

DEMODULATION REFERENCE SIGNAL PORT MAPPING AND INDICATION SCHEMES

TECHNICAL FIELD

[0001] This disclosure is directed generally to wireless communications.

BACKGROUND

[0002] Wireless communication technologies are moving the world toward an increasingly connected and networked society. The rapid growth of wireless communications and advances in technology has 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. In comparison with the existing wireless networks, next generation systems and wireless communication techniques need to provide support for an increased number of users and devices, as well as support an increasingly mobile society.

SUMMARY

[0003] Various techniques are disclosed that can be implemented by embodiments in mobile communication technology, including 5th Generation (5G), new radio (NR), 4th Generation (4G), and long-term evolution (LTE) communication systems with respect to demodulation reference signal (DMRS) design.

[0004] In a first aspect, a wireless communication method is disclosed. The method includes receiving, by a communication device, a reference signal indication; and demodulating, by the communication device, the reference signal based on a plurality of resources associated with the reference signal indication.

[0005] In a second aspect, another wireless communication method is disclosed. The method includes transmitting, by a network device to a communication device a reference signal indication; wherein the reference signal indication indicates a plurality of resources that enable the communication device to demodulate the reference signal.

[0005a] In a third aspect, the present disclosure provides a communication apparatus comprising a processor configured to implement a method according to the first or second aspect.

[0005b] In a fourth aspect, the present disclosure provides a computer readable medium having code stored thereon, the code, when executed, causing a processor to implement a method according to the first or second aspect.

[0005c] In a fifth aspect, the present disclosure provides a communication apparatus comprising a processor configured to implement a method according to the second aspect.

[0006] In yet another exemplary example, the above-described methods are embodied in the form of a computer-readable medium that stores processor-executable code for implementing the method.

CLAIMS

What is claimed is:

1. A method of wireless communication, comprising:
receiving, by a communication device, a reference signal indication; and
demodulating, by the communication device, the reference signal based on a plurality of resources associated with the reference signal indication.
2. The method of claim 1, wherein the plurality of resources are associated with at least one of: a generated sequence, a resource element or a subcarrier in a frequency domain, a demodulation reference signal (DMRS) port, a number of orthogonal DMRS ports in one code division multiplexing (CDM) group, a total number of orthogonal DMRS ports for all CDM groups, a configured DMRS type, an orthogonal cover code (OCC) length, resource elements offset in one CDM group, an OCC related information in the frequency domain, or an OCC related information in the time domain, and
wherein the DMRS port is supported as DMRS type 1 and DMRS type 2.
3. The method of claim 2,
wherein the generated sequence is based on $r(x * n + k')$;
wherein x and k' are associated with at least one of: the number of orthogonal DMRS ports in one CDM group, the OCC length in the frequency domain, the total number of DMRS ports for all the CDM groups in one OFDM symbol, or a DMRS port index,
wherein the number of orthogonal DMRS ports in one CDM group or the OCC length in the frequency domain is 4, and
wherein the generated sequence is further generated according to $r(4 * n + k')$.
4. The method of claim 1, wherein the resource element or the subcarrier in the frequency domain is determined based on an equation:
$$k = a * n + b * k' + c + \Delta$$

wherein k is an index of the resource elements or the subcarriers, a and b are associated with the number of CDM groups or the number of DMRS ports or the configured DMRS type, k' and Δ are associated with a DMRS port index or a CDM group index, n is a serial integer from 0,

wherein the parameters are further determined from at least one of: for DMRS type 1, frequency domain orthogonal cover codes (FD-OCC) length is 4, $a=8$, $b=2$, $c=0$, then $\Delta=0$ for the first CDM group and $\Delta=1$ for the second CDM group, or for DMRS type 2, FD-OCC length is 4, $a=12$, $b=1$, $c=0$ or 4, then $\Delta=0$ for the first CDM group, $\Delta=2$ for the second CDM group, and $\Delta=4$ for the third CDM group,

wherein k' is presented as $k' = 0,1,2,3$ when FD-OCC length is 4, and

wherein for DMRS type 2, $c = 0$ is associated with $k' = 0,1$ and $c = 4$ is associated with $k' = 2,3$.

5. The method of claim 4, wherein n is represented as $n = 0,1,..., \text{floor}(\text{numberofREs} / a) - 1$; or $n = 0,1,..., \text{ceil}(\text{numberofREs} / a) - 1$; and

wherein the *numberofREs* is at least one of: a total number of resource elements or subcarriers for an uplink or downlink transmission scheduling, a total number of resource elements in a precoding resource block group (PRG), a total number of resource elements or subcarriers for an uplink or downlink transmission scheduling, or a total number of resource elements in a precoding resource block group (PRG) except for the last plurality resource elements.

