

CLAIMS

1. A communication method comprising:
obtaining a first reference signal configuration parameter;
transmitting a set of signal outputs, the set of signal outputs including a first reference signal at a time p , wherein the first reference signal is defined based on the first reference signal configuration parameter, wherein the first reference signal is a first real reference signal or a first imaginary reference signal;
wherein the set of signal outputs comprise a second reference signal transmitted at a time $p+1$, and a third reference signal transmitted at a time $p-1$.
2. The method of claim 1, wherein the second reference signal is a second real reference signal at time $p+1$ and the third reference signal is a third real reference signal at time $p-1$, wherein the second reference signal replaces real traffic at time $p+1$ and the third reference signal replaces real traffic at time $p-1$; or
the second reference signal is a second imaginary reference signal at time $p+1$ and the third reference signal is a third imaginary reference signal at time $p-1$, wherein the second reference signal replaces imaginary traffic at time $p+1$ and the third reference signal replaces imaginary traffic at time $p-1$.
3. The method of any one of claims 1 to 2, wherein the second reference signal and the third reference signal are defined to pre-cancel interference from traffic to the first reference signal.
4. The method of any one of claims 1 to 3, wherein a pulse power of the first reference signal is larger than a pulse power of the second reference signal and a pulse power of the third reference signal.
5. The method of any one of claims 1 to 4, wherein the set of signal outputs comprise a first real traffic signal transmitted at a time $p-2$ and a second real traffic signal transmitted at a time $p+2$; or
wherein the set of signal outputs comprise a first imaginary traffic signal transmitted at the time $p-2$ and a second imaginary traffic signal transmitted at the time $p+2$.

6. The method of claim 5, wherein the pulse power of the first reference signal is larger than or equal to any one of the following:
 - the pulse power of the first real traffic signal;
 - the pulse power of the second real traffic signal;
 - the pulse power of the first imaginary traffic signal; and
 - the pulse power of the second imaginary traffic signal.
7. The method of any one of claim 5 to claim 6, wherein any one of the pulse power of the second reference signal and the pulse power of the third reference signal is smaller than any one of the following:
 - the pulse power of the first real traffic signal;
 - the pulse power of the second real traffic signal;
 - the pulse power of the first imaginary traffic signal; and
 - the pulse power of the second imaginary traffic signal.
8. The method of any one of claims 1 to 7, wherein the first reference signal is a phase tracking reference signal usable for estimating the phase distortion of a communication channel.
9. The method of any one of claims 1 to 7, wherein the first reference signal is usable to estimate phase and amplitude-related measurements of a communication channel.
10. The method of any one of claims 1 to 9, wherein obtaining the first reference signal configuration parameter comprises receiving the first reference signal configuration parameter.
11. The method of claim 10, further comprising:
 - transmitting a transmitter interference pre-cancellation capability signal prior to receiving the first reference signal configuration parameter.
12. The method of any one of claims 1 to 9, wherein obtaining the first reference signal configuration parameter comprises determining the first reference signal configuration

parameter based on one or more operational characteristics for a communication channel and/or a communication device.

13. The method of claim 12, wherein the one or more operational characteristics comprises a transmitter interference pre-cancellation capability and/or an interference cancellation requirement and/or a reference signal measurement type.
14. The method of claim 13, wherein the one or more operational characteristics comprise the transmitter interference pre-cancellation capability, and the method further comprises receiving a transmitter interference pre-cancellation capability signal indicating the transmitter interference pre-cancellation capability prior to determining the first reference signal configuration parameter.
15. A communication method comprising:
 - obtaining a first reference signal configuration parameter;
 - transmitting a set of signal outputs, the set of signal outputs including a first reference signal at a time p , wherein the first reference signal is defined based on the first reference signal configuration parameter, wherein the first reference signal is a first real reference signal replacing imaginary traffic at time p or a first imaginary reference signal replacing real traffic at time p .
16. The method of claim 15, wherein the first reference signal is the first imaginary reference signal, and the set of signal outputs comprise a first real traffic signal transmitted at a time $p-2$ and a second real traffic signal transmitted at a time $p+2$; or wherein the first reference signal is the first real reference signal, and the set of signal outputs comprise a first imaginary traffic signal transmitted at the time $p-2$ and a second imaginary traffic signal transmitted at the time $p+2$.
17. The method of claim 16, wherein the pulse power of the first reference signal is larger than or equal to any one of the following:
 - the pulse power of the first real traffic signal;
 - the pulse power of the second real traffic signal;
 - the pulse power of the first imaginary traffic signal; and
 - the pulse power of the second imaginary traffic signal.

