

METHODS AND SYSTEMS FOR REFERENCE SIGNALING IN WIRELESS COMMUNICATION NETWORKS

TECHNICAL FIELD

This disclosure is directed generally to digital wireless communications.

BACKGROUND

Mobile telecommunication technologies are moving the world toward an increasingly connected and networked society. In comparison with the existing wireless networks, next generation systems and wireless communication techniques will need to support a much wider range of use-case characteristics and provide a more complex and sophisticated range of access requirements and flexibilities.

Long-Term Evolution (LTE) is a standard for wireless communication for mobile devices and data terminals developed by 3rd Generation Partnership Project (3GPP). LTE Advanced (LTE-A) is a wireless communication standard that enhances the LTE standard. The 5th generation of wireless system, known as 5G, advances the LTE and LTE-A wireless standards and is committed to supporting higher data-rates, large number of connections, ultra-low latency, high reliability and other emerging business needs.

SUMMARY

Apparatuses, methods, systems, and computer readable media are disclosed. In ~~one~~a first aspect, a wireless communication method is disclosed. The method includes determining, by a wireless device, a plurality of physical cell identifiers of a serving cell, determining by the wireless device, a first physical cell identifier corresponding to a target element from the plurality of physical cell identifiers; and determining one or more parameters of the target element based on the first physical cell identifier, wherein the target element includes a channel or a signal., and wherein the target element is in the serving cell.

In a second aspect, the present disclosure provides an apparatus for wireless communication, comprising a memory and a processor, wherein the processor reads code from the memory and implements a method according to the first aspect.

In a third aspect, the present disclosure provides a computer readable program storage medium having code stored thereon, the code, when executed by a processor, causing the processor to implement a method according to the first aspect.

In another ~~aspect~~example, a wireless communication method includes determining, by a wireless device, a first physical cell identifier corresponding to a target element from the plurality of physical cell identifiers, and determining one or more parameters of the target element based on the first physical cell identifier, wherein the target element includes a channel or a signal.

In another ~~aspect~~example, a wireless communication method includes determining, by a wireless device, whether boundaries of radio frames corresponding to the plurality of physical cell identifiers are aligned.

In another aspectexample, a wireless communication method includes determining, by a wireless device, a bandwidth part switching delay depending on a relationship between a third physical cell identifier of a newly activated bandwidth part and a second physical cell identifier of an old bandwidth part.

In another aspectexample, a wireless communication method includes determining, by a wireless device, a time of applying a new parameter in a signaling according to a relationship between a fourth physical cell identifier of a parameter included in the signaling and a fifth physical cell identifier of an old parameter.

In another aspectexample, a wireless communication method includes determining, by a wireless device, a sixth physical cell identifier from the plurality of physical cell identifiers of the serving cell, and determining a mobility measurement result of the serving cell based on mobility measurement reference signals of the sixth physical cell identifier.

In another aspectexample, a wireless communication method includes determining, by a wireless device, a seventh physical cell identifier from the plurality of physical cell identifiers of the serving cell, and using the seventh physical cell identifier to obtain first common information.

In another aspectexample, a wireless communication method includes determining, by a wireless device, a mobility reference signal as a quasi-co-location reference signal of a target reference signal in the serving cell, wherein the mobility reference signal is associated with one of the plurality of physical cell identifiers of the serving cell.

In another aspectexample, a wireless communication method includes determining, by a wireless device, a mapping relationship between the plurality of physical cell identifiers and one or more M fourth parameters, wherein M is positive integer. The fourth parameters includes at least one of following parameter: RNTI (Radio Network Temporary Identifier); the association between RACH resources and SSB(s); the association between RACH resources and CSI-RS; common RACH resources, and system information.

In another aspectexample, a wireless communication method includes determining a mobility measurement reference signal as a quasi-co-location reference signal of a target reference signal in a serving cell.

The above and other aspects and their implementations are described in greater detail in the drawings, the descriptions, and the claims.

CLAIMS

What is claimed is:

1. A wireless communication method, comprising:
determining, by a wireless device, a plurality of physical cell identifiers of a serving cell;
- ~~2. The method of claim 1, further comprising:~~
determining, by the wireless device, a first physical cell identifier corresponding to a target element from the plurality of physical cell identifiers; and
determining one or more parameters of the target element based on the first physical cell identifier,
wherein the target element includes a channel or a signal, and wherein the target element is in the serving cell.
- ~~3. The method of claim 2, wherein the one or more parameters of the target element includes parameters for generating a sequence for the target element.~~
- ~~4. The method of claim 3, wherein the sequence includes a pseudo-random sequence, and wherein the parameters for generating the sequence for the target element includes initial parameters for generating the pseudo-random sequence.~~
- ~~5. The method of claim 3, wherein the parameters for generating the sequence for the target element include at least one of: a time unit offset between the first physical cell identifier and a reference physical cell identifier; a time unit index; a relative index of the first physical cell identifier among the plurality of physical cell identifiers; an indication as to whether a sequence generation function for generating the sequence for the target element includes the relative index of the first physical cell identifier; an indication as to selection of the sequence generation function; or an indication as to whether the sequence generation function includes a time unit index of predetermined type.~~

