# US Patent & Trademark Office
# Patent Public Search | Text View



| | |
|---|---|
| United States Patent Application Publication | 20250267551 |
| Kind Code | A1 |
| Publication Date | August 21, 2025 |
| Inventor(s) | PHUYAL; Umesh et al. |


# COORDINATE SIGNALING FOR A RESTRICTED GEOGRAPHIC AREA


## Abstract

Methods, systems, and devices for wireless communications are described. The described techniques include coordinating signaling for a restricted geographic area or zone. A user equipment (UE) (e.g., aerial UE) receives one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to boundaries of a polygon that defines an area or a volume of the restricted geographic area. The one or more messages further indicate a transmission restriction policy associated with the restricted geographic area. The UE performs a procedure that complies with the transmission restriction policy based on a current geolocation of the UE relative to the geographic coordinates corresponding to the boundaries of the polygon associated with the restricted geographic area.



**Inventors:** **PHUYAL; Umesh (San Diego, CA), FACCIN; Stefano (San Ysidro, CA), KANAMARLAPUDI; Sitaramanjaneyulu (San Diego, CA), LIU; Le (San Jose, CA), SAHA; Chiranjib (Lakeside, CA), RICO ALVARINO; Alberto (San Diego, CA)**

**Applicant:** **QUALCOMM Incorporated** (San Diego, CA)



**Family ID:** **1000008477045**

**Appl. No.:** **19/052073**

**Filed:** **February 12, 2025**

## Related U.S. Application Data

us-provisional-application US 63554116 20240215

## Publication Classification

**Int. Cl.:** **H04W48/04** (20090101); **G08G5/59** (20250101); **H04W4/021** (20180101); **H04W72/0453** (20230101)

**U.S. Cl.:**

CPC **H04W48/04** (20130101); **G08G5/59** (20250101); **H04W4/022** (20130101); **H04W72/0453** (20130101);

## Background/Summary

CROSS REFERENCE [0001] The present Application for Patent claims benefit of U.S. Provisional Patent Application No. 63/554,116 by PHUYAL et al., entitled “COORDINATE SIGNALING FOR A RESTRICTED GEOGRAPHIC AREA,” filed Feb. 15, 2024, which is assigned to the assignee hereof, and which is expressly incorporated by reference in its entirety herein.

FIELD OF TECHNOLOGY
[0002] The following relates to wireless communications, including coordinate signaling for a restricted geographic area.
BACKGROUND
[0003] Wireless communications systems are widely deployed to provide various types of communication content such as voice, video, packet data, messaging, broadcast, and so on. These systems may be capable of supporting communication with multiple users by sharing the available system resources (e.g., time, frequency, and power). Examples of such multiple-access systems include fourth generation (4G) systems such as Long Term Evolution (LTE) systems, LTE-Advanced (LTE-A) systems, or LTE-A Pro systems, and fifth generation (5G) systems which may be referred to as New Radio (NR) systems. These systems may employ technologies such as code division multiple access (CDMA), time division multiple access (TDMA), frequency division multiple access (FDMA), orthogonal FDMA (OFDMA), or discrete Fourier transform spread orthogonal frequency division multiplexing (DFT-S-OFDM). A wireless multiple-access communications system may include one or more base stations, each supporting wireless communication for communication devices, which may be known as user equipment (UE).
SUMMARY
[0004] The described techniques relate to improved methods, systems, devices, and apparatuses that support coordinate signaling for a restricted geographic area. For example, the described techniques provide for an aerial user equipment (UE) to enter and operate in a geographical area with transmission restrictions. In some examples, the described techniques provide for a UE, such as an aerial UE, to receive signaling that indicates geographic coordinates forming boundaries of a polygon (e.g., to form a two-dimension (2D) or three-dimension (3D) polygon area) of a restricted area and a type of the restricted area (e.g., no-transmit zone, no-fly zone, or no-departure zone). The signaling may further indicate a transmission restriction policy associated with the restricted area (e.g., indicating permission to transmit over a frequency band while indicating prohibition to transmit over a different frequency band, as well as time periods during which the UE may transmit). The UE may receive signaling based on a release version associated with the UE (e.g., an early release version aerial UE receives signaling indicating a bar from transmitting in the restricted area while a newer version aerial UE receives signaling indicating permission and policy to transmit in the restricted area for the restricted area type).
[0005] A method for wireless communications by a UE is described. The method may include receiving one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an

area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area and performing a procedure that complies with the transmission restriction policy based on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.

[0006] A UE for wireless communications is described. The UE may include one or more memories storing processor executable code, and one or more processors coupled with the one or more memories. The one or more processors may individually or collectively be operable to execute the code to cause the UE to receive one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area and perform a procedure that complies with the transmission restriction policy based on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.

[0007] Another UE for wireless communications is described. The UE may include means for receiving one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area and means for performing a procedure that complies with the transmission restriction policy based on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.

[0008] A non-transitory computer-readable medium storing code for wireless communications is described. The code may include instructions executable by one or more processors to receive one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area and perform a procedure that complies with the transmission restriction policy based on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.

[0009] Some examples of the method, UEs, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for receiving one or more messages indicating an area type indicator for the restricted geographic area, the area type indicator indicating that the restricted geographic area may be a no fly zone, a no uplink transmission zone, or a no departure zone.

[0010] Some examples of the method, UEs, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for receiving the one or more messages indicating the geographic coordinates may be based on a capability of the UE.

[0011] In some examples of the method, UEs, and non-transitory computer-readable medium described herein, the one or more messages indicates: the geographic coordinates of the restricted geographic area and at least one frequency band associated with the restricted geographic area; or the geographic coordinates of the restricted geographic area, the at least one frequency band associated with the restricted geographic area and a time period during which the transmission restriction policy applies.

[0012] Some examples of the method, UEs, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for receiving a

control message that enables or disables the transmission restriction policy for the restricted geographic area.

[0013] In some examples of the method, UEs, and non-transitory computer-readable medium described herein, the transmission restriction policy indicates a restriction prohibiting transmission using at least a first frequency band within the restricted geographic area, permits transmission using a second frequency band within the restricted geographic area, or both.

[0014] In some examples of the method, UEs, and non-transitory computer-readable medium described herein, performing the procedure may include operations, features, means, or instructions for transmitting a first message in accordance with the transmission power limit.

[0015] In some examples of the method, UEs, and non-transitory computer-readable medium described herein, receiving the one or more messages may include operations, features, means, or instructions for receiving a radio resource control message (RRC), a system information block (SIB), a downlink control information (DCI) message, or a medium access control element (MAC-CE) message, based on the UE being disposed inside of a coverage area associated with a network entity.

[0016] In some examples of the method, UEs, and non-transitory computer-readable medium described herein, receiving the one or more messages may include operations, features, means, or instructions for receiving one or more application layer messages or one or more sidelink messages based on the UE being disposed outside of a coverage area associated with a network entity.

[0017] In some examples of the method, UEs, and non-transitory computer-readable medium described herein, receiving the one or more messages may include operations, features, means, or instructions for receiving a bit field including a barring bit indicating whether establishing connectivity with a cell within the restricted geographic area may be barred.

[0018] In some examples of the method, UEs, and non-transitory computer-readable medium described herein, receiving the one or more messages may include operations, features, means, or instructions for receiving a network signaling field including a value indicating that establishing connectivity with a cell may be permitted when the UE may be located outside of the restricted geographic area and that establishing connectivity with the cell may be not permitted when the UE may be located within the restricted geographic area.

[0019] In some examples of the method, UEs, and non-transitory computer-readable medium described herein, the network signaling field includes a first network signaling value indicating an area type, a second network signaling value indicating the geographic coordinates, or both, or the geographic coordinates are associated with an altitude for the restricted geographic area.

[0020] In some examples of the method, UEs, and non-transitory computer-readable medium described herein, receiving the one or more messages may include operations, features, means, or instructions for receiving signaling indicating that transmission may be barred in the restricted geographic area or indicating permission to transmit in accordance with the transmission restriction policy in the restricted geographic area.

[0021] A method for wireless communications by a network entity is described. The method may include generating one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area and outputting the one or more messages to a UE.

[0022] A network entity for wireless communications is described. The network entity may include one or more memories storing processor executable code, and one or more processors coupled with the one or more memories. The one or more processors may individually or collectively be operable to execute the code to cause the network entity to generate one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the

restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area and output the one or more messages to a UE.
[0023] Another network entity for wireless communications is described. The network entity may include means for generating one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area and means for outputting the one or more messages to a UE.
[0024] A non-transitory computer-readable medium storing code for wireless communications is described. The code may include instructions executable by one or more processors to generate one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area and output the one or more messages to a UE.
[0025] Some examples of the method, network entities, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for outputting, during a handover procedure, an indication of the area type indicator and the transmission restriction policy associated with the restricted geographic area, to a handover candidate network entity.
[0026] Some examples of the method, network entities, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for obtaining an indication an area type capability associated with the handover candidate network entity, where transmitting the indication of the area type indicator and the transmission restriction policy may be based on the area type capability associated with the handover candidate network entity.
[0027] Some examples of the method, network entities, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for obtaining, during the handover procedure, an indication of handover failure based on the area type capability being incompatible with the transmission restriction policy associated with the area type.
[0028] Some examples of the method, network entities, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for outputting the one or more messages indicating the geographic coordinates may be based on a capability of the UE.
[0029] In some examples of the method, network entities, and non-transitory computer-readable medium described herein, the one or more messages indicates: the geographic coordinates of the restricted geographic area and at least one frequency band associated with the restricted geographic area; or the geographic coordinates of the restricted geographic area, the at least one frequency band associated with the restricted geographic area and a time period during which the transmission restriction policy applies.
[0030] Some examples of the method, network entities, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for outputting a control message that enables or disables the transmission restriction policy for the restricted geographic area.
[0031] In some examples of the method, network entities, and non-transitory computer-readable medium described herein, the transmission restriction policy indicates a restriction prohibiting transmission using at least a first frequency band within the restricted geographic area, permits transmission using a second frequency band within the restricted geographic area, or both.
[0032] In some examples of the method, network entities, and non-transitory computer-readable medium described herein, the transmission restriction policy indicates a transmission power limit

