[8] Non-limiting examples facilitate providing communication apparatuses and methods for optimising time domain window and DMRS for joint channel estimation.

[9] According to an aspect of the present disclosure, there is provided a communication apparatus comprising: circuitry, which in operation, determines multiple time domain windows for multiple physical uplink shared channel (PUSCH) transmissions; and a transmitter, which in operation, transmits reference signals based on the multiple time domain windows, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

[10] According to another aspect of the present disclosure, there is provided a communication method comprising: determining multiple time domain windows for multiple PUSCH transmissions; and transmitting reference signals based on the one or more time domain windows, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

[11] According to another aspect of the present disclosure, there is provided a communication method comprising: receiving an indication of multiple time domain windows for multiple physical uplink shared channel (PUSCH) transmissions; and circuitry, which in operation, transmits reference signals based on the multiple time domain windows, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

[11a] According to another aspect of the present disclosure, there is provided an integrated circuit comprising: determination circuit, which in operation, determines

multiple time domain windows for multiple physical uplink shared channel (PUSCH) transmissions, and transmitting circuit, which in operation, transmits reference signals based on the multiple time domain windows, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

[12] According to another aspect of the present disclosure, there is provided a base station comprising: circuitry, which in operation, circuitry, which in operation, determines multiple time domain windows for multiple physical uplink shared channel (PUSCH) transmissions; and a transmitter, which in operation, indicates the multiple time domain windows to one or more communication apparatuses, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

[13] According to another aspect of the present disclosure, there is provided a communication method comprising: determining multiple time

domain windows for multiple physical uplink shared channel (PUSCH) transmissions; and indicating the multiple time domain windows to one or more communication apparatuses, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

[13a] According to another aspect of the present disclosure, there is provided an integrated circuit comprising: determination circuit, which in operation, determines multiple time domain windows for multiple physical uplink shared channel (PUSCH) transmissions; and transmitting circuit, which in operation, indicates the multiple time domain windows to one or more communication apparatuses, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

[14] It should be noted that general or specific embodiments may be implemented as a system, a method, an integrated circuit, a computer program, a storage medium, or any selective combination thereof.

[15] Additional benefits and advantages of the disclosed embodiments will become apparent from the specification and drawings. The benefits and/or advantages may be individually obtained by the various embodiments and features of the specification and drawings, which need not all be provided in order to obtain one or more of such benefits and/or advantages.

BRIEF DESCRIPTION OF THE DRAWINGS

[16] Embodiments of the disclosure will be better understood and readily apparent to one of ordinary skilled in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

[17] Fig. 1 shows an exemplary 3GPP NR-RAN architecture.

[18] Fig. 2 depicts a schematic drawing which shows functional split between NG-RAN and 5GC.

[19] Fig. 3 depicts a sequence diagram for RRC (radio resource control) connection setup/reconfiguration procedures.

[20] Fig. 4 depicts a schematic drawing showing usage scenarios of Enhanced mobile broadband (eMBB), Massive Machine Type Communications (mMTC) and Ultra Reliable and Low Latency Communications (URLLC).

[21] Fig. 5 shows a block diagram showing an exemplary 5G system architecture for V2X communication in a non-roaming scenario.

CLAIMS

1. A communication apparatus comprising;

circuitry, which in operation, determines multiple time domain windows for multiple physical uplink shared channel (PUSCH) transmissions; and

a transmitter, which in operation, transmits reference signals based on the multiple time domain windows, wherein

each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

2. The communication apparatus of claim 1, wherein each length of the multiple time domain windows is indicated by radio resource control (RRC).

3. The communication apparatus of claim 1, wherein each length of the multiple time domain windows is determined from a subset of candidate lengths of a time domain window.

4. The communication apparatus of claim 3, wherein each candidate length included in the subset is a number from two up to a total number of the multiple PUSCH transmissions.

5. The communication apparatus of claim 1, wherein the multiple time domain windows includes lengths different from one another.

6. The communication apparatus of claim 1, wherein each length of the multiple time domain windows is determined based on a capability of the communication apparatus.

7. The communication apparatus of claim 1, wherein each length of the multiple time domain windows is same as an inter-slot frequency hopping interval.

8. The communication apparatus of claim 1, wherein an inter-slot frequency hopping interval is a multiple of each length of the multiple time domain windows.

9. The communication apparatus of claim 1, wherein each length of the multiple time domain windows is different from an inter-slot frequency hopping interval.

10. The communication apparatus of claim 1, wherein each length of the multiple time domain windows is determined based on the number of symbols, slots, or repetitions allocated for the multiple PUSCH transmissions.

11. A communication method comprising:

determining multiple time domain windows for multiple PUSCH transmissions; and

transmitting reference signals based on the multiple time domain windows, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

12. A communication method comprising:

receiving an indication of multiple time domain windows for multiple physical uplink shared channel (PUSCH) transmissions; and

circuitry, which in operation, transmits reference signals based on the multiple time domain windows, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

13. An integrated circuit comprising:

determination circuit, which in operation, determines multiple time domain windows for multiple physical uplink shared channel (PUSCH) transmissions; and

transmitting circuit, which in operation, transmits reference signals based on the one or more time domain windows, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

14. A base station comprising:

circuitry, which in operation, determines multiple time domain windows for multiple physical uplink shared channel (PUSCH) transmissions; and

a transmitter, which in operation, indicates the multiple time domain windows to one or more communication apparatuses, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

15. A communication method comprising:

determining multiple time domain windows for multiple physical uplink shared channel (PUSCH) transmissions; and

indicating the multiple time domain windows to one or more communication apparatuses, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.

16. An integrated circuit comprising:

determination circuit, which in operation, determines multiple time domain windows for multiple physical uplink shared channel (PUSCH) transmissions; and

transmitting circuit, which in operation, indicates the multiple time domain windows to one or more communication apparatuses, wherein each length of the multiple time domain windows being no more than an overall length of the multiple PUSCH transmissions.