

CLAIMS

1. An apparatus comprising means for:

receiving, at a user equipment (UE) from a base station provisioning of a plurality of pre-configured radio resources for data transmission during an inactive state of the UE,

wherein a pre-configured radio resource is associated with a set of one or more transmission beams;

acquiring at the UE validity information associated with one or more said pre-configured resources;

using at least the validity information to determine, for use, a valid preconfigured radio resource.

2. An apparatus as claimed in claim 1, wherein the pre-configured resources are Random Access Channel (RACH) preambles and/or are Physical Uplink Shared Channel (PUSCH) pre-configured resources associated with PUSCH.

3. An apparatus as claimed in claim 1 or 2, further comprising means for uplink data transmission during an inactive state using the determined valid pre-configured radio resource.

4. An apparatus as claimed in any preceding claim comprising means for receiving the validity information from the network, wherein the validity information comprises: one or more radio quality-based thresholds and/or an indication, directly or indirectly, of one or more valid preconfigured resources.

5. An apparatus as claimed in claim 4, comprising means configured to avoid using a radio resource associated with a strongest transmission beam and falling back to a 4 step RACH-based data transmission mode, if the radio resource is an invalid radio resource.

6. An apparatus as claimed in any preceding claim wherein the one or more transmission beams associated with the one or more said pre-configured radio resources are downlink transmission beams of a base station and wherein the association is direct or indirect.

~~7. An apparatus as claimed in claim 6 comprising means for estimating a strength of one or more of the transmission beams, and using the estimated strength to determine a valid preconfigured radio resource.~~

5 ~~8. An apparatus as claimed in any preceding claim, comprising means for selecting a valid combination from possible combinations of:~~
~~(i) one of a plurality of modes for uplink data transmission during an inactive state of the UE;~~
~~and~~
~~(ii) at least a pre-configured radio resource that is associated with a set of one or more~~
10 ~~beams at a base station.~~

~~9. An apparatus as claimed in any preceding claim, comprising means for switching to a mode of data transmission, wherein at least a set-up procedure for the mode of data transmission comprises configuration of radio resources for an aligned beam.~~

15 ~~10. An apparatus as claimed in any preceding claim, comprising means configured to:~~
~~in dependence upon a current beam not being a strongest beam, using the validity information to select, for use, a combination of a configured grant mode for uplink data transmission and the strongest beam;~~
20 ~~in dependence upon there being no beam sufficient for data transmission over preconfigured resource, using the validity information to select, for use, one or more combinations of a random access mode for uplink data transmission and a strongest beam.~~

~~11. An apparatus as claimed in any preceding claim, comprising means for:~~
25 ~~using the validity information to select, for use, a valid combination from possible combinations of: one of a plurality of modes for uplink data transmission; and an estimated strongest available beam for reception, at a base station, of uplink data transmission.~~

~~12. A method comprising:~~
30 ~~receiving, at a user equipment (UE) from a base station provisioning of a plurality of pre-configured radio resources for data transmission during an inactive state of the UE, wherein a pre-configured radio resource is associated with a set of transmission beams~~
~~acquiring at the UE validity information associated with one or more said pre-~~
35 ~~configured resources;~~

~~using at least the validity information to determine, for use, a valid preconfigured radio resource.~~

~~13. A computer program, that when run by one or more processors, enable a process comprising:~~

~~receiving, at a user equipment (UE) from a base station provisioning of a plurality of pre-configured radio resources for data transmission during an inactive state of the UE wherein a pre-configured radio resource is associated with a set of transmission beams~~

~~acquiring at the UE validity information associated with one or more said pre-configured resources;~~

~~using at least the validity information to determine, for use, a valid preconfigured radio resource.~~

~~14. A base station comprising:~~

~~means for transmitting, to a user equipment (UE), validity information for constraining beam-received uplink data transmission during an inactive state of the UE to a valid combination from possible combinations of:~~

~~(i) one of a plurality of modes for uplink data transmission;~~

~~(ii) a sub-set of beams for reception of uplink data transmission.~~

~~15. A system comprising~~

~~an apparatus as claimed in any of claims 1 to 11; and a base station as claimed in claim 14.~~

CLAIMS

1. An apparatus (110) comprising:

means for receiving, at a user equipment, UE, (110) from a base station (120), provisioning (220) of a plurality of pre-configured radio resources (240) for data transmission during an inactive state of the UE (110),

wherein a pre-configured radio resource (240) of the plurality of pre-configured radio resources (240) is associated with a set of one or more downlink transmission beams (202) of the base station;

means for acquiring at the UE (110) validity information (222) associated with one or more of the plurality of pre-configured radio resources (240); and

means for determining a valid pre-configured radio resource of the plurality of pre-configured radio resources (240) based on the validity information.

