishment RRC setup or resume procedure in response to a current time being outside a time threshold to a time for a grant occasion for the preconfigured grant based uplink transmission scheme is more than a time threshold ahead and performing the selected uplink transmission scheme further comprises performing the regular connection establishment RRC setup or resume procedure to transmit the small amount of the uplink data; or~~

selecting further comprises selecting the preconfigured grant based uplink transmission scheme in response to a ~~current time being inside the time threshold to the time for the~~ grant occasion for the preconfigured grant based uplink transmission scheme is less than a time threshold ahead and performing the selected uplink transmission scheme further comprises performing ~~the~~he preconfigured grant based uplink transmission scheme using the grant occasion to transmit the ~~small~~ amount of the uplink data.

48.— The ~~apparatus~~user equipment according to any one of claims ~~33 to 47~~16-22, wherein the ~~uplink data is an amount of data that is determined to be small based on implementation in the user equipment or a received threshold based on which the~~ user equipment ~~evaluates to determine whether the amount of data is small.~~

49.— The apparatus according to any one of claims 33 to 48, wherein the selecting is based on received information, and the received information comprises one or both of data amount or time thresholds for one or more of the multiple uplink transmission schemes.

~~50-23.~~ The apparatus according to claim 49, wherein the apparatus further comprises means for receiving the received information via one or both of dedicated signaling or broadcast signaling.

~~51-24.~~ The ~~apparatus~~user equipment according to claim ~~50~~23, wherein the dedicated signaling comprises one or more radio resource control release messages or the broadcast signaling comprises system information block signaling.

52.25. A ~~user equipment network node~~ comprising ~~the apparatus of any one of~~
~~claims 33 to 51.~~

53. — An apparatus comprising means for performing:

5 sending, ~~from a network node~~ to a user equipment, information configured
to allow the user equipment to select ~~which~~, while the user equipment
is in an inactive or idle state, one of multiple uplink transmission
schemes ~~should to~~ be used to transmit uplink data, wherein the multi-
10 ple uplink transmission schemes comprise ~~a regular connection es-~~
~~tablishment~~, an uplink transmission scheme performed via a radio
resource control, RRC, setup or resume procedure, a random access
based small data transmission, ~~or and~~ a preconfigured grant based
uplink transmission scheme; and
15 means for receiving by the network the uplink data transmitted by the user
equipment using the selected uplink transmission scheme.

54. — ~~The apparatus according to claim 53, wherein the network node does not~~
~~configure both the small data transmission and preconfigured grant for the~~
~~user equipment at the substantially a same time.~~

55. — ~~The apparatus according to claim 53, wherein sending the information com-~~
~~prises configuring one of the preconfigured grant or small data transmission~~
~~with a first type of signaling and the other of the preconfigured grant or small~~
~~data transmission being configured with a second type of signaling.~~

56. — ~~The apparatus according to claim 54, wherein the first type of signaling is~~
~~dedicated signaling and the second type of signaling is broadcast signaling.~~

57. — ~~The apparatus according to claim 56, wherein the first type of signaling is~~
~~broadcast signaling and the second type of signaling is dedicated signaling.~~

~~58-26. The apparatus according to any one of claims 53 to 57~~The network node according to claim 25, wherein receiving comprises receiving a small data transmission that uses an early data transmission that uses a random access channel procedure.

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~~59-27. The apparatus~~network node according to ~~any one of claims 53 to 58~~claim 25 or 26, wherein the ~~regular connection establishment~~RRC setup or resume procedure comprises one or more of the following: a radio resource control connection setup procedure; a radio resource control connection resume procedure; or a radio resource control connection re-establishment procedure.

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~~60-28. The apparatus~~network node according to any one of claims ~~53 to 59~~25-27, wherein the sent information comprises one or both of data amount or time thresholds for one or more of the multiple uplink transmission schemes.

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~~61-29. The apparatus~~network node according to claim ~~60~~28, wherein the sending the information further comprises sending the information via one or both of dedicated signaling or broadcast signaling.

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~~62-30. The apparatus~~network node according to claim ~~61~~29, wherein the dedicated signaling comprises one or more radio resource control release messages or the broadcast signaling comprises system information block signaling.

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~~63. —The apparatus of any one of claims 53 to 62, wherein the means comprises:
at least one processor; and
at least one memory including computer program code, the at least one memory and computer program code configured to, with the at least one processor, cause the performance of the apparatus.~~

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64. — ~~A network access node comprising the apparatus of any one of claims 53 to 62.~~

65. — ~~A system comprising the apparatus of any one of claims 33 to 51 and the apparatus of any one of claims 53 to 63.~~

66. — ~~An apparatus, comprising:
one or more processors; and
one or more memories including computer program code,
wherein the one or more memories and the computer program code are
configured, with the one or more processors, to cause the apparatus
to:
by a user equipment in an inactive or idle state and in response to having
uplink data that is to be transmitted, select which one of multiple up-
link transmission schemes should be used to transmit the uplink data,
wherein the multiple uplink transmission schemes comprise a regular
connection establishment, a small data transmission, or a preconfig-
ured grant; and
perform the selected uplink transmission scheme to transmit the uplink data.~~

67. — ~~An apparatus, comprising:
one or more processors; and
one or more memories including computer program code,
wherein the one or more memories and the computer program code are
configured, with the one or more processors, to cause the apparatus
to:
send, from a network node to a user equipment, information configured to
allow the user equipment to select which one of multiple uplink trans-
mission schemes should be used to transmit uplink data, wherein the
multiple uplink transmission schemes comprise a regular connection~~

~~establishment, a small data transmission, or a preconfigured grant;
and
receive by the network uplink data transmitted by the user equipment using
the selected uplink transmission scheme.~~