

REFERENCE SIGNAL RESOURCE MANAGEMENT FOR FAST PANEL SWITCHING AND ANTENNA SWITCHING

TECHNICAL FIELD

This patent document is directed generally to wireless communications.

BACKGROUND

Mobile communication technologies are moving the world toward an increasingly connected and networked society. The rapid growth of mobile communications and advances in technology have led to greater demand for capacity and connectivity. Other aspects, such as energy consumption, device cost, spectral efficiency, and latency are also important to meeting the needs of various communication scenarios. Various techniques, including new ways to provide higher quality of service, longer battery life, and improved performance are being discussed.

SUMMARY

This patent document describes, among other things, techniques related to reference signal resource management to enable fast panel switching and antenna switching for wireless devices that have multiple panels (e.g., transmission/reception entities).

In ~~one example~~a first aspect, a wireless communication method is disclosed. The method ~~includes~~comprises receiving, by a ~~wireless mobile~~ device, a configuration parameter from a base station. The method also ~~includes~~comprises transmitting, by the ~~wireless mobile~~ device, a sounding reference signal (SRS) to the base station according to an SRS procedure in which one or more resource sets are determined according to the configuration parameter.

In a second aspect, a wireless communication method is disclosed. The method comprises transmitting, by a base station, a configuration parameter to a mobile device. The method also comprises receiving, by the base station, a sounding reference signal (SRS) from the mobile device according to an SRS procedure in which one or more resource sets are determined according to the configuration parameter.

In another example ~~aspect~~, a wireless communication method is disclosed. The method includes transmitting, by a base station, a configuration parameter to a wireless device.

The method also includes receiving, by the base station, a sounding reference signal (SRS) to the base station according to an SRS procedure in which one or more resource sets are determined according to the configuration parameter.

In another example ~~aspect~~, a communication ~~apparatus-device~~ is disclosed. The apparatus ~~includes-comprises one or more transceivers and~~ a processor ~~that-in communication with the one or more transceivers is~~ configured to ~~implement an above-described a~~ method according to the first or second aspect.

In yet another example~~-aspect~~, a computer-program storage medium is disclosed. The computer-program storage medium includes code stored thereon. The code, when executed by a processor, causes the processor to implement a described method.

These, and other, aspects are described in the present document.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 illustrates an example of beamforming training process in a one-Transmission/Reception Point (TRP) and one-panel scenario.

FIG. 2 illustrates an example of multi-panel transmission in a multiple TRP scenario.

FIG. 3 illustrates an example framework for Sounding Reference Signal (SRS) transmissions in an SRS procedure in accordance with the present technology.

FIG. 4A illustrates an example intra-panel antenna switching scenario in accordance with the present technology.

FIG. 4B illustrates an example inter-panel antenna switching scenario in accordance with the present technology.

FIG. 5A is a flow chart representation of a method for wireless communication in accordance with the present technology.

FIG. 5B is a flow chart representation of another method for wireless communication in accordance with the present technology.

FIG. 6 illustrates an example of organizing SRS resources for an SRS procedure in accordance with the present technology.

FIG. 7 illustrates an example of triggering an SRS procedure in accordance with the present technology.

FIG. 8 illustrates an example of single-beam inter-panel antenna switching in accordance with the present technology.

FIG. 9 illustrates an example multi-beam inter-panel antenna switching in accordance with the present technology.

FIG. 10 illustrates another example multi-beam inter-panel antenna switching in accordance with the present technology.

FIG. 11 shows an example of a wireless communication system where techniques in accordance with one or more embodiments of the present technology can be applied.

CLAIMS

What is claimed is:

1. A method for wireless communication, comprising:
receiving, by a mobile device, a configuration parameter from a base station; and
transmitting, by the mobile device, a sounding reference signal (SRS) to the base station according to an SRS procedure in which one or more resource sets are determined according to the configuration parameter.

2. The method of claim 1, further comprising:

(1) receiving, by the mobile device, a first message from the base station for triggering the SRS procedure, wherein a time-domain offset between receiving the first message and transmitting the sounding reference signal is less than or equal to a first threshold, wherein resources of at least one of the one or more resource sets correspond to a same panel or a same transmission state; or

(2) receiving, by the mobile device, a second message from the base station for triggering the SRS procedure, wherein a time-domain offset between receiving the second message and transmitting the sounding reference signal is more than or equal to a second threshold, wherein the resources of the at least one resource set correspond to different panels or different transmission states.

