CLAIMS

~~What is claimed is:~~

1. A ~~channel state information feedback~~communications method, comprising:

receiving, by a terminal, first indication information from a network device, wherein the first indication information ~~is used to~~ indicates a type of a right multiplication matrix in a first codebook, the first codebook satisfies a formula $W = W_1\widetilde{W}_2W_f^H$, the first codebook is W, W_1 is a port selection matrix, $\widetilde{W}_2$ is a linear superposition coefficient matrix, W_f is the right multiplication matrix, and W_f^H is a conjugate transpose of W_f~~, and is used by the terminal to determine channel state information based on the first codebook~~; and

~~sending~~determining, by the terminal, ~~the~~ channel state information based on the first indication information ~~to the network device~~.

2. The method according to claim 1, wherein the first indication information ~~is used to~~ indicates that the type of W_f is a port selection matrix.

3. The method according to claim 1, wherein the first indication information ~~is used to~~ indicates that the type of W_f is one ~~or a plurality of~~ specific column vector~~s~~.

4. The method according to claim 3, wherein the one specific column vector is a column vector in which all elements are 1~~, or the plurality of specific column vectors comprise a column vector in which all elements are 1~~.

5. The method according to claim 1, wherein the first indication information ~~is used to~~ indicates that the type of W_f is a discrete Fourier transform (DFT) matrix, and the DFT matrix comprises a column vector in which all elements are 1.

6. The method according to claim 5, wherein the first indication information ~~is~~ further ~~used to~~ indicates the column vector in which all elements are 1.

7. The method according to claim 5, wherein the method further comprises:

receiving, by the terminal, second indication information from the network device, wherein the second indication information is used to indicate the column vector in which all elements are 1.

8. The method according to any one of claims 1 to 7, wherein W_1 is used to select one or a plurality of channel state information reference signal (CSI-RS) port groups, and W_f is used to

select one or more CSI-RS ports in the CSI-RS port group, or used to select one or more CSI-RS ports in the plurality of CSI-RS port groups.

9. The method according to claim 1 or 2, wherein W_f is a port selection matrix, a length of a column vector of W_f is M_{Group}, a length of a column vector of W_1 is $2\tilde{X}_{Group}$, $M_{Group}*\tilde{X}_{Group}$=X/2, X is used to indicate a quantity of CSI-RS ports, M_{Group} is an integer greater than or equal to 1, and is used to indicate to select M_{Group} frequency-domain vectors, and $\tilde{X}_{Group}$ is an integer greater than or equal to 1, and is used to indicate to select $\tilde{X}_{Group}$ spatial-domain vectors in one polarization direction.

10. The method according to claim 3, wherein the channel state information comprises feedback information, and the feedback information indicates W_1 and $\widetilde{W}_2$.

~~11. The method according to claim 10, wherein the feedback information comprises N_{Rx} $\widetilde{W}_2$, and N_{Rx} is a quantity of receive antennas of the terminal.~~

~~12. The method according to claim 10, wherein the feedback information comprises R $\widetilde{W}_2$, and R is a value of a rank corresponding to a precoding matrix.~~

~~13~~11. The method according to claim 3 or 4, wherein a length of a column vector of W_f is N_{RB}^0, a length of a column vector of W_1 is X, X is used to indicate a quantity of CSI-RS ports, and N_{RB}^0 is an integer greater than or equal to 1, and is used to indicate to select N_{RB}^0 frequency-domain vectors.

~~14. The method according to claim 13, wherein N_{RB}^0 is related to a quantity of resource blocks RBs or a quantity of subbands of a CSI-RS transmission bandwidth.~~

~~15. The method according to claim 13, wherein N_{RB}^0 is equal to a quantity of resource blocks RBs or a quantity of subbands of a CSI-RS transmission bandwidth.~~

~~16. The method according to any one of claims 13 to 15, wherein in different polarization directions, quantities of ports selected by the terminal are the same, sequence numbers of the selected ports are the same, and W_1 satisfies the following formula:~~

$$W_1=\begin{bmatrix} E_{\frac{X}{2}\times\tilde{L}} & 0 \\ 0 & E_{\frac{X}{2}\times\tilde{L}} \end{bmatrix}, \text{ wherein } E_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix} e_{mod\left(m_1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & e_{mod\left(m_2,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & e_{mod\left(m_{\tilde{L}-1},\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix},$$

~~wherein~~

~~X is the quantity of CSI-RS ports, $\tilde{L}$ is a quantity of CSI-RS ports selected in one~~

~~polarization direction, $\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}$ is a matrix consisting of $\boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(i,\frac{X}{2}\right)}$, $\boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(i,\frac{X}{2}\right)}$ is a vector whose length is X/2, a $(mod\left(i,\frac{X}{2}\right))^{th}$ element in elements comprised in the vector is 1 and other elements are 0, $i=m_1, m_2, ..., m_{\tilde{L}-1}$, and i is an integer greater than or equal to 0.~~