for transmissions within the restricted geographic area.
[0033] In some examples of the method, network entities, and non-transitory computer-readable medium described herein, outputting the one or more messages may include operations, features, means, or instructions for outputting a RRC message, a SIB, a DCI message, or a MAC-CE message, based on the UE being disposed inside of a coverage area associated with a network entity.
[0034] In some examples of the method, network entities, and non-transitory computer-readable medium described herein, outputting the one or more messages may include operations, features, means, or instructions for outputting one or more application layer messages or one or more sidelink messages based on the UE being disposed outside of a coverage area associated with a network entity.
[0035] In some examples of the method, network entities, and non-transitory computer-readable medium described herein, outputting the one or more messages may include operations, features, means, or instructions for outputting a bit field including a barring bit indicating whether establishing connectivity with a cell within the restricted geographic area may be barred.
[0036] In some examples of the method, network entities, and non-transitory computer-readable medium described herein, outputting the one or more messages may include operations, features, means, or instructions for outputting a network signaling field including a value indicating that establishing connectivity with a cell may be permitted when the UE may be located outside of the restricted geographic area and that establishing connectivity with the cell may be not permitted when the UE may be located within the restricted geographic area.
[0037] In some examples of the method, network entities, and non-transitory computer-readable medium described herein, the network signaling field includes a first network signaling value indicating an area type or a second network signaling value indicating the geographic coordinates or the geographic coordinates are associated with an altitude for the restricted geographic area.
[0038] Some examples of the method, network entities, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for outputting one or more messages indicating an area type indicator for the restricted geographic area, the area type indicator indicating that the restricted geographic area may be a no fly zone, a no uplink transmission zone, or a no departure zone.
[0039] Some examples of the method, network entities, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for outputting signaling indicating that transmission may be barred in the restricted geographic area or indicating permission to transmit in accordance with the transmission restriction policy in the restricted geographic area.

---

## Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0040] FIG. **1** shows an example of a wireless communications system that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure.
[0041] FIG. **2** shows an example of a wireless communications system that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure.
[0042] FIG. **3** shows an example of a process flow that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure.
[0043] FIGS. **4** and **5** show block diagrams of devices that support coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure.

[0044] FIG. **6** shows a block diagram of a communications manager that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure.
[0045] FIG. **7** shows a diagram of a system including a device that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure.
[0046] FIGS. **8** and **9** show block diagrams of devices that support coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure.
[0047] FIG. **10** shows a block diagram of a communications manager that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure.
[0048] FIG. **11** shows a diagram of a system including a device that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure.
[0049] FIGS. **12** through **15** show flowcharts illustrating methods that support coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure.

## DETAILED DESCRIPTION

[0050] Some geographical areas may be deemed as “no-transmit zones,” where aerial user equipment (UE) are not allowed to operate in a certain frequency band. For example, an area with a highly sensitive radiotelescope which scans using radio waves may be deemed a no-transmit zone for aerial UEs, as transmissions from the aerial UEs may cause interference to the radiotelescope. In some examples, restrictions for no-transmit zones for aerial UEs may be extensive, such as not allowing any transmission in specific radio frequency spectrum bands while an aerial UE is in a no-transmit zone. However, in some examples, some of the UEs in the no-transmit zones may otherwise be permitted to transmit within certain coordinates, or within certain transmission power limit, based on one or more conditions (e.g., during a time period), or based on belonging to a certain release version. Current techniques do not support signaling to facilitate such transmission restriction exceptions.
[0051] The UE may receive signaling that indicates geographic coordinates forming boundaries of a polygon (e.g., to form a two-dimension (2D) or three-dimension (3D) polygon area) of a restricted area and a type of the restricted area (e.g., no-transmit zone, no-fly zone, or no-departure zone). The signaling may further indicate a transmission restriction policy associated with the restricted area (e.g., indicating permission to transmit over a frequency band while indicating prohibition to transmit over a different frequency band, as well as time periods during which the UE may transmit). The UE may receive signaling based on a release version associated with the UE (e.g., an early release version aerial UE receives signaling indicating a bar from transmitting in the restricted area while a newer version aerial UE receives signaling indicating permission and policy to transmit in the restricted area for the restricted area type).
[0052] Although the techniques described herein are discussed with respect to an aerial environment with an aerial UE, the techniques described herein may additionally or alternatively apply to non-aerial UEs positioned relative to or within a restricted geographic area. For example, the non-aerial UEs may be positioned relative to or within a ground level area (e.g., not in the air). In some cases, the zone may include a portion that is partially in air and a portion on the ground, such that the UE may be aerial or non-aerial. Aspects of the disclosure are initially described in the context of wireless communications systems. Aspects of the disclosure are further illustrated by and described with reference to apparatus diagrams, system diagrams, and flowcharts that relate to coordinate signaling for a restricted geographic area.
[0053] FIG. **1** shows an example of a wireless communications system **100** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The wireless communications system **100** may include one or more devices, such as one or more network devices (e.g., network entities **105**), one or more UEs **115**, and a core network **130**. In some examples, the wireless communications system **100** may be a Long Term Evolution

(LTE) network, an LTE-Advanced (LTE-A) network, an LTE-A Pro network, a New Radio (NR) network, or a network operating in accordance with other systems and radio technologies, including future systems and radio technologies not explicitly mentioned herein.

[0054] The network entities **105** may be dispersed throughout a geographic area to form the wireless communications system **100** and may include devices in different forms or having different capabilities. In various examples, a network entity **105** may be referred to as a network element, a mobility element, a radio access network (RAN) node, or network equipment, among other nomenclature. In some examples, network entities **105** and UEs **115** may wirelessly communicate via communication link(s) **125** (e.g., a radio frequency (RF) access link). For example, a network entity **105** may support a coverage area **110** (e.g., a geographic coverage area) over which the UEs **115** and the network entity **105** may establish the communication link(s) **125**. The coverage area **110** may be an example of a geographic area over which a network entity **105** and a UE **115** may support the communication of signals according to one or more radio access technologies (RATs).

[0055] The UEs **115** may be dispersed throughout a coverage area **110** of the wireless communications system **100**, and each UE **115** may be stationary, or mobile, or both at different times. The UEs **115** may be devices in different forms or having different capabilities. Some example UEs **115** are illustrated in FIG. **1**. The UEs **115** described herein may be capable of supporting communications with various types of devices in the wireless communications system **100** (e.g., other wireless communication devices, including UEs **115** or network entities **105**), as shown in FIG. **1**.

[0056] As described herein, a node of the wireless communications system **100**, which may be referred to as a network node, or a wireless node, may be a network entity **105** (e.g., any network entity described herein), a UE **115** (e.g., any UE described herein), a network controller, an apparatus, a device, a computing system, one or more components, or another suitable processing entity configured to perform any of the techniques described herein. For example, a node may be a UE **115**. As another example, a node may be a network entity **105**. As another example, a first node may be configured to communicate with a second node or a third node. In one aspect of this example, the first node may be a UE **115**, the second node may be a network entity **105**, and the third node may be a UE **115**. In another aspect of this example, the first node may be a UE **115**, the second node may be a network entity **105**, and the third node may be a network entity **105**. In yet other aspects of this example, the first, second, and third nodes may be different relative to these examples. Similarly, reference to a UE **115**, network entity **105**, apparatus, device, computing system, or the like may include disclosure of the UE **115**, network entity **105**, apparatus, device, computing system, or the like being a node. For example, disclosure that a UE **115** is configured to receive information from a network entity **105** also discloses that a first node is configured to receive information from a second node.

[0057] In some examples, network entities **105** may communicate with a core network **130**, or with one another, or both. For example, network entities **105** may communicate with the core network **130** via backhaul communication link(s) **120** (e.g., in accordance with an S1, N2, N3, or other interface protocol). In some examples, network entities **105** may communicate with one another via backhaul communication link(s) **120** (e.g., in accordance with an X2, Xn, or other interface protocol) either directly (e.g., directly between network entities **105**) or indirectly (e.g., via the core network **130**). In some examples, network entities **105** may communicate with one another via a midhaul communication link **162** (e.g., in accordance with a midhaul interface protocol) or a fronthaul communication link **168** (e.g., in accordance with a fronthaul interface protocol), or any combination thereof. The backhaul communication link(s) **120**, midhaul communication links **162**, or fronthaul communication links **168** may be or include one or more wired links (e.g., an electrical link, an optical fiber link) or one or more wireless links (e.g., a radio link, a wireless optical link), among other examples or various combinations thereof. A UE **115** may communicate with the core