18. The method of any one of claims 15 to 17, wherein the set of signal outputs omits any signal pulses at a time $p-1$ and a time $p+1$.

19. The method of any one of claims 15 to 18, wherein the first reference signal is a phase tracking reference signal usable for estimating the phase distortion of a communication channel.

~~20. The method of any one of claims 15 to 19, wherein obtaining the first reference signal configuration parameter comprises receiving the first reference signal configuration parameter.~~

21. The method of claim 20, further comprising:

~~transmitting a transmitter interference pre-cancellation capability signal prior to receiving the first reference signal configuration parameter.~~

~~22. The method of any one of claims 15 to 19, wherein obtaining the first reference signal configuration parameter comprises determining the first reference signal configuration parameter based on one or more operational characteristics for a communication channel and/or a communication device.~~

~~23. The method of claim 22, wherein the one or more operational characteristics comprises a transmitter interference pre-cancellation capability and/or an interference cancellation requirement and/or a reference signal measurement type.~~

~~24. The method of claim 23, wherein the one or more operational characteristics comprise the transmitter interference pre-cancellation capability, and the method further comprises receiving a transmitter interference pre-cancellation capability signal indicating the transmitter interference pre-cancellation capability prior to determining the first reference signal configuration parameter.~~

25. A communication method comprising:

~~transmitting a first reference signal configuration parameter;~~

receiving a set of signal outputs, the set of signal outputs including a first reference signal at a time p , wherein the first reference signal is defined based on the first reference signal configuration parameter, wherein the first reference signal is a first real reference signal or a first imaginary reference signal;

wherein the set of signal outputs comprise a second reference signal transmitted at a time $p+1$, and a third reference signal transmitted at a time $p-1$.

26. The method of claim 25, wherein the second reference signal is a second real reference signal at time $p+1$ and the third reference signal is a third real reference signal at time $p-1$, wherein the second reference signal replaces real traffic at time $p+1$ and the third reference signal replaces real traffic at time $p-1$; or

the second reference signal is a second imaginary reference signal at time $p+1$ and the third reference signal is a third imaginary reference signal at time $p-1$, wherein the second reference signal replaces imaginary traffic at time $p+1$ and the third reference signal replaces imaginary traffic at time $p-1$.

27. The method of any one of claims 25 to 26, wherein the second reference signal and the third reference signal are defined to pre-cancel interference from traffic to the first reference signal.

28. The method of any one of claims 25 to 27, wherein a pulse power of the first reference signal is larger than a pulse power of the second reference signal and a pulse power of the third reference signal.

29. The method of any one of claims 25 to 28, wherein the set of signal outputs comprise a first real traffic signal transmitted at a time $p-2$ and a second real traffic signal transmitted at a time $p+2$; or

wherein the set of signal outputs comprise a first imaginary traffic signal transmitted at the time $p-2$ and a second imaginary traffic signal transmitted at the time $p+2$.

30. The method of claim 29, wherein the pulse power of the first reference signal is larger than or equal to any one of the following:

the pulse power of the first real traffic signal;

the pulse power of the second real traffic signal;

the pulse power of the first imaginary traffic signal; and
the pulse power of the second imaginary traffic signal.

31. The method of any one of claim 29 to claim 30, wherein any one of the pulse power of the second reference signal and the pulse power of the third reference signal is smaller than any one of the following:

the pulse power of the first real traffic signal;

the pulse power of the second real traffic signal;

the pulse power of the first imaginary traffic signal; and

the pulse power of the second imaginary traffic signal.

32. The method of any one of claims 25 to 31, wherein the first reference signal is a phase tracking reference signal usable for estimating the phase distortion of a communication channel.

33. The method of any one of claims 25 to 32, wherein the first reference signal is usable to estimate phase and amplitude related measurements of a communication channel.

34. The method of any one of claims 25 to 33, further comprising:

receiving a transmitter interference pre-cancellation capability signal prior to transmitting the first reference signal configuration parameter.