~~17. The method according to claim 16, wherein W_1 satisfies the following formula:~~

$$\boldsymbol{W}_1=\begin{bmatrix}\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} & 0\\ 0 & \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}\end{bmatrix}, \text{ wherein } \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix}\boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(m,\frac{X}{2}\right)} & \boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(m+1,\frac{X}{2}\right)} & \cdots & \boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(m+\tilde{L}-1,\frac{X}{2}\right)}\end{bmatrix};$$

~~18. The method according to any one of claims 13 to 15, wherein in different polarization directions, quantities of ports selected by the terminal are the same, sequence numbers of the selected ports are different, and W_1 satisfies the following formula:~~

$$\boldsymbol{W}_1=\begin{bmatrix}\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} & 0\\ 0 & \bar{E}_{\frac{X}{2}\times\tilde{L}}\end{bmatrix}, \text{ wherein } \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix}\boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(m_1,\frac{X}{2}\right)} & \boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(m_2,\frac{X}{2}\right)} & \cdots & \boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(m_{\tilde{L}-1},\frac{X}{2}\right)}\end{bmatrix};$$

~~and~~

$$\bar{E}_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix}\boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(n_1,\frac{X}{2}\right)} & \boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(n_2,\frac{X}{2}\right)} & \cdots & \boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(n_{\tilde{L}-1},\frac{X}{2}\right)}\end{bmatrix},$$

~~wherein X is the quantity of CSI-RS ports, L is a quantity of CSI-RS ports selected in one polarization direction, and $\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}$ is a matrix consisting of $\boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(i,\frac{X}{2}\right)}$; $\boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(i,\frac{X}{2}\right)}$ is a vector whose length is X/2, a $(mod\left(i,\frac{X}{2}\right))^{th}$ element in elements comprised in the vector is 1 and other elements are 0, $i=m_1, m_2, ..., m_{\tilde{L}-1}$, and i is an integer greater than or equal to 0; and $\bar{E}_{\frac{X}{2}\times\tilde{L}}$ is a matrix consisting of $\boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(i,\frac{X}{2}\right)}$, $\boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(i,\frac{X}{2}\right)}$ is a vector whose length is X/2, a $(mod\left(i,\frac{X}{2}\right))^{th}$ element in elements comprised in the vector is 1 and other elements are 0, $i=n_1, n_2, ..., n_{\tilde{L}-1}$, and i is an integer greater than or equal to 0.~~

~~19. The method according to claim 18, wherein~~

$$\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix}\boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(m,\frac{X}{2}\right)} & \boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(m+1,\frac{X}{2}\right)} & \cdots & \boldsymbol{e}^{\left(\frac{X}{2}\right)}_{mod\left(m+\tilde{L}-1,\frac{X}{2}\right)}\end{bmatrix}, \text{ and}$$

~~$\bar{E}_{\frac{X}{2}\times\tilde{L}} = \left[e^{\left(\frac{X}{2}\right)}_{mod\left(n,\frac{X}{2}\right)} \quad e^{\left(\frac{X}{2}\right)}_{mod\left(n+1,\frac{X}{2}\right)} \quad \cdots \quad e^{\left(\frac{X}{2}\right)}_{mod\left(n+\tilde{L}-1,\frac{X}{2}\right)} \right]$.~~

~~20. The method according to any one of claims 13 to 15, wherein in different polarization directions, quantities of ports selected by the terminal are different, sequence numbers of the selected ports are different, dimensions of W_1 are X*L, L≤X, X is used to indicate the quantity of CSI-RS ports, and L is a quantity of selected CSI-RS ports.~~

~~21. The method according to claim 20, wherein W_1 is a subset of $F_{X\times X}$, dimensions of $F_{X\times X}$ are X*X, and $F_{X\times X} = \left[e^{(X)}_0 \quad e^{(X)}_1 \quad \ldots \quad e^{(X)}_{(X-1)} \right]$, wherein $e^{(X)}_i$ is a vector whose length is X, an i^{th} element in $F_{X\times X}$ is 1 and all remaining elements are 0, and i=0, 1, ..., X-1.~~

~~22. The method according to claim 21, wherein~~

~~$W_1 = [e^{(X)}_{mod(m,X)}, \ldots, e^{(X)}_{mod(m+(L-1),X)}]$.~~

~~23. The method according to claim 9, wherein the method further comprises:~~

~~receiving, by the terminal, third indication information from the network device, wherein the third indication information is used to indicate one or more of M, L, and X.~~

~~24. The method according to any one of claims 1 to 23, wherein the first indication information is carried in a CSI reporting band CSI-ReportingBand field, and a value of the CSI-ReportingBand field is 0.~~

~~25~~12. A ~~channel state channel feedback~~communications method, comprising:

~~receiving~~determining, by a network device, ~~channel state information from a terminal, wherein the channel state information comprises~~ first indication information; and

~~determining~~transmitting, by the network device, ~~a precoding matrix based on~~ the first indication information to a terminal~~and a first codebook~~, wherein the first indication information indicates a type of a right multiplication matrix in a first codebook, the first codebook satisfies a formula $W = W_1 \widetilde{W}_2 W_f^H$, the first codebook is W, W_1 is a port selection matrix, $\widetilde{W}_2$ is a linear superposition coefficient matrix, ~~the first indication information is used to indicate a type of~~ W_f is the right multiplication matrix, and W_f^H is a conjugate transpose of W_f.

