Indicating a Transmission Configuration Indicator State

Field

The following exemplary embodiments relate to wireless communication and to indicating resources associated with transmission of data.

Background

Wireless networks, such as cellular communication networks, use control channels to for example indicate control information. Such control information may allow resources to be allocated such that data transmissions are enabled. It is also desirable to have as optimal usage of resources as possible.

Brief Description

The scope of protection sought for various embodiments of the invention is set out by the independent claims. The exemplary embodiments and features, if any, described in this specification that do not fall under the scope of the independent claims are to be interpreted as examples useful for understanding various embodiments of the invention.

Summary

According to an aspect, the present disclosure refers to an apparatus comprising at least one processor, and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured, with the at least one processor, to cause the apparatus to:

receive a first information element indicating two transmission configuration indicator states;

receive a configuration; and

determine an association between the two indicated transmission

configuration indicator states and at least one physical uplink control channel resource group according to the configuration,

wherein the configuration causes the apparatus to determine the association between the two indicated transmission configuration indicator states and the at least one physical uplink control channel resource group to be one of the following:

both of the two indicated transmission configuration indicator states are applicable to the at least one physical uplink control channel resource group;

a first indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group; or

a second indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group.

According to an aspect, the present disclosure refers to an apparatus comprising at least one processor, and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured, with the at least one processor, to cause the apparatus to:

transmit, to a terminal device, a first information element indicating two transmission configuration indicator states; and

transmit, to the terminal device, a configuration for determining an association between the two indicated transmission configuration indicator states and at least one physical uplink control channel resource group,

wherein the configuration causes the terminal device to determine the association between the two indicated transmission configuration indicator states and the at least one physical uplink control channel resource group to be one of the following:

both of the two indicated transmission configuration indicator states are applicable to the at least one physical uplink control channel resource group;

a first indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group; or

a second indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group.

According to an aspect, the present disclosure refers to a method comprising, by a terminal device:

receiving a first information element indicating two transmission configuration indicator states;

receiving a configuration; and

determining an association between the two indicated transmission configuration indicator states and at least one physical uplink control channel resource group according to the configuration,

wherein the configuration causes the terminal device to determine the association between the two indicated transmission configuration indicator states and the at least one physical uplink control channel resource group to be one of the following:

both of the two indicated transmission configuration indicator states are applicable to the at least one physical uplink control channel resource group;

a first indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group; or

a second indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group.

According to an aspect, the present disclosure refers to a method comprising, by a network device:

transmitting, to a terminal device, a first information element indicating two transmission configuration indicator states; and

transmitting, to the terminal device, a configuration for determining an association between the two indicated transmission configuration indicator states and at least one physical uplink control channel resource group,

wherein the configuration causes the terminal device to determine the association between the two indicated transmission configuration indicator states and the at least one physical uplink control channel resource group to be one of the following:

both of the two indicated transmission configuration indicator states are applicable to the at least one physical uplink control channel resource group;

a first indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group; or

a second indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group.

According to an aspect, the present disclosure refers to a computer program comprising instructions for causing an apparatus to perform at least the following:

receive a first information element indicating two transmission configuration indicator states;

receive a configuration; and

determine an association between the two indicated transmission configuration indicator states and at least one physical uplink control channel resource group according to the configuration,

wherein the configuration causes the apparatus to determine the association between the two indicated transmission configuration indicator states and the at least one physical uplink control channel resource group to be one of the following:

both of the two indicated transmission configuration indicator states are applicable to the at least one physical uplink control channel resource group;

a first indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group; or

a second indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group.

According to an aspect, the present disclosure refers to a computer program comprising instructions for causing an apparatus to perform at least the following:

transmit, to a terminal device, a first information element indicating two transmission configuration indicator states; and

transmit, to the terminal device, a configuration for determining an association between the two indicated transmission configuration indicator states and at least one physical uplink control channel resource group.,

wherein the configuration causes the terminal device to determine the association between the two indicated transmission configuration indicator states and the at least one physical uplink control channel resource group to be one of the following:

both of the two indicated transmission configuration indicator states are applicable to the at least one physical uplink control channel resource group;

a first indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group; or

a second indicated transmission configuration indicator state of the two indicated transmission configuration indicator states is applicable to the at least one physical uplink control channel resource group.