35. The method of any one of claims 25 to 33, further comprising determining the first reference signal configuration parameter based on one or more operational characteristics for a communication channel and/or a communication device.

36. The method of claim 35, wherein the one or more operational characteristics comprises a transmitter interference pre-cancellation capability and/or an interference cancellation requirement and/or a reference signal measurement type.

37. The method of claim 36, wherein the one or more operational characteristics comprise the transmitter interference pre-cancellation capability, and the method further comprises receiving a transmitter interference pre-cancellation capability signal indicating the

~~transmitter interference pre-cancellation capability prior to determining the first reference signal configuration parameter.~~

~~38. A communication method comprising:~~

~~transmitting a first reference signal configuration parameter;~~

~~receiving a set of signal outputs, the set of signal outputs including a first reference signal at a time p , wherein the first reference signal is defined based on the first reference signal configuration parameter, wherein the first reference signal is a first real reference signal replacing imaginary traffic at time p or a first imaginary reference signal replacing real traffic at time p .~~

~~39. The method of claim 38, wherein the first reference signal is the first imaginary reference signal, and the set of signal outputs comprise a first real traffic signal transmitted at a time $p-2$ and a second real traffic signal transmitted at a time $p+2$; or~~

~~wherein the first reference signal is the first real reference signal, and the set of signal outputs comprise a first imaginary traffic signal transmitted at the time $p-2$ and a second imaginary traffic signal transmitted at the time $p+2$.~~

~~40. The method of claim 39, wherein the pulse power of the first reference signal is larger than or equal to any one of the following:~~

~~the pulse power of the first real traffic signal;~~

~~the pulse power of the second real traffic signal;~~

~~the pulse power of the first imaginary traffic signal; and~~

~~the pulse power of the second imaginary traffic signal.~~

~~41. The method of any one of claims 38 to 40, wherein the set of signal outputs omits any signal pulses at a time $p-1$ and a time $p+1$.~~

~~42. The method of any one of claims 38 to 41, wherein the first reference signal is a phase tracking reference signal usable for estimating the phase distortion of a communication channel.~~

~~43. The method of any one of claims 38 to 42, further comprising:~~

~~receiving a transmitter interference pre-cancellation capability signal prior to transmitting the first reference signal configuration parameter.~~

~~44. The method of any one of claims 38 to 42, further comprising determining the first reference signal configuration parameter based on one or more operational characteristics for a communication channel and/or a communication device.~~

~~45. The method of claim 44, wherein the one or more operational characteristics comprises a transmitter interference pre-cancellation capability and/or an interference cancellation requirement and/or a reference signal measurement type.~~

~~46. The method of claim 45, wherein the one or more operational characteristics comprise the transmitter interference pre-cancellation capability, and the method further comprises receiving a transmitter interference pre-cancellation capability signal indicating the transmitter interference pre-cancellation capability prior to determining the first reference signal configuration parameter.~~

47.20. An apparatus comprising:

at least one processor; and

a non-transitory computer readable storage medium storing processor executable instructions for execution by the processor, the processor executable instructions including instructions to cause the apparatus to:

obtain a first reference signal configuration parameter; and

transmit a set of signal outputs using the transceiver, the set of signal outputs including a first reference signal at a time p , wherein the first reference signal is defined based on the first reference signal configuration parameter, wherein the first reference signal is a first real reference signal or a first imaginary reference signal;

wherein the set of signal outputs comprise a second reference signal transmitted at a time $p+1$, and a third reference signal transmitted at a time $p-1$.

~~48. The apparatus of claim 47, further comprising instructions to cause the apparatus to transmit the second reference signal as a second real reference signal at time $p+1$ and the third reference signal as a third real reference signal at time $p-1$, wherein the second~~

~~reference signal replaces real traffic at time $p+1$ and the third reference signal replaces real traffic at time $p-1$; or~~

~~further comprising instructions to cause the apparatus to transmit the second reference signal as a second imaginary reference signal at time $p+1$ and the third reference signal as a third imaginary reference signal at time $p-1$, wherein the second reference signal replaces imaginary traffic at time $p+1$ and the third reference signal replaces imaginary traffic at time $p-1$.~~