~~26~~13. The method according to claim ~~25~~12, wherein the first indication information ~~is used to~~ indicates that the type of W_f is a port selection matrix.

~~27~~14. The method according to claim ~~25~~12, wherein the first indication information ~~is used~~

~~to~~ indicates that the type of W_f is one ~~or a plurality of~~ specific column vector~~s~~.

~~28~~15. The method according to claim ~~27~~14, wherein the one specific column vector is a column vector in which all elements are 1~~, or the plurality of specific column vectors comprise a column vector in which all elements are 1~~.

~~29~~16. The method according to claim ~~25~~12, wherein the first indication information ~~is used to~~ indicates that the type of W_f is a discrete Fourier transform (DFT) matrix, and the DFT matrix comprises a column vector in which all elements are 1.

~~30~~17. The method according to claim ~~29~~16, wherein the first indication information ~~is~~ further ~~used to~~ indicates the column vector in which all elements are 1.

~~31~~18. The method according to claim ~~29~~16, wherein the method further comprises:

sending, by the network device, second indication information to the terminal, wherein the second indication information is used to indicate the column vector in which all elements are 1.

~~32~~19. The method according to any one of claims ~~25~~ 12 to ~~31~~18, wherein W_1 is used to select one or a plurality of channel state information reference signal (CSI-RS) port groups, and W_f is used to select one or more CSI-RS ports in the CSI-RS port group, or used to select one or more CSI-RS ports in the plurality of CSI-RS port groups.

~~33~~20. The method according to claim ~~25~~ 12 or ~~26~~13, wherein W_f is a port selection matrix, a length of a column vector of W_f is M_{Group}, a length of a column vector of W_1 is $2\tilde{X}_{Group}$, $M_{Group}*\tilde{X}_{Group}$=X/2, X is used to indicate a quantity of CSI-RS ports, M_{Group} is an integer greater than or equal to 1, and is used to indicate to select M_{Group} frequency-domain vectors, and $\tilde{X}_{Group}$ is an integer greater than or equal to 1, and is used to indicate to select $\tilde{X}_{Group}$ spatial-domain vectors in one polarization direction.

~~34~~21. The method according to claim ~~27~~14, wherein the channel state information comprises feedback information, and the feedback information indicates W_1 and $\widetilde{W}_2$.

~~35. The method according to claim 34, wherein the feedback information comprises N_{Rx} $\widetilde{W}_2$, and N_{Rx} is a quantity of receive antennas of the terminal.~~

~~36. The method according to claim 34, wherein the feedback information comprises R $\widetilde{W}_2$, and R is a value of a rank corresponding to the precoding matrix.~~

~~37~~22. The method according to claim ~~27~~ 14 or ~~28~~15, wherein a length of a column vector of W_f is N_{RB}^0, a length of a column vector of W_1 is X, X is used to indicate a quantity of CSI-RS

ports, and N_{RB}^{0} is an integer greater than or equal to 1, and is used to indicate to select N_{RB}^{0} frequency-domain vectors.

~~38. The method according to claim 37, wherein N_{RB}^{0} is related to a quantity of resource blocks RBs or a quantity of subbands of a CSI-RS transmission bandwidth.~~

~~39. The method according to claim 37, wherein N_{RB}^{0} is equal to a quantity of resource blocks RBs or a quantity of subbands of a CSI-RS transmission bandwidth.~~

~~40. The method according to any one of claims 37 to 39, wherein in different polarization directions, quantities of ports selected by the terminal are the same, sequence numbers of the selected ports are the same, and W_1 satisfies the following formula:~~

$$W_1=\begin{bmatrix} E_{\frac{X}{2}\times\tilde{L}} & 0 \\ 0 & E_{\frac{X}{2}\times\tilde{L}} \end{bmatrix}, \text{ wherein } E_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix} e_{mod\left(m_1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & e_{mod\left(m_2,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & e_{mod\left(m_{\tilde{L}-1},\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix},$$

~~wherein~~

~~X is the quantity of CSI-RS ports, $\tilde{L}$ is a quantity of CSI-RS ports selected in one polarization direction, $E_{\frac{X}{2}\times\tilde{L}}$ is a matrix consisting of $e_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$, $e_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$ is a vector whose length is X/2, a $\left(mod\left(i,\frac{X}{2}\right)\right)^{th}$ element in elements comprised in the vector is 1 and other elements are 0, i=m_1, m_2, ..., $m_{\tilde{L}-1}$, and i is an integer greater than or equal to 0.~~

~~41. The method according to claim 40, wherein W_1 satisfies the following formula:~~

$$W_1=\begin{bmatrix} E_{\frac{X}{2}\times\tilde{L}} & 0 \\ 0 & E_{\frac{X}{2}\times\tilde{L}} \end{bmatrix}, \text{ wherein } E_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix} e_{mod\left(m,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & e_{mod\left(m+1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & e_{mod\left(m+\tilde{L}-1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix}.$$