network **130** via a communication link **155**.
[0058] One or more of the network entities **105** or network equipment described herein may include or may be referred to as a base station **140** (e.g., a base transceiver station, a radio base station, an NR base station, an access point, a radio transceiver, a NodeB, an eNodeB (eNB), a next-generation NodeB or giga-NodeB (either of which may be referred to as a gNB), a 5G NB, a next-generation eNB (ng-eNB), a Home NodeB, a Home eNodeB, or other suitable terminology). In some examples, a network entity **105** (e.g., a base station **140**) may be implemented in an aggregated (e.g., monolithic, standalone) base station architecture, which may be configured to utilize a protocol stack that is physically or logically integrated within one network entity (e.g., a network entity **105** or a single RAN node, such as a base station **140**).
[0059] In some examples, a network entity **105** may be implemented in a disaggregated architecture (e.g., a disaggregated base station architecture, a disaggregated RAN architecture), which may be configured to utilize a protocol stack that is physically or logically distributed among multiple network entities (e.g., network entities **105**), such as an integrated access and backhaul (IAB) network, an open RAN (O-RAN) (e.g., a network configuration sponsored by the O-RAN Alliance), or a virtualized RAN (vRAN) (e.g., a cloud RAN (C-RAN)). For example, a network entity **105** may include one or more of a central unit (CU), such as a CU **160**, a distributed unit (DU), such as a DU **165**, a radio unit (RU), such as an RU **170**, a RAN Intelligent Controller (RIC), such as an RIC **175** (e.g., a Near-Real Time RIC (Near-RT RIC), a Non-Real Time RIC (Non-RT RIC)), a Service Management and Orchestration (SMO) system, such as an SMO system **180**, or any combination thereof. An RU **170** may also be referred to as a radio head, a smart radio head, a remote radio head (RRH), a remote radio unit (RRU), or a transmission reception point (TRP). One or more components of the network entities **105** in a disaggregated RAN architecture may be co-located, or one or more components of the network entities **105** may be located in distributed locations (e.g., separate physical locations). In some examples, one or more of the network entities **105** of a disaggregated RAN architecture may be implemented as virtual units (e.g., a virtual CU (VCU), a virtual DU (VDU), a virtual RU (VRU)).
[0060] The split of functionality between a CU **160**, a DU **165**, and an RU **170** is flexible and may support different functionalities depending on which functions (e.g., network layer functions, protocol layer functions, baseband functions, RF functions, or any combinations thereof) are performed at a CU **160**, a DU **165**, or an RU **170**. For example, a functional split of a protocol stack may be employed between a CU **160** and a DU **165** such that the CU **160** may support one or more layers of the protocol stack and the DU **165** may support one or more different layers of the protocol stack. In some examples, the CU **160** may host upper protocol layer (e.g., layer 3 (L3), layer 2 (L2)) functionality and signaling (e.g., Radio Resource Control (RRC), service data adaption protocol (SDAP), Packet Data Convergence Protocol (PDCP)). The CU **160** (e.g., one or more CUs) may be connected to a DU **165** (e.g., one or more DUs) or an RU **170** (e.g., one or more RUs), or some combination thereof, and the DUs **165**, RUs **170**, or both may host lower protocol layers, such as layer 1 (L1) (e.g., physical (PHY) layer) or L2 (e.g., radio link control (RLC) layer, medium access control (MAC) layer) functionality and signaling, and may each be at least partially controlled by the CU **160**. Additionally, or alternatively, a functional split of the protocol stack may be employed between a DU **165** and an RU **170** such that the DU **165** may support one or more layers of the protocol stack and the RU **170** may support one or more different layers of the protocol stack. The DU **165** may support one or multiple different cells (e.g., via one or multiple different RUs, such as an RU **170**). In some cases, a functional split between a CU **160** and a DU **165** or between a DU **165** and an RU **170** may be within a protocol layer (e.g., some functions for a protocol layer may be performed by one of a CU **160**, a DU **165**, or an RU **170**, while other functions of the protocol layer are performed by a different one of the CU **160**, the DU **165**, or the RU **170**). A CU **160** may be functionally split further into CU control plane (CU-CP) and CU user plane (CU-UP) functions. A CU **160** may be connected to a DU **165** via a midhaul communication

link **162** (e.g., F1, F1-c, F1-u), and a DU **165** may be connected to an RU **170** via a fronthaul communication link **168** (e.g., open fronthaul (FH) interface). In some examples, a midhaul communication link **162** or a fronthaul communication link **168** may be implemented in accordance with an interface (e.g., a channel) between layers of a protocol stack supported by respective network entities (e.g., one or more of the network entities **105**) that are in communication via such communication links.

[0061] In some wireless communications systems (e.g., the wireless communications system **100**), infrastructure and spectral resources for radio access may support wireless backhaul link capabilities to supplement wired backhaul connections, providing an IAB network architecture (e.g., to a core network **130**). In some cases, in an IAB network, one or more of the network entities **105** (e.g., network entities **105** or IAB node(s) **104**) may be partially controlled by each other. The IAB node(s) **104** may be referred to as a donor entity or an IAB donor. A DU **165** or an RU **170** may be partially controlled by a CU **160** associated with a network entity **105** or base station **140** (such as a donor network entity or a donor base station). The one or more donor entities (e.g., IAB donors) may be in communication with one or more additional devices (e.g., IAB node(s) **104**) via supported access and backhaul links (e.g., backhaul communication link(s) **120**). IAB node(s) **104** may include an IAB mobile termination (IAB-MT) controlled (e.g., scheduled) by one or more DUs (e.g., DUs **165**) of a coupled IAB donor. An IAB-MT may be equipped with an independent set of antennas for relay of communications with UEs **115** or may share the same antennas (e.g., of an RU **170**) of IAB node(s) **104** used for access via the DU **165** of the IAB node(s) **104** (e.g., referred to as virtual IAB-MT (vIAB-MT)). In some examples, the IAB node(s) **104** may include one or more DUs (e.g., DUs **165**) that support communication links with additional entities (e.g., IAB node(s) **104**, UEs **115**) within the relay chain or configuration of the access network (e.g., downstream). In such cases, one or more components of the disaggregated RAN architecture (e.g., the IAB node(s) **104** or components of the IAB node(s) **104**) may be configured to operate according to the techniques described herein.

[0062] For instance, an access network (AN) or RAN may include communications between access nodes (e.g., an IAB donor), IAB node(s) **104**, and one or more UEs **115**. The IAB donor may facilitate connection between the core network **130** and the AN (e.g., via a wired or wireless connection to the core network **130**). That is, an IAB donor may refer to a RAN node with a wired or wireless connection to the core network **130**. The IAB donor may include one or more of a CU **160**, a DU **165**, and an RU **170**, in which case the CU **160** may communicate with the core network **130** via an interface (e.g., a backhaul link). The IAB donor and IAB node(s) **104** may communicate via an F1 interface according to a protocol that defines signaling messages (e.g., an F1 AP protocol). Additionally, or alternatively, the CU **160** may communicate with the core network **130** via an interface, which may be an example of a portion of a backhaul link, and may communicate with other CUs (e.g., including a CU **160** associated with an alternative IAB donor) via an Xn-C interface, which may be an example of another portion of a backhaul link.

[0063] IAB node(s) **104** may refer to RAN nodes that provide IAB functionality (e.g., access for UEs **115**, wireless self-backhauling capabilities). A DU **165** may act as a distributed scheduling node towards child nodes associated with the IAB node(s) **104**, and the IAB-MT may act as a scheduled node towards parent nodes associated with IAB node(s) **104**. That is, an IAB donor may be referred to as a parent node in communication with one or more child nodes (e.g., an IAB donor may relay transmissions for UEs through other IAB node(s) **104**). Additionally, or alternatively, IAB node(s) **104** may also be referred to as parent nodes or child nodes to other IAB node(s) **104**, depending on the relay chain or configuration of the AN. The IAB-MT entity of IAB node(s) **104** may provide a Uu interface for a child IAB node (e.g., the IAB node(s) **104**) to receive signaling from a parent IAB node (e.g., the IAB node(s) **104**), and a DU interface (e.g., a DU **165**) may provide a Uu interface for a parent IAB node to signal to a child IAB node or UE **115**.

[0064] For example, IAB node(s) **104** may be referred to as parent nodes that support

communications for child IAB nodes, or may be referred to as child IAB nodes associated with IAB donors, or both. An IAB donor may include a CU **160** with a wired or wireless connection (e.g., backhaul communication link(s) **120**) to the core network **130** and may act as a parent node to IAB node(s) **104**. For example, the DU **165** of an IAB donor may relay transmissions to UEs **115** through IAB node(s) **104**, or may directly signal transmissions to a UE **115**, or both. The CU **160** of the IAB donor may signal communication link establishment via an F1 interface to IAB node(s) **104**, and the IAB node(s) **104** may schedule transmissions (e.g., transmissions to the UEs **115** relayed from the IAB donor) through one or more DUs (e.g., DUs **165**). That is, data may be relayed to and from IAB node(s) **104** via signaling via an NR Uu interface to MT of IAB node(s) **104** (e.g., other IAB node(s)). Communications with IAB node(s) **104** may be scheduled by a DU **165** of the IAB donor or of IAB node(s) **104**.

[0065] In the case of the techniques described herein applied in the context of a disaggregated RAN architecture, one or more components of the disaggregated RAN architecture may be configured to support test as described herein. For example, some operations described as being performed by a UE **115** or a network entity **105** (e.g., a base station **140**) may additionally, or alternatively, be performed by one or more components of the disaggregated RAN architecture (e.g., components such as an IAB node, a DU **165**, a CU **160**, an RU **170**, an RIC **175**, an SMO system **180**).

[0066] A UE **115** may include or may be referred to as a mobile device, a wireless device, a remote device, a handheld device, or a subscriber device, or some other suitable terminology, where the "device" may also be referred to as a unit, a station, a terminal, or a client, among other examples. A UE **115** may also include or may be referred to as a personal electronic device such as a cellular phone, a personal digital assistant (PDA), a tablet computer, a laptop computer, or a personal computer. In some examples, a UE **115** may include or be referred to as a wireless local loop (WLL) station, an Internet of Things (IoT) device, an Internet of Everything (IoE) device, or a machine type communications (MTC) device, among other examples, which may be implemented in various objects such as appliances, vehicles, or meters, among other examples.

[0067] The UEs **115** described herein may be able to communicate with various types of devices, such as UEs **115** that may sometimes operate as relays, as well as the network entities **105** and the network equipment including macro eNBs or gNBs, small cell eNBs or gNBs, or relay base stations, among other examples, as shown in FIG. **1**.

[0068] The UEs **115** and the network entities **105** may wirelessly communicate with one another via the communication link(s) **125** (e.g., one or more access links) using resources associated with one or more carriers. The term "carrier" may refer to a set of RF spectrum resources having a defined PHY layer structure for supporting the communication link(s) **125**. For example, a carrier used for the communication link(s) **125** may include a portion of an RF spectrum band (e.g., a bandwidth part (BWP)) that is operated according to one or more PHY layer channels for a given RAT (e.g., LTE, LTE-A, LTE-A Pro, NR). Each PHY layer channel may carry acquisition signaling (e.g., synchronization signals, system information), control signaling that coordinates operation for the carrier, user data, or other signaling. The wireless communications system **100** may support communication with a UE **115** using carrier aggregation or multi-carrier operation. A UE **115** may be configured with multiple downlink component carriers and one or more uplink component carriers according to a carrier aggregation configuration. Carrier aggregation may be used with both frequency division duplexing (FDD) and time division duplexing (TDD) component carriers. Communication between a network entity **105** and other devices may refer to communication between the devices and any portion (e.g., entity, sub-entity) of a network entity **105**. For example, the terms "transmitting," "receiving," or "communicating," when referring to a network entity **105**, may refer to any portion of a network entity **105** (e.g., a base station **140**, a CU **160**, a DU **165**, a RU **170**) of a RAN communicating with another device (e.g., directly or via one or more other network entities, such as one or more of the network entities **105**).