According to a first example there is provided an apparatus comprising means for: receiving a first information element, wherein the first information element indicates at least one transmission configuration indicator state, receiving a second information element, and determining, based on the second information element, an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

In some examples according to the first example, the means comprises at least one processor, and at least one memory, including a computer program code, wherein the at least one memory and the computer program code are configured, with the at least one processor, to cause the performance of the apparatus.

According to a second example there is provided an apparatus comprising at least one processor, and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured, with the at least one processor, to cause the apparatus to: receive a first information element, wherein the first information element indicates at least one transmission configuration indicator state, receive a second information element, and determine, based on the second information element, an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

According to a third example there is provided a method comprising: receiving a first information element, wherein the first information element indicates at least one transmission configuration indicator state, receiving a second information element, and determining, based on the second information element, an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

According to a fourth example there is provided a computer program comprising instructions for causing an apparatus to perform at least the following: receive a first information element, wherein the first information element indicates at least one transmission configuration indicator state, receive a second information element, and determine, based on the second information element, an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

According to a fifth example there is provided a computer program comprising instructions stored thereon for performing at least the following: receiving a first information element, wherein the first information element indicates at least one transmission configuration indicator state, receiving a second information element, and determining, based on the second information element, an association between

the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

According to a sixth example there is provided a non-transitory computer readable medium comprising program instructions for causing an apparatus to perform at least the following: receive a first information element, wherein the first information element indicates at least one transmission configuration indicator state, receive a second information element, and determine, based on the second information element, an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

According to a seventh example there is provided a non-transitory computer readable medium comprising program instructions stored thereon for performing at least the following: receiving a first information element, wherein the first information element indicates at least one transmission configuration indicator state, receiving a second information element, and determining, based on the second information element, an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

According to an eight example there is provided an apparatus comprising means for: transmitting, to a terminal device, a first information element, wherein the first information element indicates at least one transmission configuration indicator state, and transmitting, to the terminal device, a second information element, wherein the second information element is for determining an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

In some examples according to the eighth example, the means comprises at least one processor, and at least one memory, including a computer program code, wherein the at least one memory and the computer program code are

configured, with the at least one processor, to cause the performance of the apparatus.

According to a ninth example there is provided an apparatus comprising at least one processor, and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured, with the at least one processor, to cause the apparatus to: transmit, to a terminal device, a first information element, wherein the first information element indicates at least one transmission configuration indicator state, and transmit, to the terminal device, a second information element, wherein the second information element is for determining an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

According to a tenth example there is provided a method comprising: transmitting, to a terminal device, a first information element, wherein the first information element indicates at least one transmission configuration indicator state, and transmitting, to the terminal device, a second information element, wherein the second information element is for determining an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

According to an eleventh example there is provided a computer program comprising instructions for causing an apparatus to perform at least the following: transmit, to a terminal device, a first information element, wherein the first information element indicates at least one transmission configuration indicator state, and transmit, to the terminal device, a second information element, wherein the second information element is for determining an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

According to a twelfth example there is provided a computer program comprising instructions stored thereon for performing at least the following: transmitting, to a terminal device, a first information element, wherein the first information element indicates at least one transmission configuration indicator state, and transmitting, to the terminal device, a second information element, wherein the second information element is for determining an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

According to a thirteenth example there is provided a non-transitory computer readable medium comprising program instructions for causing an apparatus to perform at least the following: transmit, to a terminal device, a first information element, wherein the first information element indicates at least one transmission configuration indicator state, and transmit, to the terminal device, a second information element, wherein the second information element is for determining an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

According to a fourteenth example there is provided a non-transitory computer readable medium comprising program instructions stored thereon for performing at least the following: transmitting, to a terminal device, a first information element, wherein the first information element indicates at least one transmission configuration indicator state, and transmitting, to the terminal device, a second information element, wherein the second information element is for determining an association between the at least one transmission configuration indicator state and at least one physical uplink control channel resource group.

List of Drawings

In the following, the invention will be described in greater detail with reference to the embodiments and the accompanying drawings, in which

FIG. 1 illustrates an example embodiment of a radio access network.