CLAIMS

1. A method of wireless communication, comprising:

receiving (400, 1200), by a user equipment (115), UE, a configured grant, CG, configuration including a periodicity of CG resources available for autonomous uplink, AUL, transmissions and a resource identifier defining a plurality of sets of CG resources;

identifying (401, 1201), by the UE (115), uplink data for the AUL transmissions;

performing (402, 1202), by the UE (115), a listen before talk, LBT, procedure at a start symbol of a first set of CG resources of the plurality of sets of CG resources; and

transmitting (403, 1203), by the UE (115), the uplink data using the first set of CG resources in response to success of the LBT procedure.

2. The method of claim 1, wherein the resource identifier includes a bitmap identifying the plurality of sets of CG resources when the periodicity is less than a threshold period and a resource indicator value, RIV, identifying the plurality of sets of CG resources when the periodicity exceeds the threshold period.

3. The method of claim 1,

wherein the resource identifier indicates a start symbol of a first slot of each of the plurality of sets of CG resources and an end symbol of a last slot of each of the plurality of sets of CG resources, and

wherein the start symbol and the end symbol are one of: independently configured for each of the plurality of sets of CG resources, or commonly configured for all of the plurality of sets of CG resources.

4. The method of claim 3, wherein the start symbol is selected by the UE (115) from one of: a predefined number of first symbols of the first slot, a subset of symbols of the first slot, or any symbol of the first slot.

5. The method of claim 3, wherein the end symbols is selected by the UE (115) from a set of end symbols of the last slot no closer to a boundary of a next slot than an LBT gap.

6. The method of claim 1, further including:

receiving, by the UE (115), an allowed starting point configuration bitmap identifying one or more allowed starting points in each slot of each of the plurality of sets of CG resources, wherein the uplink data is transmitted at a first available starting point of the

one or more allowed starting points of a first slot of the first set of CG resources after the success of the LBT procedure; and

generating, by the UE (115), a random UE-specific starting point offset, wherein the uplink data is transmitted at the random UE-specific starting point offset after the first available starting point, wherein the random UE-specific starting point offset is one of: different for each of the one or more allowed starting points in each slot of each of the plurality of sets of CG resources or applied to the one or more allowed starting points within each slot and different for each slot of each of the plurality of sets of CG resources.

7. The method of claim 1, wherein the resource identifier includes a mini-slot level configuration of the plurality of sets of CG resources and a full-slot level configuration of the plurality of sets of CG resources; and

further including:

receiving, by the UE (115), a mini-slot configuration bitmap, wherein the mini-slot configuration bitmap defines a set of available mini-slots within each slot configured with the full-slot level configuration of the plurality of sets of CG resources; and

wherein a first value in the mini-slot configuration bitmap indicates a valid starting position of a mini-slot of the set of available mini-slots and a second value in the mini-slot configuration bitmap indicates an invalid starting position for any slot of the set of available mini-slots; and/or

wherein a length of each of the set of available mini-slots is indicated according to one of:

a length indicator received by the UE (115);

each portion of a slot over which the mini-slot configuration bitmap defines the set of available mini-slots, wherein the portion is indicated by boundaries of the slot and a start position of each of the set of available mini-slots identified by a bit in the mini-slot configuration bitmap; and/or

the method further including:

transmitting, by the UE (115), a slot configuration identifier indicating whether the uplink data transmitted was transmitted using one or more of the set of available mini-slots or one or more slots of the full-slot level configuration, wherein the slot configuration identifier includes one or more of: a demodulation reference signal configured according to one of the mini-slot level configuration or the full-slot level configuration, or an uplink control information indicative of one of the mini-slot level configuration or the full-slot level configuration; or

the method further including:

receiving, by the UE (115), a mini-slot window indication identifying a maximum number of slots within the first set of CG resources in which the UE (115) may transmit the uplink data according to the mini-slot level configuration.

8. The method of claim 1, further including:

receiving, by the UE (115), a identifier, ID, trigger from a serving base station, wherein the ID trigger signals the UE (115) to include a UE ID in a CG uplink control information message; and

transmitting, by the UE (115), the CG uplink control information message with the UE ID in response to the ID trigger.

9. The method of claim 8, wherein the ID trigger is received in one of:

a radio resource control, RRC, configuration message configuring the CG resources available for AUL transmissions, or

an activation downlink control information, DCI, message activating the AUL transmissions.

10. The method of claim 1, further including:

providing, by the UE (115), a gap within the first set of CG resources, wherein the gap is located at least a downlink processing time from an ending boundary of a last slot of the first set of CG resources;

receiving, by the UE (115), an uplink grant from a serving base station within the gap, wherein the uplink grant identifies scheduled uplink, SUL, resources contiguous to the first set of CG resources;

ending, by the UE (115), the autonomous transmitting by the ending boundary; and

transmitting, by the UE, uplink data using the SUL resources.

11. The method of claim 1, the CG configuration further including the resource identifier being implemented using a set of hierarchical resource configurations, wherein a first configuration of the set of hierarchical resource configurations defines a coarse span of a CG resource and subsequent configurations of the set of hierarchical resource configurations refine the definition of the coarse span to identify the plurality of sets of CG resources.

12. The method of claim 11, wherein each configuration of the set of hierarchical resource configurations includes one of a bitmap identifying the CG resource or a resource indicator value, RIV, identifying the CG resource; or

wherein a length of each configuration of the set of hierarchical resource configurations is selected up to a predefined maximum value; and

wherein the length is selected within the predefined maximum value based on the periodicity; or

wherein a number of configurations within the set of hierarchical resource configurations is one of explicitly configured by a serving base station, or derived as a function of the periodicity.

13. An apparatus configured for wireless communication at a user equipment (115), UE, the apparatus comprising:

means for receiving, by the UE (115), a configured grant, CG, configuration including a periodicity of CG resources available for autonomous uplink, AUL, transmissions and a resource identifier defining a plurality of sets of CG resources;

means for identifying, by the UE (115), uplink data for the AUL transmissions;

means for performing, by the UE (115), a listen before talk, LBT, procedure at a start symbol of a first set of CG resources of the plurality of sets of CG resources; and

means for transmitting, by the UE (115), the uplink data using the first set of CG resources in response to success of the LBT procedure.

14. The apparatus for wireless communication according to claim 13, further comprising means for carrying out the method of any of claims 2 to 12.

15. A computer program comprising instructions which, when the program is executed by a computer, cause the computer to carry out the method of any of claims 1 to 12.