[0069] In some examples, such as in a carrier aggregation configuration, a carrier may have

acquisition signaling or control signaling that coordinates operations for other carriers. A carrier may be associated with a frequency channel (e.g., an evolved universal mobile telecommunication system terrestrial radio access (E-UTRA) absolute RF channel number (EARFCN)) and may be identified according to a channel raster for discovery by the UEs **115**. A carrier may be operated in a standalone mode, in which case initial acquisition and connection may be conducted by the UEs **115** via the carrier, or the carrier may be operated in a non-standalone mode, in which case a connection is anchored using a different carrier (e.g., of the same or a different RAT).

[0070] The communication link(s) **125** of the wireless communications system **100** may include downlink transmissions (e.g., forward link transmissions) from a network entity **105** to a UE **115**, uplink transmissions (e.g., return link transmissions) from a UE **115** to a network entity **105**, or both, among other configurations of transmissions. Carriers may carry downlink or uplink communications (e.g., in an FDD mode) or may be configured to carry downlink and uplink communications (e.g., in a TDD mode).

[0071] A carrier may be associated with a particular bandwidth of the RF spectrum and, in some examples, the carrier bandwidth may be referred to as a "system bandwidth" of the carrier or the wireless communications system **100**. For example, the carrier bandwidth may be one of a set of bandwidths for carriers of a particular RAT (e.g., 1.4, 3, 5, 10, 15, 20, 40, or 80 megahertz (MHz)). Devices of the wireless communications system **100** (e.g., the network entities **105**, the UEs **115**, or both) may have hardware configurations that support communications using a particular carrier bandwidth or may be configurable to support communications using one of a set of carrier bandwidths. In some examples, the wireless communications system **100** may include network entities **105** or UEs **115** that support concurrent communications using carriers associated with multiple carrier bandwidths. In some examples, each served UE **115** may be configured for operating using portions (e.g., a sub-band, a BWP) or all of a carrier bandwidth.

[0072] Signal waveforms transmitted via a carrier may be made up of multiple subcarriers (e.g., using multi-carrier modulation (MCM) techniques such as orthogonal frequency division multiplexing (OFDM) or discrete Fourier transform spread OFDM (DFT-S-OFDM)). In a system employing MCM techniques, a resource element may refer to resources of one symbol period (e.g., a duration of one modulation symbol) and one subcarrier, in which case the symbol period and subcarrier spacing may be inversely related. The quantity of bits carried by each resource element may depend on the modulation scheme (e.g., the order of the modulation scheme, the coding rate of the modulation scheme, or both), such that a relatively higher quantity of resource elements (e.g., in a transmission duration) and a relatively higher order of a modulation scheme may correspond to a relatively higher rate of communication. A wireless communications resource may refer to a combination of an RF spectrum resource, a time resource, and a spatial resource (e.g., a spatial layer, a beam), and the use of multiple spatial resources may increase the data rate or data integrity for communications with a UE **115**.

[0073] One or more numerologies for a carrier may be supported, and a numerology may include a subcarrier spacing (Δf) and a cyclic prefix. A carrier may be divided into one or more BWPs having the same or different numerologies. In some examples, a UE **115** may be configured with multiple BWPs. In some examples, a single BWP for a carrier may be active at a given time and communications for the UE **115** may be restricted to one or more active BWPs.

[0074] The time intervals for the network entities **105** or the UEs **115** may be expressed in multiples of a basic time unit which may, for example, refer to a sampling period of T.sub.s=1/(Δf.sub.max.Math.N.sub.f) seconds, for which Δf.sub.max may represent a supported subcarrier spacing, and N.sub.f may represent a supported discrete Fourier transform (DFT) size. Time intervals of a communications resource may be organized according to radio frames each having a specified duration (e.g., 10 milliseconds (ms)). Each radio frame may be identified by a system frame number (SFN) (e.g., ranging from 0 to 1023).

[0075] Each frame may include multiple consecutively-numbered subframes or slots, and each

subframe or slot may have the same duration. In some examples, a frame may be divided (e.g., in the time domain) into subframes, and each subframe may be further divided into a quantity of slots. Alternatively, each frame may include a variable quantity of slots, and the quantity of slots may depend on subcarrier spacing. Each slot may include a quantity of symbol periods (e.g., depending on the length of the cyclic prefix prepended to each symbol period). In some wireless communications systems, such as the wireless communications system **100**, a slot may further be divided into multiple mini-slots associated with one or more symbols. Excluding the cyclic prefix, each symbol period may be associated with one or more (e.g., N.sub.f) sampling periods. The duration of a symbol period may depend on the subcarrier spacing or frequency band of operation.

[0076] A subframe, a slot, a mini-slot, or a symbol may be the smallest scheduling unit (e.g., in the time domain) of the wireless communications system **100** and may be referred to as a transmission time interval (TTI). In some examples, the TTI duration (e.g., a quantity of symbol periods in a TTI) may be variable. Additionally, or alternatively, the smallest scheduling unit of the wireless communications system **100** may be dynamically selected (e.g., in bursts of shortened TTIs (sTTIs)).

[0077] Physical channels may be multiplexed for communication using a carrier according to various techniques. A physical control channel and a physical data channel may be multiplexed for signaling via a downlink carrier, for example, using one or more of time division multiplexing (TDM) techniques, frequency division multiplexing (FDM) techniques, or hybrid TDM-FDM techniques. A control region (e.g., a control resource set (CORESET)) for a physical control channel may be defined by a set of symbol periods and may extend across the system bandwidth or a subset of the system bandwidth of the carrier. One or more control regions (e.g., CORESETs) may be configured for a set of the UEs **115**. For example, one or more of the UEs **115** may monitor or search control regions for control information according to one or more search space sets, and each search space set may include one or multiple control channel candidates in one or more aggregation levels arranged in a cascaded manner. An aggregation level for a control channel candidate may refer to an amount of control channel resources (e.g., control channel elements (CCEs)) associated with encoded information for a control information format having a given payload size. Search space sets may include common search space sets configured for sending control information to UEs **115** (e.g., one or more UEs) or may include UE-specific search space sets for sending control information to a UE **115** (e.g., a specific UE).

[0078] A network entity **105** may provide communication coverage via one or more cells, for example a macro cell, a small cell, a hot spot, or other types of cells, or any combination thereof. The term “cell” may refer to a logical communication entity used for communication with a network entity **105** (e.g., using a carrier) and may be associated with an identifier for distinguishing neighboring cells (e.g., a physical cell identifier (PCID), a virtual cell identifier (VCID)). In some examples, a cell also may refer to a coverage area **110** or a portion of a coverage area **110** (e.g., a sector) over which the logical communication entity operates. Such cells may range from smaller areas (e.g., a structure, a subset of structure) to larger areas depending on various factors such as the capabilities of the network entity **105**. For example, a cell may be or include a building, a subset of a building, or exterior spaces between or overlapping with coverage areas **110**, among other examples.

[0079] A macro cell generally covers a relatively large geographic area (e.g., several kilometers in radius) and may allow unrestricted access by the UEs **115** with service subscriptions with the network provider supporting the macro cell. A small cell may be associated with a network entity **105** operating with lower power (e.g., a base station **140** operating with lower power) relative to a macro cell, and a small cell may operate using the same or different (e.g., licensed, unlicensed) frequency bands as macro cells. Small cells may provide unrestricted access to the UEs **115** with service subscriptions with the network provider or may provide restricted access to the UEs **115** having an association with the small cell (e.g., the UEs **115** in a closed subscriber group (CSG), the

UEs **115** associated with users in a home or office). A network entity **105** may support one or more cells and may also support communications via the one or more cells using one or multiple component carriers.

[0080] In some examples, a carrier may support multiple cells, and different cells may be configured according to different protocol types (e.g., MTC, narrowband IoT (NB-IoT), enhanced mobile broadband (eMBB)) that may provide access for different types of devices.

[0081] In some examples, a network entity **105** (e.g., a base station **140**, an RU **170**) may be movable and therefore provide communication coverage for a moving coverage area, such as the coverage area **110**. In some examples, coverage areas **110** (e.g., different coverage areas) associated with different technologies may overlap, but the coverage areas **110** (e.g., different coverage areas) may be supported by the same network entity (e.g., a network entity **105**). In some other examples, overlapping coverage areas, such as a coverage area **110**, associated with different technologies may be supported by different network entities (e.g., the network entities **105**). The wireless communications system **100** may include, for example, a heterogeneous network in which different types of the network entities **105** support communications for coverage areas **110** (e.g., different coverage areas) using the same or different RATs.

[0082] The wireless communications system **100** may support synchronous or asynchronous operation. For synchronous operation, network entities **105** (e.g., base stations **140**) may have similar frame timings, and transmissions from different network entities (e.g., different ones of the network entities **105**) may be approximately aligned in time. For asynchronous operation, network entities **105** may have different frame timings, and transmissions from different network entities (e.g., different ones of network entities **105**) may, in some examples, not be aligned in time. The techniques described herein may be used for either synchronous or asynchronous operations.

[0083] Some UEs **115**, such as MTC or IoT devices, may be relatively low cost or low complexity devices and may provide for automated communication between machines (e.g., via Machine-to-Machine (M2M) communication). M2M communication or MTC may refer to data communication technologies that allow devices to communicate with one another or a network entity **105** (e.g., a base station **140**) without human intervention. In some examples, M2M communication or MTC may include communications from devices that integrate sensors or meters to measure or capture information and relay such information to a central server or application program that uses the information or presents the information to humans interacting with the application program. Some UEs **115** may be designed to collect information or enable automated behavior of machines or other devices. Examples of applications for MTC devices include smart metering, inventory monitoring, water level monitoring, equipment monitoring, healthcare monitoring, wildlife monitoring, weather and geological event monitoring, fleet management and tracking, remote security sensing, physical access control, and transaction-based business charging.

