

DESCRIPTION

Title Of Invention: WIRELESS COMMUNICATION DEVICE AND WIRELESS COMMUNICATION METHOD

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BACKGROUND

1. Technical Field

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The present disclosure relates to the field of wireless communication, and in particular, to wireless communication devices and wireless communication methods related to reference signal design.

15 2. Description of the Related Art

Latency reduction is a new study item in 3GPP RAN1 and a main assumption is that the transmission time interval (TTI) length can be shortened from 14 orthogonal frequency division multiplexing (OFDM) symbols (1ms) to 7 or less OFDM symbol(s) to reduce the latency. The TTI whose length is 7 or less OFDM symbol(s) is also referred to a shortened TTI (also abbreviated as sTTI) hereafter.

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SUMMARY

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One non-limiting and exemplary embodiment provides reference signal design with respect to shortened TTIs for latency reduction.

In an aspect, the present disclosure refers to a communication apparatus, comprising:
a receiver, which, in operation, receives a reference signal (RS) and first data mapped
to a first shortened transmission time interval (TTI), a second shortened TTI, and a third
shortened TTI within 14 consecutive symbols and receives second data mapped to a
5 fourth shortened TTI and a fifth shortened TTI within the 14 consecutive symbols, no
RS being mapped to the fourth shortened TTI and the fifth shortened TTI; and
circuitry, which is coupled to the receiver and which, in operation, demodulates the first
and second data based on the RS,

wherein the RS is mapped to non-consecutive symbols within the 14 consecutive
10 symbols,

wherein a first number of shortened TTIs having no RS between the first shortened TTI
and the second shortened TTI is different from a second number of shortened TTIs
having no RS between the second shortened TTI and the third shortened TTI, and
wherein a difference between the first number and the second number is one.

15 In an aspect, the present disclosure refers to a communication method, comprising:
receiving a reference signal (RS) and first data mapped to a first shortened
transmission time interval (TTI), a second shortened TTI, and a third shortened TTI
within 14 consecutive symbols and receives second data mapped to a fourth shortened
20 TTI and a fifth shortened TTI within the 14 consecutive symbols, no RS being mapped
to the fourth shortened TTI and the fifth shortened TTI; and
demodulating the first and second data based on the RS,

wherein the RS is mapped to non-consecutive symbols within the 14 consecutive
symbols,

25 wherein a first number of shortened TTIs having no RS between the first shortened TTI
and the second shortened TTI is different from a second number of shortened TTIs
having no RS between the second shortened TTI and the third shortened TTI, and
wherein a difference between the first number and the second number is one.

30 In an aspect, the present disclosure refers to a communication apparatus, comprising:

circuitry, which, in operation, maps a reference signal (RS) and first data to a first shortened transmission time interval (TTI), a second shortened TTI, and a third shortened TTI within 14 consecutive symbols and maps second data to a fourth shortened TTI and a fifth shortened TTI within the 14 consecutive symbols, no RS
5 being mapped to the fourth shortened TTI and the fifth shortened TTI; and

a transmitter, which is coupled to the circuitry and which, in operation, transmits the first and second data and the RS,

wherein the RS is mapped to non-consecutive symbols within the 14 consecutive symbols,

10 wherein a first number of shortened TTIs having no RS between the first shortened TTI and the second shortened TTI is different from a second number of shortened TTIs having no RS between the second shortened TTI and the third shortened TTI, and
wherein a difference between the first number and the second number is one.

15 In an aspect, the present disclosure refers to a communication method, comprising:
mapping a reference signal (RS) and first data to a first shortened transmission time interval (TTI), a second shortened TTI, and a third shortened TTI within 14 consecutive symbols and mapping second data to a fourth shortened TTI and a fifth shortened TTI within the 14 consecutive symbols, no RS being mapped to the fourth shortened TTI
20 and the fifth shortened TTI; and

transmitting the first and second data based on the RS,

wherein the RS is mapped to non-consecutive symbols within the 14 consecutive symbols,

wherein a first number of shortened TTIs having no RS between the first shortened TTI
25 and the second shortened TTI is different from a second number of shortened TTIs having no RS between the second shortened TTI and the third shortened TTI, and
wherein a difference between the first number and the second number is one.

In a first general example of the present disclosure, there is provided a wireless communication
30 device comprising: circuitry operative to map at least a first type of

reference signals (RSs) onto orthogonal frequency division multiplexing (OFDM) symbol(s) other than the OFDM symbols onto which shortened transmission time intervals (TTIs) are mapped in a subframe, each of the shortened TTIs comprising 1-7 OFDM symbols; and a transmitter operative to transmit a physical channel in one of the shortened TTIs and transmit at least the first type of RSs.

In a second general example of the present disclosure, there is provided a wireless communication method comprising: mapping at least a first type of reference signals (RSs) onto orthogonal frequency division multiplexing (OFDM) symbol(s) other than the OFDM symbols onto which shortened transmission time intervals (TTIs) are mapped in a subframe, each of the shortened TTIs comprising 1-7 OFDM symbols; and transmitting a physical channel in one of the shortened TTIs and transmitting at least the first type of RSs.

In a third general example of the present disclosure, there is provided a wireless communication device comprising: circuitry operative to map at most one type of reference signals (RSs) from cell-specific reference signals (CRSs) and demodulation reference signals (DMRSs) in each shorten transmission time interval (TTI) in a subframe, each shortened TTI comprising 1-7 orthogonal frequency division multiplexing (OFDM) symbols; and a transmitter operative to transmit a physical channel in a shorten TTI, the RSs within the OFDM symbol(s) of or before the shorten TTI transmitting the physical channel being used to demodulate the physical channel at a receiving side.

In a fourth general example of the present disclosure, there is provided a wireless communication method comprising: mapping at most one type of reference signals (RSs) from cell-specific reference signals (CRSs) and demodulation reference signals (DMRSs) in each shorten transmission time interval (TTI) in a subframe, each shortened TTI comprising 1-7 orthogonal frequency division multiplexing (OFDM) symbols; and transmitting a physical channel in a shorten TTI, the RSs within the