

WE CLAIM:

1. A method, comprising:

5 indicating a control channel search space by a pair of parameters, wherein the pair of parameters includes a physical resource block index and an explicit control channel element index; and

transmitting on the control channel within the search space.

2. The method of claim 1, further comprising:

10 ~~implicitly indicating a plurality of code rates by explicitly indicating a single allocated primary physical resource block.~~

3. ~~The method of claim 1 or claim 2, wherein the indicating comprises indicating a starting index, wherein the starting index is configured to inform a user equipment as to which control channel element index the user equipment is to use as a reference.~~

4. ~~The method of claim 3, wherein the indicating the starting index comprises indicating a physical resource block index and offset.~~

5. The method of claim 1, further comprising:

20 ~~indicating a physical resource block that has no search positions but is to be punctured out.~~

6. A method, comprising:

25 processing a received indication of a control channel search space by a pair of parameters, wherein the pair of parameters includes a physical resource block index and an explicit control channel element index; and

attempting blind decoding of the control channel using a search strategy based on the received indication.

73. The method of claim 62, wherein the processing the received indication comprises processing a starting index, wherein the starting index is configured to inform a user equipment as to which control channel element index the user equipment is to use as a reference.

84. The method of claim 73, wherein the processing the starting index comprises processing a physical resource block index and offset.

95. The method of claim 62, further comprising:

processing an indication of a physical resource block that has no search positions but is to be punctured out.

106. The method of any of claims 62-95, further comprising:

limiting candidate physical resource blocks used in the search strategy to a predetermined number of physical resource blocks that is less than a total number of available physical resource blocks.

117. An apparatus, comprising:

at least one processor; and

at least one memory including computer program code,

wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to

indicate a control channel search space by a pair of parameters, wherein the pair of parameters includes a physical resource block index and an explicit control channel element index; and

transmit on the control channel within the search space.

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~~12. The apparatus of claim 11, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to implicitly indicate a plurality of code rates by explicitly indicating a single allocated primary physical resource block.~~

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~~13. The apparatus of claim 11 or claim 12, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to indicate a starting index, wherein the starting index is configured to inform a user equipment as to which control channel element index the user equipment is to use as a reference.~~

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~~14. The apparatus of claim 13, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to indicate the starting index by indicating a physical resource block index and offset.~~

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~~15. The apparatus of claim 11, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to indicate a physical resource block that has no search positions but is to be punctured out.~~

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~~168. An apparatus, comprising:~~

~~at least one processor; and~~

~~at least one memory including computer program code,~~

wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to

process a received indication of a control channel search space by a pair of parameters, wherein the pair of parameters includes a physical resource block index and an explicit control channel element index; and

attempt blind decoding of the control channel using a search strategy based on the received indication.

10 | 1479. The apparatus of claim 146_8, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to process a starting index, wherein the starting index is configured to inform a user equipment as to which control channel element index the user equipment is to use as a reference.

15 | 14810. The apparatus of claim 147_9, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to process a physical resource block index and offset.

20 | 14911. The apparatus of claim 146_8, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to process an indication of a physical resource block that has no search positions but is to be punctured out.

25 | 2012. The apparatus of any of claims 146_8-149_11, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to limit candidate physical resource blocks used in the search strategy to a predetermined number of physical resource blocks that is less than a total number of available physical resource blocks.

2413. A method, comprising:

deriving a control channel search space based on a set of physical resource blocks and a control channel element identifier,

5 wherein the control channel search space allows the control channel to be transmitted with different code rates, transmitted in different physical resource blocks, localized into one physical resource block, or distributed into multiple physical resource blocks.

10 ~~22. The method of claim 21, wherein parameters defining the search space are signaled directly or partly derived from other parameters.~~

~~23. The method of claim 22, wherein the other parameters include at least one of a user equipment identifier and a cell identifier.~~

15 2414. An apparatus, comprising:

at least one processor; and

at least one memory including computer program code,

wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to

20 derive a control channel search space based on a set of physical resource blocks and a control channel element identifier,

25 wherein the control channel search space allows the control channel to be transmitted with different code rates, transmitted in different physical resource blocks, localized into one physical resource block, or distributed into multiple physical resource blocks.

~~25. The apparatus of claim 24, wherein parameters defining the search space are signaled directly or partly derived from other parameters.~~

~~26. The apparatus of claim 25, wherein the other parameters include at least one of a user equipment identifier and a cell identifier.~~

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~~27~~15. An apparatus, comprising:

indicating means for indicating a control channel search space by a pair of parameters, wherein the pair of parameters includes a physical resource block index and an explicit control channel element index; and

transmitting means for transmitting on the control channel within the search space.

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~~28. The apparatus of claim 27, further comprising:~~

~~means for implicitly indicating a plurality of code rates by explicitly indicating a single allocated primary physical resource block.~~

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~~29. The apparatus of claim 27 or claim 28, wherein the indicating comprises indicating a starting index, wherein the starting index is configured to inform a user equipment as to which control channel element index the user equipment is to use as a reference.~~

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~~30. The apparatus of claim 29, wherein the indicating the starting index comprises indicating a physical resource block index and offset.~~

~~31. The apparatus of claim 27, further comprising:~~

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~~means for indicating a physical resource block that has no search positions but is to be punctured out.~~

~~32~~16. An apparatus, comprising:

processing means for processing a received indication of a control channel search space by a pair of parameters, wherein the pair of parameters includes a physical resource block index and an explicit control channel element index; and

attempting means for attempting blind decoding of the control channel using a search strategy based on the received indication.

~~33. The apparatus of claim 32, wherein the processing the received indication comprises processing a starting index, wherein the starting index is configured to inform a user equipment as to which control channel element index the user equipment is to use as a reference.~~

~~34. The apparatus of claim 33, wherein the processing the starting index comprises processing a physical resource block index and offset.~~

~~35. The apparatus of claim 32, further comprising:~~

~~means for processing an indication of a physical resource block that has no search positions but is to be punctured out.~~

~~36. The apparatus of any of claims 32-35, further comprising:~~

~~limiting means for limiting candidate physical resource blocks used in the search strategy to a predetermined number of physical resource blocks that is less than a total number of available physical resource blocks.~~

~~37~~17. An apparatus, comprising:

deriving means for deriving a control channel search space based on a set of physical resource blocks and a control channel element identifier,

wherein the control channel search space allows the control channel to be transmitted with different code rates, transmitted in different physical resource blocks,

localized into one physical resource block, or distributed into multiple physical resource blocks.

5 ~~38. The apparatus of claim 37, wherein parameters defining the search space are signaled directly or partly derived from other parameters.~~

~~39. The apparatus of claim 38, wherein the other parameters include at least one of a user equipment identifier and a cell identifier.~~

10 ~~40~~18. A non-transitory computer-readable medium encoded with instructions that, when executed in hardware, perform a process, the process comprising the method of any of claims ~~12-40~~6 or ~~248-231~~2.