[0084] Some UEs **115** may be configured to employ operating modes that reduce power consumption, such as half-duplex communications (e.g., a mode that supports one-way communication via transmission or reception, but not transmission and reception concurrently). In some examples, half-duplex communications may be performed at a reduced peak rate. Other power conservation techniques for the UEs **115** may include entering a power saving deep sleep mode when not engaging in active communications, operating using a limited bandwidth (e.g., according to narrowband communications), or a combination of these techniques. For example, some UEs **115** may be configured for operation using a narrowband protocol type that is associated with a defined portion or range (e.g., set of subcarriers or resource blocks (RBs)) within a carrier, within a guard-band of a carrier, or outside of a carrier.

[0085] The wireless communications system **100** may be configured to support ultra-reliable communications or low-latency communications, or various combinations thereof. For example, the wireless communications system **100** may be configured to support ultra-reliable low-latency communications (URLLC). The UEs **115** may be designed to support ultra-reliable, low-latency, or

critical functions. Ultra-reliable communications may include private communication or group communication and may be supported by one or more services such as push-to-talk, video, or data. Support for ultra-reliable, low-latency functions may include prioritization of services, and such services may be used for public safety or general commercial applications. The terms ultra-reliable, low-latency, and ultra-reliable low-latency may be used interchangeably herein.

[0086] In some examples, a UE **115** may be configured to support communicating directly with other UEs (e.g., one or more of the UEs **115**) via a device-to-device (D2D) communication link, such as a D2D communication link **135** (e.g., in accordance with a peer-to-peer (P2P), D2D, or sidelink protocol). In some examples, one or more UEs **115** of a group that are performing D2D communications may be within the coverage area **110** of a network entity **105** (e.g., a base station **140**, an RU **170**), which may support aspects of such D2D communications being configured by (e.g., scheduled by) the network entity **105**. In some examples, one or more UEs **115** of such a group may be outside the coverage area **110** of a network entity **105** or may be otherwise unable to or not configured to receive transmissions from a network entity **105**. In some examples, groups of the UEs **115** communicating via D2D communications may support a one-to-many (1:M) system in which each UE **115** transmits to one or more of the UEs **115** in the group. In some examples, a network entity **105** may facilitate the scheduling of resources for D2D communications. In some other examples, D2D communications may be carried out between the UEs **115** without an involvement of a network entity **105**.

[0087] In some systems, a D2D communication link **135** may be an example of a communication channel, such as a sidelink communication channel, between vehicles (e.g., UEs **115**). In some examples, vehicles may communicate using vehicle-to-everything (V2X) communications, vehicle-to-vehicle (V2V) communications, or some combination of these. A vehicle may signal information related to traffic conditions, signal scheduling, weather, safety, emergencies, or any other information relevant to a V2X system. In some examples, vehicles in a V2X system may communicate with roadside infrastructure, such as roadside units, or with the network via one or more network nodes (e.g., network entities **105**, base stations **140**, RUs **170**) using vehicle-to-network (V2N) communications, or with both.

[0088] The core network **130** may provide user authentication, access authorization, tracking, Internet Protocol (IP) connectivity, and other access, routing, or mobility functions. The core network **130** may be an evolved packet core (EPC) or 5G core (5GC), which may include at least one control plane entity that manages access and mobility (e.g., a mobility management entity (MME), an access and mobility management function (AMF)) and at least one user plane entity that routes packets or interconnects to external networks (e.g., a serving gateway (S-GW), a Packet Data Network (PDN) gateway (P-GW), or a user plane function (UPF)). The control plane entity may manage non-access stratum (NAS) functions such as mobility, authentication, and bearer management for the UEs **115** served by the network entities **105** (e.g., base stations **140**) associated with the core network **130**. User IP packets may be transferred through the user plane entity, which may provide IP address allocation as well as other functions. The user plane entity may be connected to IP services **150** for one or more network operators. The IP services **150** may include access to the Internet, Intranet(s), an IP Multimedia Subsystem (IMS), or a Packet-Switched Streaming Service.

[0089] The wireless communications system **100** may operate using one or more frequency bands, which may be in the range of 300 megahertz (MHz) to 300 gigahertz (GHz). Generally, the region from 300 MHz to 3 GHz is known as the ultra-high frequency (UHF) region or decimeter band because the wavelengths range from approximately one decimeter to one meter in length. UHF waves may be blocked or redirected by buildings and environmental features, which may be referred to as clusters, but the waves may penetrate structures sufficiently for a macro cell to provide service to the UEs **115** located indoors. Communications using UHF waves may be associated with smaller antennas and shorter ranges (e.g., less than one hundred kilometers)

compared to communications using the smaller frequencies and longer waves of the high frequency (HF) or very high frequency (VHF) portion of the spectrum below 300 MHz.

[0090] The wireless communications system **100** may also operate using a super high frequency (SHF) region, which may be in the range of 3 GHz to 30 GHz, also known as the centimeter band, or using an extremely high frequency (EHF) region of the spectrum (e.g., from 30 GHz to 300 GHz), also known as the millimeter band. In some examples, the wireless communications system **100** may support millimeter wave (mmW) communications between the UEs **115** and the network entities **105** (e.g., base stations **140**, RUs **170**), and EHF antennas of the respective devices may be smaller and more closely spaced than UHF antennas. In some examples, such techniques may facilitate using antenna arrays within a device. The propagation of EHF transmissions, however, may be subject to even greater attenuation and shorter range than SHF or UHF transmissions. The techniques disclosed herein may be employed across transmissions that use one or more different frequency regions, and designated use of bands across these frequency regions may differ by country or regulating body.

[0091] The wireless communications system **100** may utilize both licensed and unlicensed RF spectrum bands. For example, the wireless communications system **100** may employ License Assisted Access (LAA), LTE-Unlicensed (LTE-U) RAT, or NR technology using an unlicensed band such as the 5 GHz industrial, scientific, and medical (ISM) band. While operating using unlicensed RF spectrum bands, devices such as the network entities **105** and the UEs **115** may employ carrier sensing for collision detection and avoidance. In some examples, operations using unlicensed bands may be based on a carrier aggregation configuration in conjunction with component carriers operating using a licensed band (e.g., LAA). Operations using unlicensed spectrum may include downlink transmissions, uplink transmissions, P2P transmissions, or D2D transmissions, among other examples.

[0092] A network entity **105** (e.g., a base station **140**, an RU **170**) or a UE **115** may be equipped with multiple antennas, which may be used to employ techniques such as transmit diversity, receive diversity, multiple-input multiple-output (MIMO) communications, or beamforming. The antennas of a network entity **105** or a UE **115** may be located within one or more antenna arrays or antenna panels, which may support MIMO operations or transmit or receive beamforming. For example, one or more base station antennas or antenna arrays may be co-located at an antenna assembly, such as an antenna tower. In some examples, antennas or antenna arrays associated with a network entity **105** may be located at diverse geographic locations. A network entity **105** may include an antenna array with a set of rows and columns of antenna ports that the network entity **105** may use to support beamforming of communications with a UE **115**. Likewise, a UE **115** may include one or more antenna arrays that may support various MIMO or beamforming operations. Additionally, or alternatively, an antenna panel may support RF beamforming for a signal transmitted via an antenna port.

[0093] The network entities **105** or the UEs **115** may use MIMO communications to exploit multipath signal propagation and increase spectral efficiency by transmitting or receiving multiple signals via different spatial layers. Such techniques may be referred to as spatial multiplexing. The multiple signals may, for example, be transmitted by the transmitting device via different antennas or different combinations of antennas. Likewise, the multiple signals may be received by the receiving device via different antennas or different combinations of antennas. Each of the multiple signals may be referred to as a separate spatial stream and may carry information associated with the same data stream (e.g., the same codeword) or different data streams (e.g., different codewords). Different spatial layers may be associated with different antenna ports used for channel measurement and reporting. MIMO techniques include single-user MIMO (SU-MIMO), for which multiple spatial layers are transmitted to the same receiving device, and multiple-user MIMO (MU-MIMO), for which multiple spatial layers are transmitted to multiple devices.

[0094] Beamforming, which may also be referred to as spatial filtering, directional transmission, or

directional reception, is a signal processing technique that may be used at a transmitting device or a receiving device (e.g., a network entity **105**, a UE **115**) to shape or steer an antenna beam (e.g., a transmit beam, a receive beam) along a spatial path between the transmitting device and the receiving device. Beamforming may be achieved by combining the signals communicated via antenna elements of an antenna array such that some signals propagating along particular orientations with respect to an antenna array experience constructive interference while others experience destructive interference. The adjustment of signals communicated via the antenna elements may include a transmitting device or a receiving device applying amplitude offsets, phase offsets, or both to signals carried via the antenna elements associated with the device. The adjustments associated with each of the antenna elements may be defined by a beamforming weight set associated with a particular orientation (e.g., with respect to the antenna array of the transmitting device or receiving device, or with respect to some other orientation).

[0095] A network entity **105** or a UE **115** may use beam sweeping techniques as part of beamforming operations. For example, a network entity **105** (e.g., a base station **140**, an RU **170**) may use multiple antennas or antenna arrays (e.g., antenna panels) to conduct beamforming operations for directional communications with a UE **115**. Some signals (e.g., synchronization signals, reference signals, beam selection signals, or other control signals) may be transmitted by a network entity **105** multiple times along different directions. For example, the network entity **105** may transmit a signal according to different beamforming weight sets associated with different directions of transmission. Transmissions along different beam directions may be used to identify (e.g., by a transmitting device, such as a network entity **105**, or by a receiving device, such as a UE **115**) a beam direction for later transmission or reception by the network entity **105**.

[0096] Some signals, such as data signals associated with a particular receiving device, may be transmitted by a transmitting device (e.g., a network entity **105** or a UE **115**) along a single beam direction (e.g., a direction associated with the receiving device, such as another network entity **105** or UE **115**). In some examples, the beam direction associated with transmissions along a single beam direction may be determined based on a signal that was transmitted along one or more beam directions. For example, a UE **115** may receive one or more of the signals transmitted by the network entity **105** along different directions and may report to the network entity **105** an indication of the signal that the UE **115** received with a highest signal quality or an otherwise acceptable signal quality.