~~42. The method according to any one of claims 37 to 39, wherein in different polarization directions, quantities of ports selected by the terminal are the same, sequence numbers of the selected ports are different, and W_1 satisfies the following formula:~~

$$W_1=\begin{bmatrix} E_{\frac{X}{2}\times\tilde{L}} & 0 \\ 0 & \overline{E}_{\frac{X}{2}\times\tilde{L}} \end{bmatrix}, \text{ wherein } E_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix} e_{mod\left(m_1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & e_{mod\left(m_2,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & e_{mod\left(m_{\tilde{L}-1},\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix},$$

~~and~~

$$\overline{E}_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix} e_{mod\left(n_1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & e_{mod\left(n_2,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & e_{mod\left(n_{\tilde{L}-1},\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix}, \text{ wherein } X \text{ is the quantity of}$$

~~CSI-RS ports, L is a quantity of CSI-RS ports selected in one polarization direction, and $\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}$ is a matrix consisting of $\boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$; $\boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$ is a vector whose length is X/2, a $\left(mod\left(i,\frac{X}{2}\right)\right)^{th}$ element in elements comprised in the vector is 1 and other elements are 0, $i=m_1, m_2, ..., m_{\tilde{L}-1}$, and i is an integer greater than or equal to 0; and $\bar{\boldsymbol{E}}_{\frac{X}{2}\times\tilde{L}}$ is a matrix consisting of $\boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$, $\boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$ is a vector whose length is X/2, a $\left(mod\left(i,\frac{X}{2}\right)\right)^{th}$ element in elements comprised in the vector is 1 and other elements are 0, $i=n_1, n_2, ..., n_{\tilde{L}-1}$, and i is an integer greater than or equal to 0.~~

~~43. The method according to claim 42, wherein~~

~~$$\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}=\left[\boldsymbol{e}_{mod\left(m,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}\ \boldsymbol{e}_{mod\left(m+1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}\ \cdots\ \boldsymbol{e}_{mod\left(m+\tilde{L}-1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}\right],\text{ and}$$~~

~~$$\bar{\boldsymbol{E}}_{\frac{X}{2}\times\tilde{L}}=\left[\boldsymbol{e}_{mod\left(n,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}\ \boldsymbol{e}_{mod\left(n+1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}\ \cdots\ \boldsymbol{e}_{mod\left(n+\tilde{L}-1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}\right].$$~~

~~44. The method according to any one of claims 37 to 39, wherein in different polarization directions, quantities of ports selected by the terminal are different, sequence numbers of the selected ports are different, dimensions of W_1 are X*L, L≤X, X is used to indicate the quantity of CSI-RS ports, and L is a quantity of selected CSI-RS ports.~~

~~45. The method according to claim 44, wherein W_1 is a subset of $F_{X\times X}$, dimensions of $F_{X\times X}$ are X*X, and $F_{X\times X}=\left[\boldsymbol{e}_0^{(X)}\ \boldsymbol{e}_1^{(X)}\ \ldots\ \boldsymbol{e}_{(X-1)}^{(X)}\right]$, wherein $\boldsymbol{e}_i^{(X)}$ is a vector whose length is X, an i^{th} element in $F_{X\times X}$ is 1 and all remaining elements are 0, and i=0, 1, ..., X-1.~~

~~46. The method according to claim 45, wherein~~

~~$W_1=\left[e_{mod(m,X)}^{(X)},\ldots,e_{mod(m+(L-1),X)}^{(X)}\right]$.~~

~~47. The method according to claim 33, wherein the method further comprises:~~

~~sending, by the network device, third indication information to the terminal, wherein the third indication information is used to indicate one or more of M, L, and X.~~

~~48. The method according to any one of claims 25 to 47, wherein the first indication information is carried in a CSI reporting band CSI-ReportingBand field, and a value of the CSI-~~

~~ReportingBand field is 0.~~

~~49~~23. A communications apparatus, comprising a receiving unit and a ~~sending~~ processing unit, wherein

the receiving unit is configured to receive first indication information from a network device, wherein the first indication information ~~is used to~~ indicates a type of a right multiplication matrix in a first codebook, the first codebook satisfies a formula $\mathrm{W} = W_1\widetilde{W}_2W_f^H$, the first codebook is W, W_1 is a port selection matrix, $\widetilde{W}_2$ is a linear superposition coefficient matrix, W_f is the right multiplication matrix, and W_f^H is a conjugate transpose of W_f, and is used by ~~a terminal~~the apparatus to determine channel state information based on the first codebook; and

the ~~sending~~ processing unit is configured to ~~send~~ determine ~~the~~ channel state information based on the first indication information~~to the network device~~.

~~50~~24. The communications apparatus according to claim ~~49~~23, wherein the first indication information ~~is used to~~ indicates that the type of W_f is a port selection matrix.