3. A method for wireless communication, comprising:

transmitting, by a base station, a configuration parameter to a mobile device; and
receiving, by the base station, a sounding reference signal (SRS) from the mobile device according to an SRS procedure in which one or more resource sets are determined according to the configuration parameter.

4. The method of claim 3, further comprising:

(1) transmitting, by the base station, a message to the mobile device for triggering the SRS procedure, wherein the time-domain offset between a reception of the message and a

transmission of the sounding reference signal by the mobile device is less than or equal to a first threshold, wherein resources of at least one of the one or more resource sets correspond to a same panel or a same transmission state; or

(2) transmitting, by the base station, a message to the mobile device for triggering the SRS procedure, wherein the time-domain offset between a reception of the message and a transmission of the sounding reference signal by the mobile device is more than or equal to a second threshold, wherein resources of at least one of the one or more resource sets correspond to different panels or different transmission states.

~~2. The method of claim 1, wherein the one or more resource sets are organized in one or more groups.~~

~~3. The method of claim 1 or 2, wherein the one or more resource sets or resources in the one or more resource sets are associated with a same configuration parameter.~~

~~45.~~ The method of any one ~~or more~~ of claims ~~1 to 34~~, wherein the configuration parameter comprises an indicator indicating an association of the one or more resource sets.

~~56.~~ The method of any one ~~or more~~ of claims 1 to ~~34~~, wherein the configuration parameter comprises at least one of: a time-domain behavior, a number of antenna ports corresponding to resources in each of the one or more resource sets, a number of resources in each of the one or more resource sets, a triggering state, a resource type, a bandwidth part, a component carrier, a transmission state, a spatial relation, a panel, a number of transmitting and receiving antennas, or a power control parameter.

~~6. The method of any one or more of claims 1 to 5, wherein resources from different resource sets of the one or more resource sets correspond to different antenna ports or port groups of the mobile device.~~

~~7. The method of any one or more of claims 1 to 5, resources from a same resource set or a same resource group of the one or more resource sets correspond to different antenna ports or port groups of the mobile device.~~

~~8. The method of claim 6 or 7, wherein the resources correspond to a same transmission state or a same panel.~~

~~9. The method of any one or more of claims 1 to 8, further comprising:
receiving, by the mobile device, a message from the base station for triggering the SRS procedure, wherein the time domain offset between receiving the message and transmitting the sounding reference signal is less than or equal to a first threshold.~~

~~10. The method of claim 9, wherein resources of at least one of the one or more resource sets correspond to a same panel or a same transmission state.~~

~~11. The method of any one or more of claims 1 to 8, further comprising:
receiving, by the mobile device, a message from the base station for triggering the SRS procedure, wherein the time domain offset between receiving the message and transmitting the sounding reference signal is more than or equal to a second threshold.~~

~~12. The method of claim 11, wherein resources of at least one of the one or more resource sets correspond to different panels or different transmission states.~~

137. The method of ~~any one or more of~~ claims 93 or 4~~to 12~~, wherein the first threshold or second threshold is configured by the base station or is determined according to a capability of the mobile device.

148. The method of any one ~~or more of~~ claims 1 to 137, wherein at least one resource sets of the one or more resource sets are used for a first usage and ~~or~~ a second usage, the first usage including an antenna switching usage or a beam management usage, and the second usage including a codebook transmission usage or a non-codebook transmission usage.

~~15. The method of any one or more of claims 1 to 14, wherein all resources of at least one resource sets are associated with a same panel, or a same transmission state.~~

169. The method of ~~any one or more of claims 1 to 158~~, wherein a subset of the one or more resource sets that is positioned at a beginning or an end of the SRS transmission is applicable to an uplink data transmission, or used for the codebook transmission usage or the non-codebook transmission usage.

~~1710~~. The method of ~~any one or more of claims 1 to 168~~, wherein a subset of the one or more resource sets that has N lowest or highest indices is applicable to an uplink data transmission, or used for the codebook transmission usage or the non-codebook transmission usage, wherein N is a positive integer.

~~1811~~. The method of any one ~~or more~~ of claims 1 to ~~1710~~, wherein a guard period is applied between a first resource and a second resource, and wherein the first resource and the second resource correspond to different panels, same transmission states, ~~and/or~~ different resource sets, and wherein no signal is transmitted by the mobile device in the guard period.

