

# **SENSING INFORMATION ASSISTED BEAM MANAGEMENT**

## **TECHNICAL FIELD**

The disclosure relates generally to wireless communications, including but not limited to systems and methods for performing sensing information assisted beam management.

## **BACKGROUND**

The standardization organization Third Generation Partnership Project (3GPP) is currently in the process of specifying a new Radio Interface called 5G New Radio (5G NR) as well as a Next Generation Packet Core Network (NG-CN or NGC). The 5G NR will have three main components: a 5G Access Network (5G-AN), a 5G Core Network (5GC), and a User Equipment (UE). In order to facilitate the enablement of different data services and requirements, the elements of the 5GC, also called Network Functions, have been simplified with some of them being software based so that they could be adapted according to need.

## **SUMMARY**

The example embodiments disclosed herein are directed to solving the issues relating to one or more of the problems presented in the prior art, as well as providing additional features that will become readily apparent by reference to the following detailed description when taken in conjunction with the accompanying drawings. In accordance with various embodiments, example systems, methods, devices and computer program products are disclosed herein. It is understood, however, that these embodiments are presented by way of example and are not limiting, and it will be apparent to those of ordinary skill in the art who read the present disclosure that various modifications to the disclosed embodiments can be made while remaining within the scope of this disclosure.

At least one example is directed to a system, a method, an apparatus, or a computer-readable medium for performing sensing information assisted beam management. A wireless communication device may receive, from a wireless communication node, a first signaling that includes a transmission parameter setting. The wireless communication device may associate the transmission parameter setting and resource related information. The wireless communication

device may communicate with the wireless communication node, a signal according to the resource related information.

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In a first aspect, the present disclosure provides a method comprising: receiving, by a wireless communication device from a wireless communication node, a first signaling that includes a transmission parameter setting; associating, by the wireless communication device, the transmission parameter setting and resource related information; and communicating, by the wireless communication device with the wireless communication node, a signal according to the resource related information or the transmission parameter setting.

In a second aspect, the present disclosure provides a wireless communication device, comprising: at least one processor configured to: receive, via a transceiver from a wireless communication node, a first signaling that includes a transmission parameter setting; associate the transmission parameter setting and resource related information; and communicate, via the transceiver with the wireless communication node, a signal according to the resource related information or the transmission parameter setting.

In some examples, the signal may include at least one of a downlink signal or an uplink signal. In some embodiments, the transmission parameter setting may represent sensing information associated with an anchor, for assisting beam determination by the wireless communication device. In some embodiments, the transmission parameter setting may include at least one of: location information, size information or a range of angles. In some embodiments, the anchor may include a virtual anchor or a physical anchor.

In some examples, the location information may include at least one of: a location of an anchor, a location of a reflector, or a location of a blockage. In some embodiments, the size information may include at least one of a radius or a length; or size information of an anchor, a reflector, or a blockage. In some embodiments, the range of angles may include at least one of: an available range of angles of at least one of: an anchor; or at least one of a range of an angle of arrival (AoA), or a range of an angle of departure (AoD).

In some examples, the transmission parameter setting may include sensing information related to each of a plurality of sub-entities of an anchor, the sensing information comprising at least one of: location information, size information or a range of angles. In some embodiments, the transmission parameter setting may include spread information that corresponds to location information, spread information that corresponds to size information or spread information that corresponds to angle.

In some examples, the spread information that corresponds to angle may include angular spread. In some embodiments, the angular spread may include at least one of: azimuth angle spread of arrival, zenith angle spread of arrival, azimuth angle spread of departure, or zenith angle spread of departure.

In some examples, the first signaling may include: system information block (SIB) signalling, master information block (MIB) signalling, medium access control control element (MAC-CE) signalling or radio resource control (RRC) signalling. In some embodiments, the resource related information may include at least one of: a reference signal (RS), a beam state, group information, a reporting configuration, a bandwidth part (BWP), a component carrier (CC), a control resource set (CORESET) pool, or an uplink power control parameter.

