and is transmitted.

[0006]

Furthermore, in NR, "Short PUCCH" and "Long PUCCH" are supported. According to Short PUCCH, PUCCH is transmitted by using one symbol or two symbols in one slot. According to Long PUCCH, PUCCH is transmitted by using three or more symbols in one slot (for example, the minimum number of symbols may be four). Hereinafter, Short PUCCH which transmits PUCCH by using one symbol is referred to as "1-symbol PUCCH."

Citation List

Non Patent Literature

[0007]

NPL 1: 3GPP TS 36.211 V13.4.0, "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (Release 13)," December 2016.

NPL 2: 3GPP TS 36.212 V13.4.0, "Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding (Release 13)," December 2016.

NPL 3: 3GPP TS 36.213 V13.4.0, "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 13)," December 2016.

Summary

[0008]

However, a technique for transmitting SR in 1-symbol PUCCH has not been fully examined.

[0008a]

In a first aspect, the present disclosure provides a terminal comprising: circuitry, which, in operation, generates, based on sequence selection, uplink control information including HARQ-ACK for downlink data; and a transmitter, which, in operation, transmits the uplink control information using a physical uplink control channel (PUCCH) of one symbol, wherein a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.

[0008b]

In a second aspect, the present disclosure provides a base station comprising: a transmitter, which, in operation, transmits downlink data to a

terminal; and a receiver, which, in operation, receives uplink control information including HARQ-ACK for the downlink data, the uplink control information being transmitted, from the terminal, using a physical uplink control channel (PUCCH) of one symbol, wherein the uplink control information including the HARQ-ACK is based on sequence selection, and a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.

[0008c]

In a third aspect, the present disclosure provides a communication method comprising: generating, based on sequence selection, uplink control information including HARQ-ACK for downlink data; and transmitting the uplink control information using a physical uplink control channel (PUCCH) of one symbol, wherein a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.

[0008d]

In a fourth aspect, the present disclosure provides a communication method comprising: transmitting downlink data to a terminal; and receiving uplink control information including HARQ-ACK for the downlink data, the uplink control information being transmitted, from the terminal, using a physical uplink control channel (PUCCH) of one symbol, wherein the uplink control information including the HARQ-ACK is based on sequence selection, and a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.

[0008e]

In a fifth aspect, the present disclosure provides an integrated circuit to control a process, the process comprising: generating, based on sequence selection, uplink control information including HARQ-ACK for downlink data; and transmitting the uplink control information using a physical uplink control channel (PUCCH) of one symbol, wherein a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.

[0008f]

In a sixth aspect, the present disclosure provides an integrated circuit to

control a process, the process comprising: transmitting downlink data to a terminal; and receiving uplink control information including HARQ-ACK for the downlink data, the uplink control information being transmitted, from the terminal, using a physical uplink control channel (PUCCH) of one symbol, wherein the uplink control information including the HARQ-ACK is based on sequence selection, and a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.

[0009]

One embodiment of the present disclosure facilitates providing a terminal and a communication method capable of appropriately transmitting SR in 1-symbol PUCCH.

[0010]

According to an embodiment of the present disclosure, a terminal includes circuitry and a transmitter. The circuitry allocates uplink control information including at least one of a response signal responsive to downlink data and an uplink radio resource allocation request signal to a resource for an uplink control channel on the basis of a mode selected from among a plurality of modes relating to the channel configuration of the uplink control channel in accordance with an

According to an embodiment of the present disclosure, a communication method includes allocating uplink control information including at least one of a response signal responsive to downlink data and an uplink radio resource allocation request signal to a resource for an uplink control channel on the basis of a mode selected from among a plurality of modes relating to the channel configuration of the uplink control channel in accordance with an operating environment of the terminal when transmission of the response signal and transmission of an uplink radio resource allocation request signal occur simultaneously and transmitting the uplink control information.

[0015]

According to an embodiment of the present disclosure, a communication method includes allocating uplink control information including at least one of a response signal responsive to downlink data and an uplink radio resource allocation request signal to a resource for an uplink control channel, transmitting the uplink control channel, allocating, to a terminal, a first resource used to transmit the response signal, a second resource used to transmit the radio resource allocation request signal, and a third resource used to transmit a reference signal frequency-multiplexed with the uplink control information, and transmitting the uplink control information and the reference signal by using one of the first resource and the second resource and the third resource. The first resource and the second resource are allocated to the same resource block.

[0016]

It should be noted that these general and specific embodiments may be implemented as a system, a method, an integrated circuit, a computer program, or a recording medium, or any combination of a system, a method, an integrated circuit, a computer program, and a recording medium.

[0017]

According to one embodiment of the present disclosure, SR can be properly transmitted on a 1-symbol PUCCH.

[0018]

Additional benefits and advantages of an embodiment of the present disclosure will become apparent from the specification and drawings. The benefits and/or advantages may be individually obtained by the various embodiments and

CLAIMS

1. A terminal comprising:
circuitry, which, in operation, generates, based on sequence selection, uplink control information including HARQ-ACK for downlink data; and
a transmitter, which, in operation, transmits the uplink control information using a physical uplink control channel (PUCCH) of one symbol,
wherein a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.