~~19. The method of any one or more of claims 1 to 18, wherein resources in a resource set are positioned without any guard period between each other, and wherein the resources correspond to a same resource set, a same panel, and/or different transmission states.~~

~~20. The method of any one or more of claims 1 to 19, wherein a guard period is excluded between a first resource and a second resource, and wherein the first resource and the second resource correspond to a same resource set, a same panel, and/or different transmission states.~~

~~21. The method of any one or more of claims 1 to 20, wherein a guard period is excluded between a first resource and a second resource, and wherein the first resource and the second resource correspond to a different resource set.~~

~~22~~12. The method of any one ~~or more~~ of claims ~~1 to 24~~11, wherein resources in at least one of the one or more resource sets correspond to a same transmission state or a same panel, and wherein the resources correspond to different ports or port groups of the mobile device.

~~23. The method of any one or more of claim 1 to 21, where resources in at least one of the one or more resource sets correspond to different transmission states or different panels.~~

~~24. The method of claim 22 or 23, wherein the resources correspond to different ports or port groups of the mobile device.~~

~~25. The method of any one or more of claims 1 to 24, wherein resources in at least one of the one or more resource sets are associated with different panels.~~

~~26. The method of any one or more of claims 1 to 24, wherein resources in at least one of the one or more resource sets are associated with a same panel.~~

~~27. The method of any one or more of claims 1 to 26, wherein a first resource in a first resource set has a same transmission state or a same panel as a corresponding second resource in a second resource set.~~

~~28. The method of any one or more of claims 1 to 27, wherein a first resource set in a first group has a same transmission state or a same panel as a corresponding second resource set in a second resource group.~~

~~29~~13. The method of any one ~~or more~~ of claims 1 to ~~28~~12, wherein a capability of the mobile device indicates that resources in at least one of the one or more resource sets support different transmission states.

~~30~~14. The method of any one ~~or more~~ of claims 1 to ~~29~~13, wherein a number of different ports or port groups for the same transmission state, a number of resources that are associated with the

same transmission state or the same panel, or a number of resources that are associated with different transmission states or different panels is a predefined value or is determined based on a capability of mobile device.

~~31. — The method of any one or more of claims 1 to 30, wherein a number of the resources that are associated with the same transmission state or the same panel is a predefined value or is determined according to a capability of the mobile device.~~

~~32. — The method of any one or more of claims 1 to 31, wherein a number of the resources that are associated with different transmission states or different panels is a predefined value or determined according to a capability of the mobile device.~~

~~33. — The method of any one or more of claims 1 to 32, wherein a number of the resources is determined based on an antenna indicator indicating a number of transmitting and receiving antennas.~~

~~34. — A method for wireless communication, comprising:
—— transmitting, by a base station, a configuration parameter from a wireless device; and
—— receiving, by the base station, a sounding reference signal (SRS) from the wireless device according to an SRS procedure in which one or more resource sets are determined according to the configuration parameter.~~

~~35. — The method of claim 34, wherein the one or more resource sets are organized in one or more groups.~~

~~36. — The method of claim 34 or 35, wherein the one or more resource sets or resources in the one or more resource sets are associated with a same configuration parameter.~~

~~37. — The method of any one or more of claims 34 to 36, wherein the configuration parameter comprises an indicator indicating an association of the one or more resource sets.~~

~~38. —The method of any one or more of claims 34 to 36, wherein the configuration parameter comprises at least one of: a time domain behavior, a number of antenna ports corresponding to resources in each of the one or more resource sets, a number of resources in each of the one or more resource sets, a triggering state, a resource type, a bandwidth part, a component carrier, a transmission state, a spatial relation, a panel, a number of transmitting and receiving antennas, or a power control parameter.~~

~~39. —The method of any one or more of claims 34 to 38, wherein resources from different resource sets of the one or more resource sets correspond to different antenna ports or port groups of the mobile device.~~

~~40. —The method of any one or more of claims 34 to 38, resources from a same resource set or a same resource group of the one or more resource sets correspond to different antenna ports or port groups of the mobile device.~~

~~41. —The method of claim 39 or 40, wherein the resources correspond to a same transmission state or a same panel.~~

~~42. —The method of any one or more of claims 34 to 41, further comprising:
—transmitting, by the base station, a message to the mobile device for triggering the SRS procedure, wherein the time domain offset between a reception of the message and a transmission of the sounding reference signal by the mobile device is less than or equal to a first threshold.~~

~~43. —The method of claim 42, wherein resources of at least one of the one or more resource sets correspond to a same panel or a same transmission state.~~

~~44. —The method of any one or more of claims 34 to 41, further comprising:
—transmitting, by the base station, a message to be mobile device for triggering the SRS procedure, wherein the time domain offset between a reception of the message and a~~