6. — ~~The method of claim 5, wherein a time unit associated with the time unit offset or the time unit index includes at least one of a slot or a time domain symbol.~~

7. — ~~The method of claim 5, wherein the time unit offset is determined based on signaling from a base station.~~

8. — ~~The method of claim 5, wherein the time unit offset is determined based on a reference time unit offset associated with a reference subcarrier spacing and a subcarrier spacing of the target element.~~

9. — ~~The method of claim 5, wherein the time unit index of the target element is determined based on the reference signals of the first physical cell identifier.~~

10. — ~~The method of claim 5, wherein the time unit index of the target element is determined based on a timing of the first physical cell identifier.~~

11. — ~~The method of claim 5, wherein the reference physical cell identifier is obtained based on at least one of first information configured by a base station in communication with the wireless device, the first information including physical cell identifier, absolute radio frequency channel number (ARFCN), a mobility object identifier, or serving cell index.~~

12. — ~~The method of claim 5, wherein the reference physical cell identifier is a physical cell identifier corresponding to one of PCell, PSCell, or a serving cell of the target element.~~

13. — ~~The method of claim 2, wherein the first physical cell identifier is determined from the plurality of physical cell identifiers based on information associated with the target element, the information including at least one of a control resource set pool, a transmission configuration indicator state pool, a transmission configuration indicator state, or a bandwidth part.~~

~~14. —The method of claim 13, wherein the first physical cell identifier is a physical cell identifier associated with a control resource set pool including a physical downlink control channel scheduling the target element.~~

~~15. —The method of claim 13, wherein the first physical cell identifier is a physical cell identifier associated with the transmission configuration indicator state pool including the transmission configuration indicator state of the target element.~~

~~16. —The method of claim 13, wherein the first physical cell identifier is a physical cell identifier associated with the transmission configuration indicator state of the target element.~~

~~17. —The method of claim 13, wherein the first physical cell identifier is a physical cell identifier associated with the bandwidth part that includes the target element.~~

~~18. —The method of claim 2, wherein the one or more parameters of the target element includes at least one of a timing of the target element.~~

~~19. —The method of claim 18, further comprising using the timing of the target element to determine information of the target element, the information including at least one of a time domain location of the target element or a time unit index for sequence generation.~~

202. The method of claim 21, wherein the target element includes at least two target elements that are in the serving cell, and each of the at least two target elements is associated with a first physical cell identifier respectively.

~~21. —The method of claim 20, wherein parameters of each of the at least two target elements are determined based on the first physical cell identifier associated with each of the at least two target elements respectively.~~

~~22. —The method of any of claims 2-20, wherein the target element is in the serving cell.~~

~~233.~~ The method of any of claims 1-~~202~~, further comprising reporting, by the wireless device, to a second ~~wireless~~ device, a maximum number of the physical cell identifiers activated for ~~at~~the serving cell.

~~24.—The method of claim 1, wherein each of the plurality of physical cell identifiers is associated with a second element respectively, and wherein the second element includes at least one of a control resource set pool, a transmission configuration indicator state pool, or a bandwidth part in the serving cell.~~

~~254.~~ The method of claim 1, wherein different physical cell identifiers are associated with different second elements, respectively, and wherein each of the different second elements includes at least one of a control resource set pool, a transmission configuration indicator state pool, or a bandwidth part in ~~at~~the serving cell.

~~265.~~ The method of claim 1, wherein a medium access control element (MAC-CE) signaling activates a physical cell identifier for a second element of the serving cell, wherein the second element includes at least one of a control resource set pool, a transmission configuration indicator state pool, or a bandwidth part in the serving cell.

~~276.~~ The method of claim 1, further comprising determining whether boundaries of radio frames corresponding to the plurality of physical cell identifiers are aligned.

~~287.~~ The method of claim ~~276~~, wherein whether the boundaries of radio frames corresponding to the plurality of physical cell identifiers are aligned ~~are~~is determined based on signaling from a base station, and wherein each of the plurality of physical cell identifiers is associated with frequencies of synchronization signals respectively.