In some examples, the RS may include at least one of: a RS port, a RS port group, a RS resource, a RS resource set, or a RS resource setting. In some embodiments, the RS may include synchronization signal blocks (SSBs) or channel state information reference signals (CSI-RSs). In some embodiments, the transmission parameter setting may be associated with a group of the RSs. In some embodiments, the RS may be associated with a plurality of transmission parameter settings.

In some examples, the wireless communication device may communicate the RS. The RS may be configured with the beam state or the group information, and the beam state or the group information may be associated with the transmission parameter setting. In some embodiments, a measurement corresponding to the reporting configuration may be performed according to the transmission parameter setting.

In some examples, the transmission parameter setting may be selected from a pool of transmission parameter settings. In some embodiments, the first signaling may include a pool of transmission parameter settings comprising one or more transmission parameter settings. In some embodiments, the wireless communication device may receive a second signaling to activate a subset of a pool of beam states

In some examples, the second signaling may associate a plurality of beam states with a codepoint. The plurality of beam states may be associated with at least one

transmission parameter setting. In some embodiments, the plurality of beam states may include a first plurality of beam states to be applied to downlink signals, and a second plurality of beam states to be applied to uplink signals.

In some examples, the wireless communication device may receive a third signaling to indicate a beam state from the subset, the indicated beam state to be applied to at least one of: downlink signaling or uplink signaling. In some embodiments, the wireless communication device may determine a plurality of transmission parameter settings associated with the indicated beam state. In some embodiments, the wireless communication device may determine a first transmission parameter setting from the plurality of transmission parameter settings, that is effective and to be applied to the signal.

In some examples, the signal may include a reference signal (RS) associated with the transmission parameter setting. The RS may be used for at least one of beam detection, radio link monitoring, candidate beam identification, beam recovery or link recovery. In some embodiments, the wireless communication device may send a report. The report may include at least one of: a failure event corresponding to a reference signal (RS) or the transmission parameter setting; a recovery event corresponding to the RS or the transmission parameter setting; an indication of the RS or the transmission parameter setting, or a time stamp for beam failure or beam recovery; or channel state information (CSI) corresponding to the RS or the transmission parameter setting.

In some examples, the report may include at least one of an uplink control information (UCI) signaling, a medium access control control element (MAC-CE) signaling or a radio resource control (RRC) signalling. In some embodiments, the RS may correspond to a failed RS or a candidate RS, or the transmission parameter setting may correspond to a failed transmission parameter setting or a candidate transmission parameter setting.

In some examples, the CSI at least may meet a threshold. In some embodiments, the report may include an indication that a candidate RS or a candidate transmission setting is absent. In some embodiments, the wireless communication device may receive a downlink signal according to the RS or the transmission parameter setting.

In some examples, a beam state, spatial relation, spatial domain filter, or group information of the downlink signal may be determined according to the RS or the transmission parameter setting. In some embodiments, the wireless communication device may transmit an uplink signal according to the RS or the transmission parameter setting.

In some examples, a beam state, spatial relation, group information or spatial domain filter of the uplink signal may be determined according to the RS or the transmission parameter setting. In some embodiments, the wireless communication device may receive another signaling, the another signaling comprises a downlink control information (DCI) signaling, a medium access control control element (MAC-CE) signaling or a radio resource control (RRC) signaling.

At least one example is directed to a system, a method, an apparatus, or a computer-readable medium for performing sensing information assisted beam management. A wireless communication node may transmit, to a wireless communication device, a first signaling that includes a transmission parameter setting. The wireless communication node may cause the wireless communication device to associate the transmission parameter setting and resource related information. The wireless communication node may communicate, with the wireless communication device, a signal according to the resource related information.

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In a third aspect, the present disclosure provides a method comprising: transmitting, by a wireless communication node to a wireless communication device, a first signaling that includes a transmission parameter setting; causing the wireless communication device to associate the transmission parameter setting and resource related information; and communicating, by the

wireless communication node with the wireless communication device, a signal according to the resource related information or the transmission parameter setting.

In a fourth aspect, the present disclosure provides a wireless communication node, comprising, at least one processor configured to: transmit, via a transceiver to a wireless communication device, a first signaling that includes a transmission parameter setting; cause the wireless communication device to associate the transmission parameter setting and resource related information; and communicate, via the transceiver with the wireless communication device, a signal according to the resource related information or the transmission parameter setting.