~~transmission of the sounding reference signal by the mobile device is more than or equal to a second threshold.~~

~~45. The method of claim 44, wherein resources of at least one of the one or more resource sets correspond to different panels or different transmission states.~~

~~46. The method of any one or more of claims 42 to 45, wherein the first threshold or second threshold is configured by the base station or is determined according to a capability of the mobile device.~~

~~47. The method of any one or more of claims 34 to 46, wherein at least one resource sets of the one or more resource sets are used for a first usage and/or a second usage, the first usage including an antenna switching usage or a beam management usage, and the second usage including a codebook transmission usage or a non-codebook transmission usage.~~

~~48. The method of any one or more of claims 34 to 47, wherein all resources of at least one resource sets are associated with a same panel, or a same transmission state.~~

~~49. The method of any one or more of claims 34 to 48, where a subset of the one or more resource sets that is positioned at a beginning or an end of the SRS transmission is applicable to an uplink data transmission, or used for the codebook transmission usage or the non-codebook transmission usage.~~

~~50. The method of any one or more of claims 34 to 49, where a subset of the one or more resource sets that has N lowest or highest indices is applicable to an uplink data transmission, or used for the codebook transmission usage or the non-codebook transmission usage, wherein N is a positive integer.~~

~~51. The method of any one or more of claims 34 to 50, wherein a guard period is applied between a first resource and a second resource, and wherein the first resource and the second~~

~~resource correspond to different panels, same transmission states, and/or different resource sets, and wherein no signal is transmitted by the mobile device in the guard period.~~

~~52. —The method of any one or more of claims 34 to 51, wherein resources in a resource set are positioned without any guard period between each other, and wherein the resources correspond to a same resource set, a same panel, and/or different transmission states.~~

~~53. —The method of any one or more of claims 34 to 52, wherein a guard period is excluded between a first resource and a second resource, and wherein the first resource and the second resource correspond to a same resource set, a same panel, and/or different transmission states.~~

~~54. —The method of any one or more of claims 34 to 53, wherein a guard period is excluded between a first resource and a second resource, and wherein the first resource and the second resource correspond to a different resource set.~~

~~55. —The method of any one or more of claim 34 to 54, wherein resources in at least one of the one or more resource sets correspond to a same transmission state or a same panel.~~

~~56. —The method of any one or more of claim 34 to 54, where resources in at least one of the one or more resource sets correspond to different transmission states or different panels.~~

~~57. —The method of claim 55 or 56, wherein the resources correspond to different ports or port groups of the mobile device.~~

~~58. —The method of any one or more of claims 34 to 57, wherein resources in at least one of the one or more resource sets are associated with different panels.~~

~~59. —The method of any one or more of claims 34 to 57, wherein resources in at least one of the one or more resource sets are associated with a same panel.~~

~~60. —The method of any one or more of claims 34 to 59, wherein a first resource in a first resource set has a same transmission state or a same panel as a corresponding second resource in a second resource set.~~

~~61. —The method of any one or more of claims 34 to 60, wherein a first resource set in a first group has a same transmission state or a same panel as a corresponding second resource set in a second resource group.~~

~~62. —The method of any one or more of claims 34 to 61, wherein a capability of the mobile device indicates that resources in at least one of the one or more resource sets support different transmission states.~~

~~63. —The method of any one or more of claims 34 to 62, wherein a number of different ports or port groups for the same transmission state is a predefined value or is determined based on a capability of mobile device.~~

~~64. —The method of any one or more of claims 34 to 63, wherein a number of the resources that are associated with the same transmission state or the same panel is a predefined value or is determined according to a capability of the mobile device.~~

~~65. —The method of any one or more of claims 34 to 64, wherein a number of the resources that are associated with different transmission states or different panels is a predefined value or determined according to a capability of the mobile device.~~

~~66. —The method of any one or more of claims 34 to 65, wherein a number of the resources is determined based on an antenna indicator indicating a number of transmitting and receiving antennas.~~

6715. A wireless communication device, comprising:
one or more transceivers; and
a processor in communication with the one or more transceivers configured to a method

of any one ~~or more~~ of claims 1 to ~~33~~14.

~~68. — A wireless communication device, comprising:~~

~~—— a transceiver; and~~

~~—— a processor in communication with the one or more transceivers configured to a method of any one or more of claims 34 to 66.~~

~~69. — A computer program product stored on a non-transitory computer readable media, the computer program product including program code for carrying out the method in any one of claims 1 to 66.~~