[4] UL channel performance could be challenging in most scenarios in real deployment. There are also emerging vertical use cases that require UL heavy traffic, e.g., for video uploading or camera surveillance. It was studied to identify that PRACH is one of bottleneck channels in term of coverage performance. However, due to the limited scope of Rel. 17 Coverage Enhancement (CovEnh), PRACH coverage has not been enhanced. A new working item (WI) for further New Radio (NR) CovEnh has been approved in Rel. 18, where one of the main objectives is to specify the following PRACH coverage enhancements (RAN1, RAN2) [RP-213579]:

- Implementation of multiple PRACH transmissions with same beams for 4-step RACH procedure; and
- studying, and if justified, specifying PRACH transmissions with different beams for 4-step RACH procedure.

The enhancements of PRACH are targeted for Frequency Range 2 (FR2), and can also apply to FR1 when applicable. Further, the enhancements of PRACH are targeting short PRACH formats, and can also apply to other formats when applicable.

[5] However, there has been no discussion on communication apparatuses and methods for multi-PRACH transmissions.

[6] There is thus a need for communication apparatuses and methods that provide feasible technical solutions for multi-PRACH transmissions over multiple ROs in NR. Furthermore, other desirable features and characteristics will become apparent from the subsequent detailed description and the appended claims, taken in conjunction with the accompanying drawings and this background of the disclosure.

SUMMARY

[7] Non-limiting and exemplary embodiments facilitate providing communication apparatuses and methods for multi-PRACH transmissions.

[8]

[7A] According to a first aspect of the present disclosure, there is provided a communication apparatus, comprising:a receiver, which, in operation, receives control information relating to a repetition of a physical random access channel (PRACH), and a transmitter, which is operation, transmits the repetition of PRACH based on the control information.

[7B] According to a second aspect of the present disclosure, there is provided a communication method, comprising:receiving control information relating to a repetition of a physical random access channel (PRACH), and transmitting the repetition of PRACH based on the control information.

[7C] According to a third aspect of the present disclosure, there is provided a base station, comprising: a transmitter, which in operation, transmits control information relating to a repetition of a physical random access channel (PRACH), and a receiver, which in operation, receives the repetition of PRACH based on the control information.

[7D] According to another aspect of the present disclosure, there is provided a communication method, comprising: transmitting control information relating to a repetition of a physical random access channel (PRACH), and receiving the repetition of PRACH based on the control information.

[7E] According to another aspect of the present disclosure, there is provided an integrated circuit, comprising:reception circuitry, which in operation, controls a reception of control information relating to a repetition of a physical random access channel (PRACH), and transmission circuitry , which in operation, controls a reception of the repetition of PRACH based on the control information.

[7F] According to another aspect of the present disclosure, there is provided an integrated circuit, comprising: transmission circuitry , which in operation, controls a transmission of control information relating to a repetition of a physical random access channel (PRACH), and reception circuitry, which in operation, controls a reception of the repetition of PRACH based on the control information.

[8] According to a first embodiment of the present disclosure, there is provided a communication apparatus comprising: a receiver, which in operation, receives control information relating to a multi-PRACH transmission, and a transmitter,