2. The terminal according to claim 1, wherein the number of bits of the HARQ-ACK is 1 or 2.

3. The terminal according to claim 1, wherein the number of terminals multiplexed in the same physical resource block is up to 6 for the HARQ-ACK with 1 bit.

4. The terminal according to claim 1, wherein the sequence is a sequence including a cyclic shift or a sequence defined by a cyclic shift.

5. The terminal according to claim 1, wherein a sequence for the uplink control information including ACK as the HARQ-ACK is different from a sequence for the uplink control information including NACK as the HARQ-ACK.

6. The terminal according to claim 1, wherein a physical resource block where the uplink control information including both the HARQ-ACK and the scheduling request is transmitted is same as a physical resource block where the uplink control information including the HARQ-ACK is transmitted.

7. The terminal according to claim 1, wherein the number of sequences assigned to one terminal is 4 for the HARQ-ACK with 1 bit, and the number of sequences assigned to one terminal is 8 for the HARQ-ACK with 2 bits.

8. The terminal according to claim 1, wherein in transmission of both HARQ-ACK and a scheduling request, the uplink control information is generated using one mode out of:
a mode using the sequence for the uplink control information including both the HARQ-ACK and the scheduling request; and
a mode using both a sequence for the uplink control information including the HARQ-ACK and a sequence for the uplink control information including the scheduling request.

9. The terminal according to claim 1, comprising:
a receiver, which, in operation, receives information related to a resource of the PUCCH,
wherein the uplink control information is generated and transmitted based on the information.

10. The terminal according to claim 9, wherein the information includes information related to a cyclic shift used in the sequence.

11. A base station comprising:
a transmitter, which, in operation, transmits downlink data to a terminal; and
a receiver, which, in operation, receives uplink control information including HARQ-ACK for the downlink data, the uplink control information being transmitted, from the terminal, using a physical uplink control channel (PUCCH) of one symbol,
wherein the uplink control information including the HARQ-ACK is based on sequence selection, and a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.

12. The base station according to claim 11, wherein the number of bits of the HARQ-ACK is 1 or 2.

13. The base station according to claim 11, wherein the number of terminals multiplexed in the same physical resource block is up to 6 for the HARQ-ACK with 1 bit.

14. The base station according to claim 11, wherein the sequence is a sequence including a cyclic shift or a sequence defined by a cyclic shift.

15. The base station according to claim 11, wherein a sequence for the uplink control information including ACK as the HARQ-ACK is different from a sequence for the uplink control information including NACK as the HARQ-ACK.

16. The base station according to claim 11, wherein a physical resource block where the uplink control information including both the HARQ-ACK and the scheduling request is transmitted is same as a physical resource block where the uplink control information including the HARQ-ACK is transmitted.

17. The base station according to claim 11, wherein the number of sequences assigned to one terminal is 4 for the HARQ-ACK with 1 bit, and the number of sequences assigned to one terminal is 8 for the HARQ-ACK with 2 bits.

18. The base station according to claim 11, wherein in transmission, from the terminal, of both HARQ-ACK and a scheduling request, the uplink control information is received using one mode out of:
a mode using the sequence for the uplink control information including both the HARQ-ACK and the scheduling request; and
a mode using both a sequence for the uplink control information including the HARQ-ACK and a sequence for the uplink control information including the scheduling request.

19. The base station according to claim 11, wherein the transmitter, in operation, transmits, to the terminal, information related to a resource of the PUCCH, and the receiver, in operation, receives the uplink control information that is generated and transmitted based on the information.

20. The base station according to claim 19, wherein the information includes information related to a cyclic shift used in the sequence.

21. A communication method comprising:
generating, based on sequence selection, uplink control information including HARQ-ACK for downlink data; and
transmitting the uplink control information using a physical uplink control channel (PUCCH) of one symbol,
wherein a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.

22. A communication method comprising:
transmitting downlink data to a terminal; and
receiving uplink control information including HARQ-ACK for the downlink data, the uplink control information being transmitted, from the terminal, using a physical uplink control channel (PUCCH) of one symbol,
wherein the uplink control information including the HARQ-ACK is based on sequence selection, and a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.

23. An integrated circuit to control a process, the process comprising:
generating, based on sequence selection, uplink control information including HARQ-ACK for downlink data; and
transmitting the uplink control information using a physical uplink control channel (PUCCH) of one symbol,
wherein a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.

24. An integrated circuit to control a process, the process comprising:
transmitting downlink data to a terminal; and
receiving uplink control information including HARQ-ACK for the downlink data, the uplink control information being transmitted, from the terminal, using a physical uplink control channel (PUCCH) of one symbol,
wherein the uplink control information including the HARQ-ACK is based on

sequence selection, and a sequence for the uplink control information including the HARQ-ACK is different from a sequence for the uplink control information including both the HARQ-ACK and a scheduling request.