~~49. The apparatus of any one of claims 47 to 48, further comprising instructions to cause the apparatus to define the second reference signal and the third reference signal to pre-cancel interference from traffic to the first reference signal.~~

~~50. The apparatus of any one of claims 47 to 49, further comprising instructions to cause the apparatus to transmit the first reference signal with a first pulse power larger than a second pulse power of the second reference signal and a third pulse power of the third reference signal.~~

~~51. The apparatus of any one of claims 47 to 50, further comprising instructions to cause the apparatus to transmit the set of signal outputs including a first real traffic signal transmitted at a time $p-2$ and a second real traffic signal transmitted at a time $p+2$; or further comprising instructions to cause the apparatus to transmit the set of signal outputs including a first imaginary traffic signal transmitted at the time $p-2$ and a second imaginary traffic signal transmitted at the time $p+2$.~~

~~52. The apparatus of claim 51, further comprising instructions to cause the apparatus to transmit the first reference signal with a first pulse power larger than or equal to any one of the following:~~

~~the pulse power of the first real traffic signal;~~

~~the pulse power of the second real traffic signal;~~

~~the pulse power of the first imaginary traffic signal; and~~

~~the pulse power of the second imaginary traffic signal.~~

53. The apparatus of any one of claim 51 to claim 52, further comprising instructions to cause the apparatus to transmit any one of the second reference signal and the third reference signal with a pulse power smaller than any one of the following:
- the pulse power of the first real traffic signal;
 - the pulse power of the second real traffic signal;
 - the pulse power of the first imaginary traffic signal; and
 - the pulse power of the second imaginary traffic signal.
54. The apparatus of any one of claims 47 to 53, further comprising instructions to cause the apparatus to transmit the first reference signal as a phase tracking reference signal usable for estimating the phase distortion of a communication channel.
55. The apparatus of any one of claims 47 to 53, further comprising instructions to cause the apparatus to define the first reference signal to be usable to estimate phase and amplitude-related measurements of a communication channel.
56. The apparatus of any one of claims 47 to 55, further comprising instructions to cause the apparatus to obtain the first reference signal configuration parameter by receiving the first reference signal configuration parameter.
57. The apparatus of claim 56, further comprising instructions to cause the apparatus to transmit a transmitter interference pre-cancellation capability signal prior to receiving the first reference signal configuration parameter.
58. The apparatus of any one of claims 47 to 55, further comprising instructions to cause the apparatus to obtain the first reference signal configuration parameter by determining the first reference signal configuration parameter based on one or more operational characteristics for a communication channel and/or a communication device.
59. The apparatus of claim 58, wherein the one or more operational characteristics comprises a transmitter interference pre-cancellation capability and/or an interference cancellation requirement and/or a reference signal measurement type.

60. ~~The apparatus of claim 59, wherein the one or more operational characteristics comprise the transmitter interference pre-cancellation capability, and the apparatus further comprises instructions to cause the apparatus to receive a transmitter interference pre-cancellation capability signal indicating the transmitter interference pre-cancellation capability prior to determining the first reference signal configuration parameter.~~

61. ~~An apparatus comprising:~~

~~at least one processor; and~~

~~a non-transitory computer-readable storage medium storing processor-executable instructions for execution by the processor, the processor-executable instructions including instructions to cause the apparatus to:~~

~~obtain a first reference signal configuration parameter; and~~

~~transmit a set of signal outputs using the transceiver, the set of signal outputs including a first reference signal at a time p , wherein the first reference signal is defined based on the first reference signal configuration parameter, wherein the first reference signal is a first real reference signal replacing imaginary traffic at time p or a first imaginary reference signal replacing real traffic at time p .~~

62. ~~The apparatus of claim 61, further comprising instructions to cause the apparatus to transmit the first reference signal as the first imaginary reference signal, and the set of signal outputs comprise a first real traffic signal transmitted at a time $p-2$ and a second real traffic signal transmitted at a time $p+2$; or~~

~~further comprising instructions to cause the apparatus to transmit the first reference signal as the first real reference signal, and the set of signal outputs comprise a first imaginary traffic signal transmitted at the time $p-2$ and a second imaginary traffic signal transmitted at the time $p+2$.~~

63. ~~The apparatus of claim 62, further comprising instructions to cause the apparatus to transmit the first reference signal with a first pulse power larger than or equal to any one of the following:~~