~~29.—The method of claim 27, further comprising, upon determination that the boundaries of radio frames corresponding to the plurality of physical cell identifiers are not aligned, determining one or more parameters of the target element based on the first physical cell identifier of the target element.~~

~~30. — The method of claim 1, wherein the plurality of physical cell identifiers includes at least one physical cell identifier associated with a bandwidth part.~~

~~31. — The method of claim 30, wherein each of the multiple physical cell identifiers is associated with at least one of a control resource set pool or a transmission configuration indicator state pool of the bandwidth part.~~

~~32. — The method of claim 1, further comprising, upon determination that boundaries of radio frames corresponding to the plurality of physical cell identifiers are not aligned, using a time unit indices for each of the physical cell identifiers respectively to perform a wireless communication.~~

~~33. — The method of claim 1, further comprising determining a bandwidth part switching delay depending on a relationship between a third physical cell identifier of a newly activated bandwidth part and a second physical cell identifier of an old bandwidth part.~~

~~34. — The method of claim 33, wherein the bandwidth part switching delay is a first bandwidth part switching delay when one or more third physical cell identifiers belong to the second physical cell identifier(s) or is a second bandwidth part switching delay when one or more third physical cell identifiers do not belong to one or more second physical cell identifiers, and wherein the first bandwidth part switching delay smaller than the second bandwidth part switching delay.~~

~~35. — The method of claim 33, wherein the physical cell identifier of the bandwidth part includes a physical cell identifier configured for the bandwidth part or a physical cell identifier configured for a transmission configuration indicator state for the bandwidth part.~~

~~368.~~ The method of claim 1, further comprising determining a time of applying a new parameter in a signaling according to a relationship between a fourth physical cell identifier of the new parameter and a fifth physical cell identifier of an old parameter, wherein the signaling

includes at least one of a medium access control element (MAC-CE) signaling or a downlink control information (DCI) signaling.

~~37. —The method of claim 36, wherein the new parameter comprises at least one of a transmission configuration indicator state or a pathloss reference signal.~~

~~38. —The method of claim 36, wherein the signaling includes at least one of a medium access control element (MAC-CE) signaling or a downlink control information (DCI) signaling.~~

~~39. —The method of claim 36, wherein a time gap between a time when the new parameter is applied and a predefined time is a first time delay when the fourth physical cell identifier belongs to the fifth physical cell identifier or is a second time delay when the fourth physical cell identifier does not belong to the fifth physical cell identifier, wherein the first time delay is smaller than the second time delay.~~

~~40. —The method of claim 39, wherein the predefined time is one of a time when an acknowledgement signal of a physical downlink shared channel (PDSCH) including the signaling is transmitted by the wireless device if the signaling is a medium access control element (MAC-CE) signaling or an end of the signaling if the signaling is a downlink control information (DCI) signaling.~~

~~41. —The method of claim 1, further comprising:~~

~~——determining a sixth physical cell identifier from the plurality of physical cell identifiers of the serving cell; and~~

~~——determining a mobility measurement result of the serving cell based on mobility measurement reference signals of the sixth physical cell identifier.~~

~~42. —The method of claim 41, wherein the sixth physical cell identifier is activated for the serving cell and includes one or more physical cell identifiers.~~

~~43. —The method of claim 42, wherein the sixth physical cell identifier is selected from the plurality of physical cell identifiers activated for the serving cell based on at least one of a relationship between the plurality of physical cell identifiers, a physical cell identifier used for determining a monitoring occasion for a first search space, a physical cell identifier associated with a quasi-co-location assumption for the first search space, or a physical cell identifier selected by a physical random access channel (PRACH).~~

449. The method of claim 1, further comprising:

determining a seventh physical cell identifier from the plurality of physical cell identifiers of the serving cell; and

using the seventh physical cell identifier to obtain first common information;

~~45. —The method of claim 1, further comprising determining previous first common information to be invalid when the physical cell identifier of the serving cell is updated.~~

~~46. —The method of claim 1, further comprising reacquiring, by the wireless device, first common information when the physical cell identifier of the serving cell is updated.~~

~~47. —The method of any of claims 44-46, wherein the first common information includes as least one of a physical broadcast channel (PBCH), a control resource set with a first index, a monitoring occasion of a search space with the first index, a quasi-co-location reference signal for the search space with the first index, a monitoring occasion of a common search space, time domain resources of the common search space, system messages, or random access resource parameters.~~

~~48. —The method of claim 44, wherein, upon determination that there are multiple activated physical cell identifiers of the serving cell, the first common information corresponding to the respective physical cell identifiers is acquired by the wireless device based on each activated physical cell identifier.~~