2. An apparatus as claimed in claim 1, wherein the pre-configured radio resources are Physical Uplink Shared Channel, PUSCH, resources.

3. An apparatus as claimed in claim 1 or 2, further comprising means for transmitting uplink data during an inactive state using the valid pre-configured radio resource of the plurality of pre-configured radio resources.

4. An apparatus as claimed in any preceding claim, wherein the validity information comprises:

one or more radio quality-based thresholds of the valid pre-configured radio resource of the plurality of pre-configured radio resources.

5. An apparatus as claimed in claim 4, comprising means for avoiding using a pre-configured radio resource associated with a strongest downlink transmission beam of the set of one or more downlink transmission beams and falling-back to a 4-step RACH based data transmission mode, if the pre-configured radio resource is an invalid pre-configured radio resource.

6. An apparatus as claimed in any preceding claim, wherein an association between the pre-configured radio resource and the set of one or more downlink transmission beams is direct or indirect.

7. An apparatus as claimed in any preceding claim, comprising means for estimating a reference signal received power, RSRP, of one or more of the downlink transmission beams, and using the RSRP to determine the valid pre-configured radio resource of the plurality of pre-configured radio resources.

8. An apparatus as claimed in any preceding claim, comprising means for selecting based on the validity information:

(i) one of a plurality of modes for uplink data transmission during an inactive state of the UE; and

(ii) at least one of the plurality of pre-configured radio resources that is associated with the set of one or more downlink transmission beams of the base station.

9. An apparatus as claimed in any preceding claim, comprising means for switching to a mode of data transmission based on the validity information, wherein at least a set-up procedure for the mode of data transmission comprises configuration of radio resources for an aligned downlink transmission beam of the set of one or more downlink transmission beams.

10. An apparatus as claimed in any preceding claim, comprising means for selecting configured to:

in dependence upon a current downlink transmission beam of the set of one or more downlink transmission beams not being a strongest downlink transmission beam of the set of one or more downlink transmission beams, select based on the validity information a configured grant mode for uplink data transmission and the strongest downlink transmission beam; and

in dependence upon the current downlink transmission beam of the set of one or more downlink transmission beams being insufficient for uplink data transmission over one of the plurality of pre-configured radio resources, select based on the validity information a random access mode for uplink data transmission and the strongest downlink transmission beam.

11. An apparatus as claimed in any preceding claim, comprising:
means for using the validity information to select:

one of a plurality of modes for uplink data transmission; and

an estimated strongest available beam of the set of one or more downlink transmission beams for uplink data transmission.

12. A method comprising:

receiving, at a user equipment, UE (110), from a base station (120), provisioning (220) of a plurality of pre-configured radio resources (240) for data transmission during an inactive state of the UE (110), wherein a pre-configured radio resource (240) of the plurality of pre-configured radio resources (240) is associated with a set of downlink transmission beams (202) of the base station (120);

acquiring at the UE (110) validity information (222) associated with one or more of the plurality of pre-configured radio resources (240); and

determining a valid pre-configured radio resource of the plurality of preconfigured radio resources (240) based on the validity information.

13. A computer program (406), that when run by one or more processors, enable a process comprising:

receiving, at a user equipment, UE (110), from a base station (120), provisioning (220) of a plurality of pre-configured radio resources (240) for data transmission during an inactive state of the UE (110),

wherein a pre-configured radio resource (240) of the plurality of pre-configured radio resources (240) is associated with a set of downlink transmission beams (202) of the base station (120);

acquiring at the UE (110) validity information (222) associated with one or more the plurality of pre-configured radio resources (240); and

determining a valid pre-configured radio resource of the plurality of pre-configured radio resources (240) based on the validity information.

14. A base station (120), comprising:

means for transmitting, to a user equipment, UE, (110) validity information for constraining beam-received uplink data transmission during an inactive state of the UE to:

(i) one of a plurality of modes for uplink data transmission; and

(ii) a sub-set of beams for uplink data transmission.

15. A system comprising:

an apparatus as claimed in any of claims 1 to 11; and a base station as claimed in claim 14.