[0097] In some examples, transmissions by a device (e.g., by a network entity **105** or a UE **115**) may be performed using multiple beam directions, and the device may use a combination of digital precoding or beamforming to generate a combined beam for transmission (e.g., from a network entity **105** to a UE **115**). The UE **115** may report feedback that indicates precoding weights for one or more beam directions, and the feedback may correspond to a configured set of beams across a system bandwidth or one or more sub-bands. The network entity **105** may transmit a reference signal (e.g., a cell-specific reference signal (CRS), a channel state information reference signal (CSI-RS)), which may be precoded or unprecoded. The UE **115** may provide feedback for beam selection, which may be a precoding matrix indicator (PMI) or codebook-based feedback (e.g., a multi-panel type codebook, a linear combination type codebook, a port selection type codebook). Although these techniques are described with reference to signals transmitted along one or more directions by a network entity **105** (e.g., a base station **140**, an RU **170**), a UE **115** may employ similar techniques for transmitting signals multiple times along different directions (e.g., for identifying a beam direction for subsequent transmission or reception by the UE **115**) or for transmitting a signal along a single direction (e.g., for transmitting data to a receiving device).

[0098] A receiving device (e.g., a UE **115**) may perform reception operations in accordance with multiple receive configurations (e.g., directional listening) when receiving various signals from a transmitting device (e.g., a network entity **105**), such as synchronization signals, reference signals, beam selection signals, or other control signals. For example, a receiving device may perform

reception in accordance with multiple receive directions by receiving via different antenna subarrays, by processing received signals according to different antenna subarrays, by receiving according to different receive beamforming weight sets (e.g., different directional listening weight sets) applied to signals received at multiple antenna elements of an antenna array, or by processing received signals according to different receive beamforming weight sets applied to signals received at multiple antenna elements of an antenna array, any of which may be referred to as "listening" according to different receive configurations or receive directions. In some examples, a receiving device may use a single receive configuration to receive along a single beam direction (e.g., when receiving a data signal). The single receive configuration may be aligned along a beam direction determined based on listening according to different receive configuration directions (e.g., a beam direction determined to have a highest signal strength, highest signal-to-noise ratio (SNR), or otherwise acceptable signal quality based on listening according to multiple beam directions).

[0099] The wireless communications system **100** may be a packet-based network that operates according to a layered protocol stack. In the user plane, communications at the bearer or PDCP layer may be IP-based. An RLC layer may perform packet segmentation and reassembly to communicate via logical channels. A MAC layer may perform priority handling and multiplexing of logical channels into transport channels. The MAC layer also may implement error detection techniques, error correction techniques, or both to support retransmissions to improve link efficiency. In the control plane, an RRC layer may provide establishment, configuration, and maintenance of an RRC connection between a UE **115** and a network entity **105** or a core network **130** supporting radio bearers for user plane data. A PHY layer may map transport channels to physical channels.

[0100] The UEs **115** and the network entities **105** may support retransmissions of data to increase the likelihood that data is received successfully. Hybrid automatic repeat request (HARQ) feedback is one technique for increasing the likelihood that data is received correctly via a communication link (e.g., the communication link(s) **125**, a D2D communication link **135**). HARQ may include a combination of error detection (e.g., using a cyclic redundancy check (CRC)), forward error correction (FEC), and retransmission (e.g., automatic repeat request (ARQ)). HARQ may improve throughput at the MAC layer in relatively poor radio conditions (e.g., low signal-to-noise conditions). In some examples, a device may support same-slot HARQ feedback, in which case the device may provide HARQ feedback in a specific slot for data received via a previous symbol in the slot. In some other examples, the device may provide HARQ feedback in a subsequent slot, or according to some other time interval.

[0101] In some examples, some geographical areas may be deemed as "no-transmit zones," where a UE **115** (e.g., an aerial UE) are not allowed to operate in a certain frequency band. For example, an area with a highly sensitive radiotelescope which scans using radio waves may be deemed a no-transmit zone for UEs **115**, as transmissions from the UEs **115** may cause interference to the radiotelescope. In some examples, restrictions for no-transmit zones for UEs **115** may be extensive, such as not allowing any transmission in specific radio frequency spectrum bands while a UE **115** is in a no-transmit zone. However, in some examples, some of the UEs **115** in the no-transmit zones may otherwise be permitted to transmit within certain coordinates, based on one or more conditions (e.g., during a time period), or based on belonging to a certain release version. Current techniques do not support signaling to facilitate such transmission restriction exceptions for a UE **115**.

[0102] The UE **115** may receive signaling that indicates geographic coordinates forming boundaries of a polygon (e.g., to form a two-dimension (2D) or three-dimension (3D) polygon area) of a restricted area and a type of the restricted area (e.g., no-transmit zone, no-fly zone, or no-departure zone). The signaling may further indicate a transmission restriction policy associated with the restricted area (e.g., indicating permission to transmit over a frequency band while indicating prohibition to transmit over a different frequency band, as well as time periods during which the UE **115** may transmit). The UE **115** may receive signaling based on a release version

associated with the UE **115** (e.g., an early release version UE **115** receives signaling indicating a bar from transmitting in the restricted area while a newer version UE **115** receives signaling indicating permission and policy to transmit in the restricted area for the restricted area type).

[0103] FIG. **2** shows an example of a wireless communications system **200** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The wireless communications system **200** may include a UE **115**-*a* and a network entity **105**-*a*. The UE **115** a may be an example of a UE **115** described herein, such as an aerial UE **115**. The network entity **105**-*a* may be an example of a network node or a network entity **105** described herein.

[0104] In some examples, the UE **115**-*a* (e.g., an aerial UE or a drone) may be a no-transmit zone (NTZ) or no-fly zones (NFZ) that limit the transmissions from drones, for example, in order not to cause too much interference at a nearby base station. In such zones, a mechanism, such as the techniques discussed herein, may be used to ensure that the UE **115**-*a* complies with the no-transmit zones. For example, the techniques discussed herein may including, for NTZ, defining transmission policies according to regional or national protocols, mapping to one or more cells, a fraction of a cell, overlapping different cells in a mobile operator network, and/or coordinating mapping of the cells with RAN working groups (WGs). The techniques discussed herein may facilitate in ensuring that a UE **115**-*a* complies with no-transmit zones. For example, compliance may include determining whether a mobile network cell overlaps completely or partially with the NTZ and uses the restricted frequency bands of the NTZ, whether policies may be used to differentiate UEs **115** that support functions defined for NTZs (e.g., latest version of UEs **115**) and aerial UEs that do not support functions defined for NTZs (e.g., older versions of UEs **115**), or whether certain UE **115** behavior occurs when the UE **115**-*a* approaches, enters, or exits the NTZ. Determining compliance may further include determining whether and how to enable configuration of NTZ information in the UE **115**-*a*, whether to allow the enforcement of no-transmit zones for both UEs **115** in connected mode and UEs **115** in idle mode and/or how to allow enforcement, and how the UE **115** may interact with other regulatory services.

[0105] In some examples, the techniques discussed herein may include defining signaling for zones, coexistence between current and previous versions of UEs **115** (e.g., previous UE **115** versions may not support the NTZ signaling), and applying techniques to a “restricted geographic area” (e.g., a “special area”) instead of limiting to NTZ. The techniques applied for coexistence between current and previous versions of UEs **115** may facilitate compliance for backward compatibility, for example, for idle or connected modes or for handling special area information during a handover procedure.

[0106] The techniques discussed herein may apply to a “restricted geographic area.” The term “restricted geographic area” may refer to any area or space (e.g., two-dimension or three-dimension) associated with a communication restriction for the UE **115**. That is, the restricted geographic area may not be limited to NTZ. Instead, the restricted geographic area may include the NTZ, as well as the NFZ, or other areas defined by geofencing. The restricted geographic area, such a geofenced area, may be designated based on one or more conditions, such as weather alerts associated with tornados, wild-fire zones, or other geofenced areas from which the UE **115**-*a* may not depart. The restricted geographic area may include an NTZ, which may restrict radio frequency transmissions from the UE **115**-*a* (e.g., drone, unmanned aerial vehicle (UAV), or aerial UE) in the zone. The NTZ may restrict transmissions but may not include a restriction on flying or receiving signals. The restricted geographic area may include an NFZ, which may restrict flying in the zone (e.g., cannot enter or fly, such that transmission and reception are implicitly restricted). The restricted geographic area may include a no-leaving zone (NLZ), which may restrict leaving the zone. In the NLZ, the UE **115**-*a* may not leave the zone but transmissions and reception are permitted. The restriction may include a geofence so that the UE **115**-*a* may not leave (e.g., pass the fence).

[0107] To illustrate, wireless communications system **200** may include a restricted geographic area **205**. The restricted geographic area **205** may correspond to a geographical area where transmission from certain devices on certain radio frequency spectrum bands is restricted, as well as other conditions (e.g., for a time period). For example, the UE **115**-*a* may be restricted from transmitting on a radio frequency spectrum band which the UE **115**-*a* uses for communications (e.g., LTE or NR communications) while the UE **115**-*a* is in the restricted geographic area **205** (e.g., where the special area is a NTZ). That is, one or more frequencies or frequency bands may be restricted from being used for transmissions within the restricted geographic area **205**. The wireless communications system **200** may support techniques for the UE **115**-*a* to identify the restricted geographic area **205** and operate in the restricted geographic area **205** according to transmission restrictions.

[0108] In some examples, the UE **115**-*a* may transmit a capability message **210** indicating one or more capabilities of the UE **115**-*a*. The capability message **210** may indicate that the UE **115**-*a* supports restrictions or is able to support compliance with restrictions while operating in the restricted geographic area **205**. In some examples, the capability message **210** may indicate a production or manufacturing version of the UE **115**-*a*, such that the network entity **105**-*a* may transmit a message indicating the transmission policy associated with the restricted geographic area **205** based on the version (e.g., different signaling based on version of the UE **115**-*a*, such that different versions are associated with different capabilities with respect to compliance within the restricted geographic area **205**).