~~51~~25. The communications apparatus according to claim ~~49~~23, wherein the first indication information ~~is used to~~ indicates that the type of W_f is one ~~or a plurality of~~ specific column vectors~~.~~

~~52~~26. The communications apparatus according to claim ~~51~~25, wherein the one specific column vector is a column vector in which all elements are 1~~, or the plurality of specific column vectors comprise a column vector in which all elements are 1~~.

~~53~~27. The communications apparatus according to claim ~~49~~23, wherein the first indication information ~~is used to~~ indicates that the type of W_f is a discrete Fourier transform (DFT) matrix, and the DFT matrix comprises a column vector in which all elements are 1.

~~54~~28. The communications apparatus according to claim ~~53~~27, wherein the first indication information ~~is~~ further ~~used to~~ indicates the column vector in which all elements are 1.

~~55~~29. The communications apparatus according to claim ~~53~~27, wherein the receiving unit is further configured to~~comprises~~:

~~receiving~~ receive second indication information from the network device, wherein the second indication information is used to indicate the column vector in which all elements are 1.

~~56~~30. The communications apparatus according to any one of claims ~~49~~ 23 to ~~55~~29, wherein W_1 is used to select one or a plurality of channel state information reference signal (CSI-RS) port groups, and W_f is used to select one or more CSI-RS ports in the CSI-RS port group, or used to

select one or more CSI-RS ports in the plurality of CSI-RS port groups.

~~57~~31. The communications apparatus according to claim ~~49~~ 23 or ~~50~~24, wherein W_f is a port selection matrix, a length of a column vector of W_f is M_{Group}, a length of a column vector of W_1 is $2\tilde{X}_{Group}$, $M_{Group} * \tilde{X}_{Group}$=X/2, X is used to indicate a quantity of CSI-RS ports, M_{Group} is an integer greater than or equal to 1, and is used to indicate to select M_{Group} frequency-domain vectors, and $\tilde{X}_{Group}$ is an integer greater than or equal to 1, and is used to indicate to select $\tilde{X}_{Group}$ spatial-domain vectors in one polarization direction.

~~58~~32. The communications apparatus according to claim ~~57~~31, wherein the channel state information comprises feedback information, and the feedback information indicates W_1 and $\widetilde{W}_2$.

~~59. The communications apparatus according to claim 58, wherein the feedback information comprises N_{Rx} $\widetilde{W}_2$, and N_{Rx} is a quantity of receive antennas of the terminal.~~

~~60. The communications apparatus according to claim 58, wherein the feedback information comprises R $\widetilde{W}_2$, and R is a value of a rank corresponding to a precoding matrix.~~

~~61~~33. The communications apparatus according to claim ~~51~~ 25 or ~~52~~26, wherein a length of a column vector of W_f is N_{RB}^0, a length of a column vector of W_1 is X, X is used to indicate a quantity of CSI-RS ports, and N_{RB}^0 is an integer greater than or equal to 1, and is used to indicate to select N_{RB}^0 frequency-domain vectors.

~~62. The communications apparatus according to claim 61, wherein N_{RB}^0 is related to a quantity of resource blocks RBs or a quantity of subbands of a CSI-RS transmission bandwidth.~~

~~63. The communications apparatus according to claim 61, wherein N_{RB}^0 is equal to a quantity of resource blocks RBs or a quantity of subbands of a CSI-RS transmission bandwidth.~~

~~64. The communications apparatus according to any one of claims 61 to 63, wherein in different polarization directions, quantities of ports selected by the terminal are the same, sequence numbers of the selected ports are the same, and W_1 satisfies the following formula:~~

$$W_1 = \begin{bmatrix} E_{\frac{X}{2}\times\tilde{L}} & 0 \\ 0 & E_{\frac{X}{2}\times\tilde{L}} \end{bmatrix}, \text{ wherein } E_{\frac{X}{2}\times\tilde{L}} = \begin{bmatrix} e_{mod\left(m_1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & e_{mod\left(m_2,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & e_{mod\left(m_{\tilde{L}-1},\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix};$$

wherein

X is the quantity of CSI-RS ports, $\tilde{L}$ is a quantity of CSI-RS ports selected in one

polarization direction, $\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}$ is a matrix consisting of $\boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$, $\boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$ is a vector whose length is X/2, a $\left(mod\left(i,\frac{X}{2}\right)\right)^{th}$ element in elements comprised in the vector is 1 and other elements are 0, $i=m_1, m_2, ..., m_{\tilde{L}-1}$, and i is an integer greater than or equal to 0.