6. The method of claim 3, wherein the resource element or the subcarrier in the frequency domain is mapped to the intermediate quantity $a_{k,l}^{(p,\mu)}$ on following equation:

$$\begin{aligned}
a_{k,l}^{(p,\mu)} &= w_f(k')w_t(l')r(4*n+k') \\
k &= \begin{cases} 8*n+2*k'+\Delta, & \text{configuration type I} \\ 12*n+k'+c+\Delta, & \text{configuration type II} \end{cases} \\
k' &= 0,1,2,3 \\
c &= \begin{cases} 0 & \text{when } k'=0,1 \\ 4 & \text{when } k'=2,3 \end{cases} \\
l &= \bar{l} + l' \\
n &= 0,1,\dots \\
j &= 0,1,\dots,v-1
\end{aligned}$$

wherein k is an index of resource elements or subcarrier, b is associated with the number of CDM groups or the configured DMRS type, k' represents DMRS mapping parameter, n represents different times of DMRS mapping for the same CDM group, Δ is associated to an index of a CDM group or a DMRS port, $w_f(k')$ and $w_t(l')$ are OCC parameters in frequency domain and time domain, and $r(4*n+k')$ is the resource sequence of the DMRS port.

7. A method of wireless communication, comprising:

transmitting, by a network device to a communication device a reference signal indication;

wherein the reference signal indication indicates a plurality of resources that enable the communication device to demodulate the reference signal.

8. The method of claim 7, wherein the plurality of resources are associated with at least one of: a generated sequence, a resource element or the subcarrier in a frequency domain, a demodulation reference signal (DMRS) port, a number of orthogonal DMRS ports in one code division multiplexing (CDM) group, a total number of orthogonal DMRS ports for all CDM groups, a configured DMRS type, an orthogonal cover code (OCC) length, resource elements offset in one CDM group, an OCC related information in the frequency domain, or an OCC related information in the time domain, and

wherein the DMRS port are supported as DMRS type 1 and DMRS type 2.

9. The method of claim 8,

wherein the generated sequence is based on $r(x*n+k')$,

wherein x and k' are associated with at least one of: the number of orthogonal DMRS ports in one CDM group, the OCC length in the frequency domain, the total number of DMRS ports for all the CDM groups in one OFDM symbol, or a DMRS port index

wherein the number of orthogonal DMRS ports in one CDM group or the OCC length in the frequency domain is 4, and

wherein the generated sequence is further generated according to $r(4 * n + k')$.

10. The method of claim 7, wherein the resource element or the subcarrier in the frequency domain is determined based on an equation:

$$k = a * n + b * k' + c + \Delta$$

wherein k is an index of the resource elements or the subcarriers, a and b are associated with the number of CDM groups or the number of DMRS ports or the configured DMRS type, k' and Δ are associated with a DMRS port index or a CDM group index, n is a serial integer from 0,

wherein the parameters are further determined from at least one of: for DMRS type 1, frequency domain orthogonal cover codes (FD-OCC) length is 4, $a=8$, $b=2$, $c=0$, then $\Delta=0$ for the first CDM group and $\Delta=1$ for the second CDM group, or for DMRS type 2, FD-OCC length is 4, $a=12$, $b=1$, $c=0$ or 4, then $\Delta=0$ for the first CDM group, $\Delta=2$ for the second CDM group, and $\Delta=4$ for the third CDM group,

wherein k' is presented as $k' = 0,1,2,3$ when FD-OCC length is 4, and

wherein for DMRS type 2, $c = 0$ is associated with $k' = 0,1$ and $c = 4$ is associated with $k' = 2,3$.

11. The method of claim 10, wherein n is represented as $n = 0,1,..., \text{floor}(\text{numberofREs} / a) - 1$; or $n = 0,1,..., \text{ceil}(\text{numberofREs} / a - 1)$; and

wherein the *numberofREs* is at least one of: a total number of resource elements or subcarriers for an uplink or downlink transmission scheduling, a total number of resource elements in a precoding resource block group (PRG), a total number of resource elements or subcarriers for an uplink or downlink transmission scheduling, or a total number of resource elements in a precoding resource block group (PRG) except for the last plurality resource elements.

12. The method of claim 9, wherein the resource element or the subcarrier in the frequency domain is mapped to the intermediate quantity $a_{k,l}^{(p,\mu)}$ on following equation:

$$\begin{aligned}
 a_{k,l}^{(p,\mu)} &= w_f(k')w_t(l')r(4 * n + k') \\
 k &= \begin{cases} 8 * n + 2 * k' + \Delta, & \text{configuration type I} \\ 12 * n + k' + c + \Delta, & \text{configuration type II} \end{cases} \\
 k' &= 0, 1, 2, 3 \\
 c &= \begin{cases} 0 & \text{when } k' = 0, 1 \\ 4 & \text{when } k' = 2, 3 \end{cases} \\
 l &= \bar{l} + l' \\
 n &= 0, 1, \dots \\
 j &= 0, 1, \dots, v - 1
 \end{aligned}$$

wherein k is an index of resource elements or subcarrier, b is associated with the number of CDM groups or the configured DMRS type, k' represents DMRS mapping parameter, n represents different times of DMRS mapping for the same CDM group, Δ is associated to an index of a CDM group or a DMRS port, $w_f(k')$ and $w_t(l')$ are OCC parameters in frequency domain and time domain, and $r(4 * n + k')$ is the resource sequence of the DMRS port.

13. A communication apparatus comprising a processor configured to implement a method recited in any one or more of claims 1 to 6.

14. A computer readable medium having code stored thereon, the code, when executed, causing a processor to implement a method recited in any one or more of claims 1 to 12.

15. A communication apparatus comprising a processor configured to implement a method recited in any one or more of claims 7 to 12.