[0109] In some examples, some operations or processes of the network may be based on radio capabilities of UE **115**-*a*. The UE **115**-*a* may report capability indicating whether the UE **115**-*a* supports other frequency bands besides the frequency bands that are not allowed within the restricted geographic area **205**. If the UE **115**-*a* does not support other frequency bands, the network may consider the UE **115**-*a* unreachable. If the UE **115**-*a* does support other bands, the network may consider the UE **115**-*a* reachable and available for at least downlink signaling. In some examples, the UE **115**-*a* may receive paging signaling on the other bands which do not correspond to the restricted geographic area **205**. After the UE **115**-*a* enters the restricted geographic area **205**, the UE **115**-*a* may locally modify the radio capabilities of the UE **115**-*a* and reselects to another band that does not correspond to the restricted geographic area **205**. The UE **115**-*a* may perform idle mode procedures for cell reselection after reselecting to a band that does not correspond to the restricted geographic area **205**.

[0110] The UE **115**-*a* may receive restriction information **215**, which may indicate transmission restrictions for the restricted geographic area **205**. In some examples, the restriction information **215** may identify one or more radio frequency bands where transmission by the UE **115**-*b* is restricted or prohibited within the restricted geographic area **205**. In some examples, the UE **115**-*a* may transmit the capability message **210** to the network entity **105**-*a*. In some examples, the network entity **105**-*a* may transmit the restriction information **215** to the UE **115**-*a*. In some other examples, separate devices, nodes, or entities may transmit and receive the capability message **210** or the restriction information **215**. In some examples, the restriction information **215** may be referred to as the transmission restriction policy, indication of the area type (e.g., NFZ, NTZ, or NLZ), and the like.

[0111] In some examples, network entity **105**-*a* may output a transmission policy enablement message **225** to the UE **115**-*a* that enables a transmission policy. The transmission policy may correspond to the restricted geographic area **205**, such that the network entity **105**-*a* may enable the respective transmission policy while the UE **115**-*a* is in the restricted geographic area **205** and disable it, for example, when the UE **115**-*a* is no longer in the restricted geographic area **205**, using the transmission policy enablement message **225**.

[0112] In some examples, cells may correspond to the restricted geographic area **205**. The wireless communication network may receive restriction information and map to a restricted geographic

area. In some examples, the core network may receive an indication of the restricted geographic area **205** via an operations, administration, and management (OAM) entity from an external party (e.g., a government or entity enforcing the restricted geographic area **205**). The core network may configure the UE **115**-*a* with the restricted geographic area **205**. For example, the network entity **105**-*a* may transmit control signaling to configure the UE **115**-*a* with the restricted geographic area via the restriction information **215**.

[0113] For example, the restricted geographic area **205** may be implemented using NTZ, NFZ, geofencing, and the like. The network entity **105**-*a* may output signaling indicating restriction information **215**. The restriction information **215** may include geographic coordinates of the restricted geographic area **205** and an area type indicator for the restricted geographic area **205**. The geographic coordinates may correspond to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area. The area type indicator may indicate that the restricted geographic area is an NFZ, a no uplink transmission zone (e.g., NTZ), a no departure zone (e.g., NLZ). The area type indicator may further indicate a transmission restriction policy associated with the restricted geographic area **205**.

[0114] The geographic coordinates may correspond to or define a 2D boundary or a 3D boundary. For a 2D boundary, the restricted geographic area **205** may have, effectively, an infinite height. For a three-dimensional boundary, the restricted geographic area **205** may be a box, sphere, cylinder, ellipsoid, etc. In some examples, the restricted geographic area **205** may be limited in an altitude axis. For example, for a restricted geographic area **205** around an airport, the restricted geographic area **205** may extend to 500 meters in the air. Above 500 meters, there may not be a restricted geographic area **205** above the airport.

[0115] In some examples, the UE **115**-*a* may transmit a first message **220** in accordance with a transmission power limit. That is, the UE **115**-*a* may transmit a message based on the transmission policy for the restricted geographic area **205** after the transmission policy has been enabled for the UE **115**-*a* (e.g., based on being in the restricted geographic area **205**, capability of the UE **115**-*a*, and the transmission policy for the area).

[0116] In some examples, the UE **115**-*a* may receive coordinates to form the area or the volume identifying a “special area of interest,” which may be the restricted geographic area **205**. The restricted geographic area **205** may include the NFZ, the NTZ, the NLZ, or the like, having boundaries corresponding to a 2D or a 3D polygon. As discussed herein, the restricted geographic area **205** may be further associated with a time period (e.g., time component), such that the transmission policy associated with the restricted geographic area **205** may apply based on the time component. As an example, an NFZ of the restricted geographic area **205** may apply from 7 am to 9 am or the NFZ may apply for 24 hours as a default. In some examples, the network may indicate each type of area in an area type indication (e.g., NTZ, NFZ, NLZ) (e.g., in the restriction information **215** or a new message). Based on the indication, the UE **115**-*a* may determine performance (e.g., do not enter NFZ, apply NTZ policies, no transmission for NTZ, do not leave for NLZ, and so forth) in the restricted geographic area **205**.

[0117] In some examples, geofencing information may be provided using an application layer (e.g., by an unmanned aircraft system traffic management (UTM)). In such examples, a network operator may be involved and provide bit-pipe messages or messaging by upper layers (e.g., Non-Access Stratum (NAS) based solutions).

[0118] In some examples, the restriction information **215** indicating one or more transmission restriction policies for the restricted geographic area **205** may be signaled by a RAN operator (e.g., via network entity **105**-*a* or via a different network entity, not shown) using dedicated RRC messages (e.g., for UE-specific geofencing for different entities, such as different UEs **115**). The RRC reconfiguration messages may include any restriction information for the restricted geographic area **205** that is received in RRC reconfiguration and may apply upon receiving the RRC configuration message. The information may be applicable in a connected mode or in an idle

mode (e.g., inactive mode). For example, idle mode may be based on activity specific restrictions, such that the UE **115**-*a* may store the configuration to be used when the UE **115**-*a* is in the idle or inactive mode. The UE **115**-*a* may receive the restricted geographic area **205** in RRC release messages for applicability for the idle or inactive mode. The network entity **105**-*a* may output to the UE **115**-*a* or broadcast (e.g., similar to a warning area) if the RRC restriction information **215** is applicable for multiple UEs **115** (e.g., in a system information block (SIB)).

[0119] The restricted geographic area **205** information may be outputted (e.g., transmitted) in a groupcast or multicast message to different groups of UEs **115** using group radio network temporary identifiers (G-RNTIs). In some examples, the restricted geographic area **205** information may be outputted using a new medium access control element (MAC-CE) defined for the restricted geographic area **205**. The MAC-CE may indicate the entire restriction information **215** for the restricted geographic area **205**, or the MAC-CE may be used for enabling or disabling of the restricted geographic area **205**.

[0120] In some examples, an indication of the restricted geographic area **205** may be provided using a downlink control information (DCI) for enabling or disabling of the restricted geographic area information for the UE **115**-*a*. The absence of a restricted geographic area **205** may be defined to indicate that there is no restriction. In some examples, the signaling may define or indicate that the UE **115**-*a* may not be allowed to go to an aerial state (e.g., NFZ).

[0121] A SIB, dedicated RRC, MAC-CE, or DCI signaling (e.g., from network entity **105**-*a* or from a different network entity, not shown) may be used for in-coverage (e.g., within a threshold distance from a cell). For example, such signaling may provide restriction information **215** for the restricted geographic area **205**. However, for out-of-coverage scenarios (e.g., outside of a threshold distance from a cell), the restriction information **215** for the restricted geographic area **205** may be provided before the UE **115**-*a* enters the restricted geographic area (e.g., at application layer and stored in the UE, provided using direct communications (PC5) sidelink by other UAVs which are able to retrieve the restriction information **215** from the network, and the like).

[0122] The restriction information **215** for the restricted geographic area **205** may be provided via signaling using a SIB, and such signaling may provide geographic coordinates of a polygon defining the restricted geographic area **205**. For example, an AreaCoordinatesSegment in the signaling may carry a segment, with one or more octets, providing geographic coordinates of a polygon defining the restricted geographic area **205** where the restriction information **215** (e.g., transmission restriction policy) is valid. Similar segments may be used in the signaling for restriction information **215** for a restricted geographic area **205**.

[0123] New control signaling, such as a new SIB, may be added to SIB signaling to indicate the restricted geographic area **205**. For example, the SIB may include an indication of geofencing information (including the x, y, z coordinates), as well as an indication of the area type (e.g., NTZ for the restricted geographic area **205**). For example, NTZ information (e.g., restriction information **215** indicating one or more transmission restriction policies for a restricted geographic area **205** that is an NTZ) may indicate, for example, one or more of an indication that the NTZ zone implicitly applies to a current serving frequency, other frequencies over which transmissions are restricted in the restricted geographic area **205**, frequencies over which transmissions are permitted, or any combination thereof. In some examples, the NTZ information may indicate one or more restricted transmission limits (e.g., non-zero transmit power permitted but limited in the zone).

[0124] In some example, the UE **115**-*a* may be capable of understanding and complying with an indicated restricted geographic area **205** based on a version of the UE **115**-*a*. For example, a current or recent version of the UE **115**-*a* (e.g., generation of UE **115** produced after a particular year or complying with a particular version of a wireless communication standard) may be capable of processing the signaling indicating the restricted geographic area **205** while earlier versions of the UE **115**-*a* are not capable. For example, a UE **115**-*a* complying with a particular version may be expected to know geofenced boundaries (e.g., 2D or 3D) while an older version (e.g., complying

with an older version of a standard) may not understand the geofenced boundaries for NTZ/NFZ/NLZ.

[0125] In some examples, for the older version of the UE **115** (e.g., first UE) to not attach to the cells covering NTZ or NFZ area (e.g., partially or completely), a new barring bit may be used to indicate to the first UE **115** that the cell is barred (e.g., that the first UE is not permitted to establish connectivity with that cell). Another specific barring bit may be used for a second UE **115**-*a* (e.g., that complies with a later version of a standard) to indicate that the cell is not barred (e.g., that the second UE is permitted to establish connectivity with the cell). However, barring the cell for all the older versions of the UE **115** may also bar UEs **115** from using the cell that may otherwise be intended to use the cell (e.g., terrestrial UEs **115**).