49. ~~The method of claim 44, wherein, upon determination that there is only one activated physical cell identifier in the serving cell at a given time, the first common information is obtained based on the activated physical cell identifier.~~

50. ~~The method of claim 44, wherein determining a seventh physical cell identifier from multiple physical cell identifiers of the serving cell according to at least one of following information: signaling information or a predetermined rule, physical cell identifier selected during random access, or the relationship of the multiple physical cell identifier.~~

51. ~~The method of claim 1, further comprising:~~

~~—determining a mobility reference signal as a quasi-co-location reference signal of a target reference signal in the serving cell,~~

~~—wherein the mobility reference signal is associated with one of the plurality of physical cell identifiers of the serving cell.~~

52. ~~The method of claim 51, wherein the mobility reference signal is associated with the one of the plurality of physical cell identifiers and one of an absolute radio frequency channel number (ARFCN), a reference signal resource index, and a mobility object index.~~

53. ~~The method of claim 51, wherein the mobility reference signal is a quasi-co-location reference signal of the target reference signal in the serving cell when the target reference signal is a channel state information reference signal (CSI-RS) for tracking.~~

5410. The method of any of claims 1-~~539~~, wherein ~~the signaling received by~~ the wireless device receives a signaling that includes a time unit offset between a physical cell identifier from the plurality of physical cell identifier and a reference physical cell identifier.

~~5511.~~ The method of any of claims 1-~~539~~, wherein each of the plurality of physical cell identifiers is associated with a third parameter, respectively, wherein the third parameter includes at least one of an absolute radio frequency channel number (ARFCN), or a mobility object identifier.

~~56. The method of claim 55, wherein the third parameter associated with a physical cell identifier is determined by a signaling received by the wireless device.~~

~~57~~12. The method of claim 1, further comprising:

determining a mapping relationship between the plurality of physical cell identifiers and M fourth parameters, wherein M is positive integer, and wherein the fourth parameters include at least one of: radio network temporary identifier (RNTI); the association between RACH resources and one or more SSBs; the association between RACH resources and one or more CSI-RS; common RACH resources; or system information.

~~58~~13. The method of any of claims 1-~~57~~12, wherein the multiple-plurality of physical cell identifiers of the serving cell is activated at different times, and there is only one activated physical cell identifier of the serving cell at a given time.

~~59. A wireless communication method, comprising:~~

~~—determining a mobility measurement reference signal as a quasi-co-location reference signal of a target reference signal in a serving cell.~~

~~60. The method of claim 59, wherein the mobility measurement reference signal is associated with at least one of a physical cell identifier, an absolute radio frequency channel number, a reference signal resource index, or mobility object index.~~

~~61. The method of claim 59, wherein the mobility measurement reference signal includes at least one of a synchronization signal block or a channel state information reference signal (CSI-RS) measurement reference signal configured in a mobility object.~~

~~62. The method of claim 59, wherein the mobility reference signal is determined as the quasi-co-location reference signal of the target reference signal in the serving cell when the target reference signal is a channel state information reference signal (CSI-RS) for tracking.~~

63. — ~~The method of claim 59, wherein the mobility measurement reference signal is associated with at least one of a physical cell indicator, an absolute radio frequency channel number, a mobility object, a channel state information reference signal resource index for mobility configured in a transmission configuration indicator state of a channel state information reference signal (CSI-RS) for tracking a reference signal.~~

64. — ~~A wireless communication method, comprising:
— determining, by a wireless device, a number of physical cell identifiers of a serving cell;
and
— determining, by the wireless device, a parameter of the serving cell according to the number of physical cell identifiers of the serving cell.~~

65. — ~~The method of claim 64, wherein the determining of the parameter of the serving cell according to the number of physical cell identifier of the serving cell comprise:
— determining the parameter by a first method when the number is one; and
— determining the parameter by a second method when the number is more than one.~~

66. — ~~The method of claim 65, wherein the parameter includes a sequence of a target element in the serving cell, and wherein the determining of the parameter comprises:
— determining the initial parameters for generating the sequence by a first function when the number is one; and
— determining the initial parameters for generating the sequence by a second function when the number is more than one.~~

67. — ~~The method of claim 65, wherein the parameter includes at least one: a mobility measurement result of the serving cell; common information; system information; bandwidth part switching delay; or a time gap between a time when a new parameter is applied in a signaling and a predefined time.~~

6814. An apparatus for wireless communication, comprising a memory and a processor, wherein the processor reads code from the memory and implements a method recited in any of claims 1 to 6713.

6915. A computer readable program storage medium having code stored thereon, the code, when executed by a processor, causing the processor to implement a method recited in any of claims 1 to 6713.