~~the pulse power of the first real traffic signal;~~

~~the pulse power of the second real traffic signal;~~

~~the pulse power of the first imaginary traffic signal; and~~

~~the pulse power of the second imaginary traffic signal.~~

- ~~64. The apparatus of any one of claims 61 to 63, further comprising instructions to cause the apparatus to transmit the set of signal outputs omitting any signal pulses at a time $p-1$ and a time $p+1$.~~
- ~~65. The apparatus of any one of claims 61 to 64, further comprising instructions to cause the apparatus to transmit the first reference signal as a phase tracking reference signal usable for estimating the phase distortion of a communication channel.~~
- ~~66. The apparatus of any one of claims 61 to 65, further comprising instructions to cause the apparatus to obtain the first reference signal configuration parameter by receiving the first reference signal configuration parameter.~~
- ~~67. The apparatus of claim 66, further comprising instructions to cause the apparatus to transmit a transmitter interference pre-cancellation capability signal prior to receiving the first reference signal configuration parameter.~~
- ~~68. The apparatus of any one of claims 61 to 65, further comprising instructions to cause the apparatus to obtain the first reference signal configuration parameter by determining the first reference signal configuration parameter based on one or more operational characteristics for a communication channel and/or a communication device.~~
- ~~69. The apparatus of claim 68, wherein the one or more operational characteristics comprises a transmitter interference pre-cancellation capability and/or an interference cancellation requirement and/or a reference signal measurement type.~~
- ~~70. The apparatus of claim 69, wherein the one or more operational characteristics comprise the transmitter interference pre-cancellation capability, and the apparatus further comprises instructions to cause the apparatus to receive a transmitter interference pre-cancellation capability signal indicating the transmitter interference pre-cancellation capability prior to determining the first reference signal configuration parameter.~~
- ~~71. A network device comprising:
at least one processor; and~~

~~a non-transitory computer-readable storage medium storing processor-executable instructions for execution by the processor, the processor-executable instructions including instructions to cause the network device to:~~
~~transmit a first reference signal configuration parameter;~~
~~receive a set of signal outputs, the set of signal outputs including a first reference signal at a time p , wherein the first reference signal is defined based on the first reference signal configuration parameter, wherein the first reference signal is a first real reference signal or a first imaginary reference signal;~~
~~wherein the set of signal outputs comprise a second reference signal transmitted at a time $p+1$, and a third reference signal transmitted at a time $p-1$.~~

~~72. The network device of claim 71, wherein the second reference signal is a second real reference signal at time $p+1$ and the third reference signal is a third real reference signal at time $p-1$, wherein the second reference signal replaces real traffic at time $p+1$ and the third reference signal replaces real traffic at time $p-1$; or~~
~~the second reference signal is a second imaginary reference signal at time $p+1$ and the third reference signal is a third imaginary reference signal at time $p-1$, wherein the second reference signal replaces imaginary traffic at time $p+1$ and the third reference signal replaces imaginary traffic at time $p-1$.~~

~~73. The network device of any one of claims 71 to 72, wherein the second reference signal and the third reference signal are defined to pre-cancel interference from traffic to the first reference signal.~~

~~74. The network device of any one of claims 71 to 73, wherein a pulse power of the first reference signal is larger than a pulse power of the second reference signal and a pulse power of the third reference signal.~~

~~75. The network device of any one of claims 71 to 73, wherein the set of signal outputs comprise a first real traffic signal transmitted at a time $p-2$ and a second real traffic signal transmitted at a time $p+2$; or~~
~~wherein the set of signal outputs comprise a first imaginary traffic signal transmitted at the time $p-2$ and a second imaginary traffic signal transmitted at the time $p+2$.~~