65. The communications apparatus according to claim 64, wherein W_1 satisfies the following formula:

$$\boldsymbol{W}_1=\begin{bmatrix}\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} & 0\\ 0 & \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}\end{bmatrix}, \text{ wherein } \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix}\boldsymbol{e}_{mod\left(m,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \boldsymbol{e}_{mod\left(m+1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & \boldsymbol{e}_{mod\left(m+\tilde{L}-1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}\end{bmatrix};$$

66. The communications apparatus according to any one of claims 61 to 63, wherein in different polarization directions, quantities of ports selected by the terminal are the same, sequence numbers of the selected ports are different, and W_1 satisfies the following formula:

$$\boldsymbol{W}_1=\begin{bmatrix}\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} & 0\\ 0 & \bar{E}_{\frac{X}{2}\times\tilde{L}}\end{bmatrix}, \text{ wherein } \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix}\boldsymbol{e}_{mod\left(m_1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \boldsymbol{e}_{mod\left(m_2,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & \boldsymbol{e}_{mod\left(m_{\tilde{L}-1},\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}\end{bmatrix};$$

and

$$\bar{E}_{\frac{X}{2}\times\tilde{L}}=\begin{bmatrix}\boldsymbol{e}_{mod\left(n_1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \boldsymbol{e}_{mod\left(n_2,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & \boldsymbol{e}_{mod\left(n_{\tilde{L}-1},\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}\end{bmatrix}, \text{ wherein } X \text{ is the quantity of CSI-RS ports, L is a quantity of CSI-RS ports selected in one polarization direction, and } \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} \text{ is a matrix consisting of } \boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}; \boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \text{ is a vector whose length is X/2, a } \left(mod\left(i,\frac{X}{2}\right)\right)^{th}$$

element in elements comprised in the vector is 1 and other elements are 0, $i=m_1, m_2, ..., m_{\tilde{L}-1}$, and i is an integer greater than or equal to 0; and $\bar{E}_{\frac{X}{2}\times\tilde{L}}$ is a matrix consisting of $\boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$, $\boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$ is a vector whose length is X/2, a $\left(mod\left(i,\frac{X}{2}\right)\right)^{th}$ element in elements comprised in the vector is 1 and other elements are 0, $i=n_1, n_2, ..., n_{\tilde{L}-1}$, and i is an integer greater than or equal to 0.

67. The communications apparatus according to claim 66, wherein

~~$\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} = \left[\boldsymbol{e}_{mod\left(m,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \quad \boldsymbol{e}_{mod\left(m+1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \quad \cdots \quad \boldsymbol{e}_{mod\left(m+\tilde{L}-1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}\right]$, and~~

~~$\bar{\boldsymbol{E}}_{\frac{X}{2}\times\tilde{L}} = \left[\boldsymbol{e}_{mod\left(n,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \quad \boldsymbol{e}_{mod\left(n+1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \quad \cdots \quad \boldsymbol{e}_{mod\left(n+\tilde{L}-1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}\right]$.~~

~~68. The communications apparatus according to any one of claims 61 to 63, wherein in different polarization directions, quantities of ports selected by the terminal are different, sequence numbers of the selected ports are different, dimensions of W_1 are X*L, L≤X, X is used to indicate the quantity of CSI-RS ports, and L is a quantity of selected CSI-RS ports.~~

~~69. The communications apparatus according to claim 68, wherein W_1 is a subset of $F_{X\times X}$, dimensions of $F_{X\times X}$ are X*X, and $F_{X\times X} = \left[\boldsymbol{e}_0^{(X)} \quad \boldsymbol{e}_1^{(X)} \quad \ldots \quad \boldsymbol{e}_{(X-1)}^{(X)}\right]$, wherein $\boldsymbol{e}_t^{(X)}$ is a vector whose length is X, an i^{th} element in $F_{X\times X}$ is 1 and all remaining elements are 0, and i=0, 1, ..., X-1.~~

~~70. The communications apparatus according to claim 69, wherein~~

~~$W_1 = [e_{mod(m,X)}^{(X)}, \ldots, e_{mod(m+(L-1),X)}^{(X)}]$.~~

~~71. The communications apparatus according to claim 57, wherein the receiving unit is further configured to:~~

~~receive third indication information from the network device, wherein the third indication information is used to indicate one or more of M, L, and X.~~

~~72. The communications apparatus according to any one of claims 49 to 71, wherein the first indication information is carried in a CSI reporting band CSI-ReportingBand field, and a value of the CSI-ReportingBand field is 0.~~

~~73~~34. A communications apparatus, comprising a receiving unit and a processing unit, wherein

the processing ~~receiving~~ unit is configured to ~~receive~~ determine ~~channel state information from a terminal, wherein the channel state information comprises~~ first indication information; and

the receiving ~~processing~~ unit is configured to ~~determine~~ transmit ~~a precoding matrix based on~~ the first indication information to a terminal~~and a first codebook~~, wherein the first indication information indicates a type of a right multiplication matrix in a first codebook, the first codebook satisfies a formula $W = W_1\widetilde{W}_2W_f^H$, the first codebook is W, W_1 is a port selection matrix, $\widetilde{W}_2$ is a linear superposition coefficient matrix, ~~the first indication information is used to indicate a~~

~~type of~~ W_f is the right multiplication matrix, and W_f^H is a conjugate transpose of W_f.

~~74~~35. The communications apparatus according to claim 34~~73~~, wherein the first indication information ~~is used to~~ indicates that the type of W_f is a port selection matrix.

~~75~~36. The communications apparatus according to claim ~~73~~34, wherein the first indication information ~~is used to~~ indicates that the type of W_f is one ~~or a plurality of~~ specific column vector~~s~~.