## BRIEF DESCRIPTION OF THE DRAWINGS

Various example embodiments of the present solution are described in detail below with reference to the following figures or drawings. The drawings are provided for purposes of illustration only and merely depict example embodiments of the present solution to

## CLAIMS

1. A method comprising:  
receiving, by a wireless communication device from a wireless communication node, a first signaling that includes a transmission parameter setting;  
associating, by the wireless communication device, the transmission parameter setting and resource related information; and  
communicating, by the wireless communication device with the wireless communication node, a signal according to the resource related information or the transmission parameter setting.
2. The method of claim 1, wherein the signal comprises at least one of a downlink signal or an uplink signal.
3. The method of claim 1, wherein the transmission parameter setting represents sensing information associated with an anchor, for assisting beam determination by the wireless communication device.
4. The method of claim 1, wherein the transmission parameter setting comprises at least one of: location information, size information or a range of angles.
5. The method of claim 4, wherein the location information comprises at least one of: a location of an anchor, a location of a reflector, or a location of a blockage.
6. The method of claim 4, wherein the size information comprises at least one of:  
at least one of a radius or a length; or  
size information of an anchor, a reflector, or a blockage.
7. The method of claim 4, wherein the range of angles comprises at least one of:  
an available range of angles of at least one of: an anchor; or  
at least one of a range of an angle of arrival (AoA), or a range of an angle of departure (AoD).

8. The method of claim 1, wherein the transmission parameter setting comprises information related to each of a plurality of sub-entities of an anchor, the information comprising at least one of: location information, size information or a range of angles.
9. The method of claim 3, wherein the anchor comprises a virtual anchor or a physical anchor.
10. The method of claim 1, wherein the transmission parameter setting comprises spread information that corresponds to location information, spread information that corresponds to size information or spread information that corresponds to angle.
11. The method of claim 10, wherein the spread information that corresponds to angle comprises angular spread.
12. The method of claim 11, wherein the angular spread comprises at least one of: azimuth angle spread of arrival, zenith angle spread of arrival, azimuth angle spread of departure, or zenith angle spread of departure.
13. The method of claim 1, wherein the first signaling comprises: system information block (SIB) signalling, master information block (MIB) signalling, medium access control control element (MAC-CE) signalling or radio resource control (RRC) signalling
14. The method of claim 1, wherein the resource related information comprises at least one of: a reference signal (RS), a beam state, group information, a reporting configuration, a bandwidth part (BWP), a component carrier (CC), a control resource set (CORESET) pool, or an uplink power control parameter.
15. The method of claim 14, wherein the RS comprises at least one of: a RS port, a RS port group, a RS resource, a RS resource set, or a RS resource setting.
16. The method of claim 14, wherein the RS comprises a demodulation reference signal

(DMRS), a sounding reference signal (SRS), a synchronization signal block (SSB) or a channel state information reference signal (CSI-RS).

17. The method of claim 14, wherein the transmission parameter setting is associated with a group of the RSs.

18. A method comprising,  
transmitting, by a wireless communication node to a wireless communication device, a first signaling that includes a transmission parameter setting;  
causing the wireless communication device to associate the transmission parameter setting and resource related information; and  
communicating, by the wireless communication node with the wireless communication device, a signal according to the resource related information or the transmission parameter setting.

19. A wireless communication device, comprising:  
at least one processor configured to:  
receive, via a transceiver from a wireless communication node, a first signaling that includes a transmission parameter setting;  
associate the transmission parameter setting and resource related information; and  
communicate, via the transceiver with the wireless communication node, a signal according to the resource related information or the transmission parameter setting.

20. A wireless communication node, comprising,  
at least one processor configured to:  
transmit, via a transceiver to a wireless communication device, a first signaling that includes a transmission parameter setting;  
cause the wireless communication device to associate the transmission parameter setting and resource related information; and  
communicate, via the transceiver with the wireless communication device, a signal according to the resource related information or the transmission parameter setting.