- ~~76. The network device of claim 75, wherein the pulse power of the first reference signal is larger than or equal to any one of the following:~~
- ~~the pulse power of the first real traffic signal;~~
 - ~~the pulse power of the second real traffic signal;~~
 - ~~the pulse power of the first imaginary traffic signal; and~~
 - ~~the pulse power of the second imaginary traffic signal.~~
- ~~77. The network device of any one of claim 75 to claim 76, wherein any one of the pulse power of the second reference signal and the pulse power of the third reference signal is smaller than any one of the following:~~
- ~~the pulse power of the first real traffic signal;~~
 - ~~the pulse power of the second real traffic signal;~~
 - ~~the pulse power of the first imaginary traffic signal; and~~
 - ~~the pulse power of the second imaginary traffic signal.~~
- ~~78. The network device of any one of claims 71 to 77, wherein the first reference signal is a phase tracking reference signal usable for estimating the phase distortion of a communication channel.~~
- ~~79. The network device of any one of claims 71 to 78, wherein the first reference signal is usable to estimate phase and amplitude related measurements of a communication channel.~~
- ~~80. The network device of any one of claims 71 to 79, further comprising instructions to cause the network device to:~~
- ~~receive a transmitter interference pre-cancellation capability signal prior to transmitting the first reference signal configuration parameter.~~
- ~~81. The network device of any one of claims 71 to 79, further comprising instructions to cause the network device to determine the first reference signal configuration parameter based on one or more operational characteristics for a communication channel and/or a communication device.~~

~~82. The network device of claim 81, wherein the one or more operational characteristics comprises a transmitter interference pre-cancellation capability and/or an interference cancellation requirement and/or a reference signal measurement type.~~

~~83. The network device of claim 82, wherein the one or more operational characteristics comprise the transmitter interference pre-cancellation capability, and the network device further comprises instructions to cause the network device to receive a transmitter interference pre-cancellation capability signal indicating the transmitter interference pre-cancellation capability prior to determining the first reference signal configuration parameter.~~

~~84. A network device comprising:~~

~~at least one processor; and~~

~~a non-transitory computer readable storage medium storing processor-executable instructions for execution by the processor, the processor-executable instructions including instructions to cause the network device to:~~

~~transmit a first reference signal configuration parameter;~~

~~receive a set of signal outputs, the set of signal outputs including a first reference signal at a time p , wherein the first reference signal is defined based on the first reference signal configuration parameter, wherein the first reference signal is a first real reference signal replacing imaginary traffic at time p or a first imaginary reference signal replacing real traffic at time p .~~

~~85. The network device of claim 84, wherein the first reference signal is the first imaginary reference signal, and the set of signal outputs comprise a first real traffic signal transmitted at a time $p-2$ and a second real traffic signal transmitted at a time $p+2$; or wherein the first reference signal is the first real reference signal, and the set of signal outputs comprise a first imaginary traffic signal transmitted at the time $p-2$ and a second imaginary traffic signal transmitted at the time $p+2$.~~

~~86. The network device of claim 85, wherein the pulse power of the first reference signal is larger than or equal to any one of the following:
the pulse power of the first real traffic signal;
the pulse power of the second real traffic signal;~~

the pulse power of the first imaginary traffic signal; and
the pulse power of the second imaginary traffic signal.

87. The network device of any one of claims 84 to 86, wherein the set of signal outputs omits any signal pulses at a time $p-1$ and a time $p+1$.

88. The network device of any one of claims 84 to 87, wherein the first reference signal is a phase tracking reference signal usable for estimating the phase distortion of a communication channel.

89. The network device of any one of claims 84 to 88, further comprising instructions to cause the network device to:
receive a transmitter interference pre-cancellation capability signal prior to transmitting the first reference signal configuration parameter.

90. The network device of any one of claims 84 to 88, further comprising instructions to cause the network device to determine the first reference signal configuration parameter based on one or more operational characteristics for a communication channel and/or a communication device.

91. The network device of claim 90, wherein the one or more operational characteristics comprises a transmitter interference pre-cancellation capability and/or an interference cancellation requirement and/or a reference signal measurement type.

92. The network device of claim 91, wherein the one or more operational characteristics comprise the transmitter interference pre-cancellation capability, and the network device further comprises instructions to cause the network device to receive a transmitter interference pre-cancellation capability signal indicating the transmitter interference pre-cancellation capability prior to determining the first reference signal configuration parameter.

93. An apparatus, comprising one or more units for performing the method according to any one of claims 1 to 46.

94. ~~An apparatus comprising a processor and a non-transitory computer readable storage medium storing processor executable instructions for execution by the processor, the processor executable instructions including instructions to cause the apparatus to perform a method according to any of claims 1 to 46.~~