~~76~~37. The communications apparatus according to claim ~~75~~36, wherein the one specific column vector is a column vector in which all elements are 1~~, or the plurality of specific column vectors comprise a column vector in which all elements are 1~~.

~~77~~38. The communications apparatus according to claim ~~73~~34, wherein the first indication information ~~is used to~~ indicates that the type of W_f is a discrete Fourier transform (DFT) matrix, and the DFT matrix comprises a column vector in which all elements are 1.

~~78~~39. The communications apparatus according to claim ~~77~~38, wherein the first indication information ~~is~~ further ~~used to~~ indicates the column vector in which all elements are 1.

~~79~~40. The communications apparatus according to claim ~~77~~38, wherein the communications apparatus comprises a sending unit, the sending unit is further configured to:

send second indication information to the terminal, wherein the second indication information is used to indicate the column vector in which all elements are 1.

~~80~~41. The communications apparatus according to any one of claims ~~73~~ 34 to ~~79~~40, wherein W_1 is used to select one or a plurality of channel state information reference signal (CSI-RS) port groups, and W_f is used to select one or more CSI-RS ports in the CSI-RS port group, or used to select one or more CSI-RS ports in the plurality of CSI-RS port groups.

~~81~~42. The communications apparatus according to claim ~~73~~ 34 or ~~74~~35, wherein W_f is a port selection matrix, a length of a column vector of W_f is M_{Group}, a length of a column vector of W_1 is $2\tilde{X}_{Group}$, $M_{Group} * \tilde{X}_{Group}$=X/2, X is used to indicate a quantity of CSI-RS ports, M_{Group} is an integer greater than or equal to 1, and is used to indicate to select M_{Group} frequency-domain vectors, and $\tilde{X}_{Group}$ is an integer greater than or equal to 1, and is used to indicate to select $\tilde{X}_{Group}$ spatial-domain vectors in one polarization direction.

~~82~~43. The communications apparatus according to claim ~~75~~36, wherein the channel state information comprises feedback information, and the feedback information indicates W_1 and $\widetilde{W}_2$.

~~83. The communications apparatus according to claim 82, wherein the feedback information~~

~~comprises N_{Rx} $\widetilde{W}_2$, and N_{Rx} is a quantity of receive antennas of the terminal.~~

~~84. The communications apparatus according to claim 82, wherein the feedback information comprises R $\widetilde{W}_2$, and R is a value of a rank corresponding to the precoding matrix.~~

~~85~~44. The communications apparatus according to claim ~~75~~ 36 or ~~76~~37, wherein a length of a column vector of W_f is N_{RB}^0, a length of a column vector of W_1 is X, X is used to indicate a quantity of CSI-RS ports, and N_{RB}^0 is an integer greater than or equal to 1, and is used to indicate to select N_{RB}^0 frequency-domain vectors.

~~86. The communications apparatus according to claim 85, wherein N_{RB}^0 is related to a quantity of resource blocks RBs or a quantity of subbands of a CSI-RS transmission bandwidth.~~

~~87. The communications apparatus according to claim 85, wherein N_{RB}^0 is equal to a quantity of resource blocks RBs or a quantity of subbands of a CSI-RS transmission bandwidth.~~

~~88. The communications apparatus according to any one of claims 85 to 87, wherein in different polarization directions, quantities of ports selected by the terminal are the same, sequence numbers of the selected ports are the same, and W_1 satisfies the following formula:~~

$$W_1 = \begin{bmatrix} \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} & 0 \\ 0 & \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} \end{bmatrix}, \text{ wherein } \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} = \begin{bmatrix} \boldsymbol{e}_{mod\left(m_1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \boldsymbol{e}_{mod\left(m_2,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & \boldsymbol{e}_{mod\left(m_{\tilde{L}-1},\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix};$$

~~wherein~~

~~X is the quantity of CSI-RS ports, $\tilde{L}$ is a quantity of CSI-RS ports selected in one polarization direction, $\boldsymbol{E}_{\frac{X}{2}\times\tilde{L}}$ is a matrix consisting of $\boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$, $\boldsymbol{e}_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$ is a vector whose length is X/2, a $(mod\left(i,\frac{X}{2}\right))^{th}$ element in elements comprised in the vector is 1 and other elements are 0, $i=m_1, m_2, \ldots, m_{\tilde{L}-1}$, and i is an integer greater than or equal to 0.~~

~~89. The communications apparatus according to claim 88, wherein W_1 satisfies the following formula:~~

$$W_1 = \begin{bmatrix} \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} & 0 \\ 0 & \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} \end{bmatrix}, \text{ wherein } \boldsymbol{E}_{\frac{X}{2}\times\tilde{L}} = \begin{bmatrix} \boldsymbol{e}_{mod\left(m,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \boldsymbol{e}_{mod\left(m+1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & \boldsymbol{e}_{mod\left(m+\tilde{L}-1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix};$$

~~90. The communications apparatus according to any one of claims 85 to 87, wherein in different polarization directions, quantities of ports selected by the terminal are the same, sequence~~

~~numbers of the selected ports are different, and W_1 satisfies the following formula:~~

$$W_1 = \begin{bmatrix} E_{\frac{X}{2}\times\tilde{L}} & 0 \\ 0 & \bar{E}_{\frac{X}{2}\times\tilde{L}} \end{bmatrix}$$

~~, wherein~~ $$E_{\frac{X}{2}\times\tilde{L}} = \begin{bmatrix} e_{mod\left(m_1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & e_{mod\left(m_2,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & e_{mod\left(m_{\tilde{L}-1},\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix},$$

~~and~~

$$\bar{E}_{\frac{X}{2}\times\tilde{L}} = \begin{bmatrix} e_{mod\left(n_1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & e_{mod\left(n_2,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & e_{mod\left(n_{\tilde{L}-1},\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix}$$

~~, wherein X is the quantity of CSI-RS ports, L is a quantity of CSI-RS ports selected in one polarization direction, and~~ $E_{\frac{X}{2}\times\tilde{L}}$ ~~is a matrix consisting of~~ $e_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$; $e_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$ ~~is a vector whose length is X/2, a~~ $\left(mod\left(i,\frac{X}{2}\right)\right)^{th}$ ~~element in elements comprised in the vector is 1 and other elements are 0,~~ $i=m_1, m_2, \ldots, m_{\tilde{L}-1}$, ~~and i is an integer greater than or equal to 0; and~~ $\bar{E}_{\frac{X}{2}\times\tilde{L}}$ ~~is a matrix consisting of~~ $e_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$, $e_{mod\left(i,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)}$ ~~is a vector whose length is X/2, a~~ $\left(mod\left(i,\frac{X}{2}\right)\right)^{th}$ ~~element in elements comprised in the vector is 1 and other elements are 0,~~ $i=n_1, n_2, \ldots, n_{\tilde{L}-1}$, ~~and i is an integer greater than or equal to 0.~~

~~91. The communications apparatus according to claim 90, wherein~~

$$E_{\frac{X}{2}\times\tilde{L}} = \begin{bmatrix} e_{mod\left(m,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & e_{mod\left(m+1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & e_{mod\left(m+\tilde{L}-1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix}$$

~~, and~~

$$\bar{E}_{\frac{X}{2}\times\tilde{L}} = \begin{bmatrix} e_{mod\left(n,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & e_{mod\left(n+1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} & \cdots & e_{mod\left(n+\tilde{L}-1,\frac{X}{2}\right)}^{\left(\frac{X}{2}\right)} \end{bmatrix}.$$

~~92. The communications apparatus according to any one of claims 85 to 87, wherein in different polarization directions, quantities of ports selected by the terminal are different, sequence numbers of the selected ports are different, dimensions of W_1 are X*L, L≤X, X is used to indicate the quantity of CSI-RS ports, and L is a quantity of selected CSI-RS ports.~~

~~93. The communications apparatus according to claim 92, wherein W_1 is a subset of $F_{X\times X}$, dimensions of $F_{X\times X}$ are X*X, and $F_{X\times X} = \left[e_0^{(X)} \quad e_1^{(X)} \quad \ldots \quad e_{(X-1)}^{(X)}\right]$, wherein $e_i^{(X)}$ is a vector whose length is X, an i^{th} element in $F_{X\times X}$ is 1 and all remaining elements are 0, and i=0, 1, ..., X–1.~~

~~94. The communications apparatus according to claim 93, wherein~~

~~$W_1 = [e^{(X)}_{mod(m,X)}, \cdots, e^{(X)}_{mod(m+(L-1),X)}]$.~~

~~95. The communications apparatus according to claim 81, wherein the sending unit is further configured to:~~

~~send third indication information to the terminal, wherein the third indication information is used to indicate one or more of M, L, and X.~~

~~96. The communications apparatus according to any one of claims 73 to 95, wherein the first indication information is carried in a CSI reporting band CSI-ReportingBand field, and a value of the CSI-ReportingBand field is 0.~~

~~97~~45. A communications apparatus, wherein the communications apparatus comprises a processor and a memory, the memory is configured to store a computer program, and the processor is configured to execute the computer program stored in the memory, to enable the apparatus to perform the communications method according to any one of claims 1 to ~~24~~11, or any one of claims ~~25~~ 12 to 22~~48~~.

46. The communications apparatus according to any one of claims 23-45, wherein the communications apparatus is a chip.

~~98~~47. A communications system, comprising the communications apparatus according to any one of claims ~~49~~ 23 to ~~72~~ 33 and the communications apparatus according to any one of claims ~~73~~ 34 to ~~96~~44.

~~99~~48. A computer-readable storage medium, wherein the computer-readable storage medium stores a computer program; and when the computer program is executed by a computer, the computer is enabled to perform the method according to any one of claims 1 to ~~24~~11, or any one of claims ~~25~~ 12 to ~~48~~22.

~~100~~49. A computer program product, wherein the computer program product stores a computer program; and when the computer program is executed by a computer, the computer is enabled to perform the method according to any one of claims 1 to ~~24~~11, or any one of claims ~~25~~ 12 to ~~48~~22.