[0126] Accordingly, in some examples, network signaling (NS) fields for indicating additional spectrum emission values may be used in a SIB (e.g., SIB1) to cause the older version of the UEs **115** to disregard the values provided in the SIB. For example, one or more aerial specific NS value (also known as additional spectrum emission value) fields in the SIB may be broadcasted using NS values that are reserved for the newer UEs **115** and that are not supported by the older version UEs **115**. Therefore, a frequency indicated in the aerial specific NS value fields in the SIB is disregarded by the previous version UEs **115**. In some examples, NS field values for current UEs **115** may be added to the SIB and may be used when the current UE **115** is within an NTZ boundary (e.g., since the signaling may provide the boundaries, the UE **115** may consider the cell not usable when within the boundary and usable outside the boundary). In an idle mode, the current UEs **115** may receive SIB1 and/or SIB2 and/or other SIBs, and may apply the NS accordingly at the time of initial access.

[0127] For connected mode, for example, during a handover procedure, a source cell may be aware of a restricted geographic area **205** (e.g., NTZ) in a target area. If the source cell is already aware of the frequencies associated with the restricted geographic area **205** in the target network entity **105**, the source cell may exclude such frequencies from the potential target cells. Accordingly, a cell may notify neighboring cells about respective restriction information **215** associated with the cell. Cells with restriction information may share, provide, or forward the information to the neighbors (e.g., using Xn and next-generation application protocol).

[0128] As part of conditional handover (CHO) or L1/L2 triggered mobility (LTM), NTZ information and capabilities as indicated from another cell may be considered by the source cell to prepare preferred target handover candidates and/or order of the CHO or LTM configuration parameters. If the source cell is not already aware of the target cell NTZ area but is capable of handling NTZ (e.g., current version), the target cell may inform the source during the handover preparation phase about the NTZ and permit a UE **115** to communicate over the associated allowed frequency. If no frequencies are permitted, the target candidate cell may send a handover failure. In some examples, new handover failure causes may be defined. For example, a target cell may send a message to the source cell with the new handover failure cause in the handover preparation failure message.

[0129] In a connected mode, such as during a handover procedure, a source cell associated with an older version (e.g., is not capable of receiving or processing signaling for restriction information, such as NTZ information) may target a cell associated with the current version that is capable of receiving and processing the restriction information **215**. In such examples, the source cell may provide the UE **115**-*a* (e.g., a current version cell that implements NS field-based backward compatible solution) with a SIB1 in order to handover a UE **115**-*a* in a handover command. The UE **115** may apply the target SIB1 information. However, if the UE **115**-*a* is handed over to a cell with frequency that is not permitted for uplink in that restricted geographic area **205**, then the UE **115**-*a* may not send a handover complete message to the source cell, resulting in a handover failure. The handover procedures discussed herein may apply to a Xn-based handover, a Next Generation Application Protocol (NGAP)-based handover, or the like. In some examples, a new cause value

may be defined for a handover failure, and the value may be sent to the source cell in the handover preparation failure. In some examples, the techniques discussed herein may involve RRC signaling indicating the restricted geographic area **205** (e.g., in SIB1), a new MAC-CE defined to include restriction information **215** (e.g., coordinates, area type indicator, or transmission restriction policy) for a restricted geographic area **205** to indicate to the current UEs **115**.

[0130] FIG. **3** shows an example of a process flow **300** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The process flow **300** may implement aspects of wireless communications system **100** or a wireless communications system **200**. For instance, the process flow **300** may illustrate operations between a UE **115**-*b* and a network entity **105**-*b*, which may be respective examples of a UE **115** and a network entity **105** described herein. In the following description of the process flow **300**, the operations between the UE **115**-*b* and the network entity **105**-*b* be performed in different orders or at different times than described. Some operations also may be omitted from the process flow **300**, and other operations may be added to the process flow **300**.

[0131] In some examples, at **310**, the UE **115**-*b* may transmit an indication of a capability of the UE **115**-*b*. The capability may indicate whether the UE **115**-*b* may support signaling for a restricted geographic area. At **315**, the UE **115**-*b* may receive one or more messages indicating geographic coordinates of a restricted geographic area. The geographic coordinates may correspond to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area. The area type indicator may indicate that the restricted geographic area is an NFZ, an NTZ (e.g., no uplink transmission zone), or an NLZ (e.g., no departure zone). The one or more messages may further indicate a transmission restriction policy associated with the restricted geographic area. In some examples, UE **115**-*b* may receive one or more messages indicating an area type indicator for the restricted geographic are. The area type indicator may indicate that the restricted geographic area is an NFZ, an NTZ (e.g., no uplink transmission zone), or an NLZ (e.g., no departure zone).

[0132] The one or more messages may indicate a time period during which the transmission restriction policy applies. In some examples, at **320**, the UE **115**-*b* may receive a control message that enables or disables the transmission restriction policy for the restricted geographic area. The transmission restriction policy may indicate a restriction prohibiting transmission using at least a first frequency band within the restricted geographic area, permits transmission using a second frequency band within the restricted geographic area, or both.

[0133] In some examples, the UE **115**-*b* receiving the one or more messages indicating geographic coordinates may include receiving a RRC message, a SIB, a DCI message, or a MAC-CE message, based on the UE **115**-*b* being disposed inside of a coverage area associated with the network entity **105**-*b*. To receive the one or more messages, the UE **115**-*b* may receive one or more application layer messages or one or more sidelink messages based on the UE **115**-*b* being disposed outside of a coverage area associated with the network entity **105**-*b*. Receiving the one or more messages indicating geographic coordinates may include receiving a bit field including a barring bit indicating whether establishing connectivity with a cell within the restricted geographic area is barred. Receiving one or more messages indicating geographic coordinates may include receiving a NS field including a value indicating that establishing connectivity with a cell is permitted when the UE **115**-*b* is located outside of the restricted geographic area and that establishing connectivity with the cell is not permitted when the UE **115**-*b* is located within the restricted geographic area. The NS field may include a first network signaling value indicating an area type or a second network signaling value indicating the geographic coordinates.

[0134] At **325**, the UE **115**-*b* may perform a procedure that complies with the transmission restriction policy based on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area. In some examples, performing the procedure may include the UE **115**-*b* transmitting a first message in accordance with the transmission power limit. In some examples,

performing the procedure may also include refraining from transmitting a transmission within the restricted geographic area, maintaining the UE **115**-*b* within the restricted geographic area, staying within the restricted geographic area, transmitting using only one or more selected radio frequency channels while refraining from transmitting using one or more other radio frequency channels, as well as other operations described herein in accordance with one or more transmission restriction policies (e.g., NTZ information, restricted information, etc.).

[0135] In some examples, the network entity **105**-*b* may generate one or more messages indicating the geographic coordinates of the restricted geographic area and the area type indicator for the restricted geographic area. The geographic coordinates may correspond to one or more boundaries of a polygon that defines the area or the volume of the restricted geographic area. The area type indicator may indicate that the restricted geographic area is a NFZ, an NTZ, or an NLZ. The area type indicator may further indicate the transmission restriction policy associated with the restricted geographic area. The network entity **105**-*b* may output the one or more messages to the UE **115**-*b*. In some examples, the network entity **105**-*b* may output, during a handover procedure, an indication of the area type indicator and the transmission restriction policy associated with the restricted geographic area, to a handover candidate network entity (e.g., another network entity **105** different than the network entity **105**-*b*). The network entity **105**-*b* may obtain an indication an area type capability associated with the handover candidate network entity. Transmitting the indication of the area type indicator and the transmission restriction policy is based on the area type capability associated with the handover candidate network entity **105**. The network entity **105**-*b* may obtain, during the handover procedure, an indication of handover failure based at on the area type capability being incompatible with the transmission restriction policy associated with the area type.

[0136] FIG. **4** shows a block diagram **400** of a device **405** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The device **405** may be an example of aspects of a UE **115** as described herein. The device **405** may include a receiver **410**, a transmitter **415**, and a communications manager **420**. The device **405**, or one or more components of the device **405** (e.g., the receiver **410**, the transmitter **415**, the communications manager **420**), may include at least one processor, which may be coupled with at least one memory, to, individually or collectively, support or enable the described techniques. Each of these components may be in communication with one another (e.g., via one or more buses).

[0137] The receiver **410** may provide a means for receiving information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to coordinate signaling for a restricted geographic area). Information may be passed on to other components of the device **405**. The receiver **410** may utilize a single antenna or a set of multiple antennas.

[0138] The transmitter **415** may provide a means for transmitting signals generated by other components of the device **405**. For example, the transmitter **415** may transmit information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to coordinate signaling for a restricted geographic area). In some examples, the transmitter **415** may be co-located with a receiver **410** in a transceiver module. The transmitter **415** may utilize a single antenna or a set of multiple antennas.

[0139] The communications manager **420**, the receiver **410**, the transmitter **415**, or various combinations or components thereof may be examples of means for performing various aspects of coordinate signaling for a restricted geographic area as described herein. For example, the communications manager **420**, the receiver **410**, the transmitter **415**, or various combinations or components thereof may be capable of performing one or more of the functions described herein.

[0140] In some examples, the communications manager **420**, the receiver **410**, the transmitter **415**, or various combinations or components thereof may be implemented in hardware (e.g., in communications management circuitry). The hardware may include at least one of a processor, a

digital signal processor (DSP), a central processing unit (CPU), an application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA) or other programmable logic device, a microcontroller, discrete gate or transistor logic, discrete hardware components, or any combination thereof configured as or otherwise supporting, individually or collectively, a means for performing the functions described in the present disclosure. In some examples, at least one processor and at least one memory coupled with the at least one processor may be configured to perform one or more of the functions described herein (e.g., by one or more processors, individually or collectively, executing instructions stored in the at least one memory).

[0141] Additionally, or alternatively, the communications manager **420**, the receiver **410**, the transmitter **415**, or various combinations or components thereof may be implemented in code (e.g., as communications management software or firmware) executed by at least one processor (e.g., referred to as a processor-executable code). If implemented in code executed by at least one processor, the functions of the communications manager **420**, the receiver **410**, the transmitter **415**, or various combinations or components thereof may be performed by a general-purpose processor, a DSP, a CPU, an ASIC, an FPGA, a microcontroller, or any combination of these or other programmable logic devices (e.g., configured as or otherwise supporting, individually or collectively, a means for performing the functions described in the present disclosure).

[0142] In some examples, the communications manager **420** may be configured to perform various operations (e.g., receiving, obtaining, monitoring, outputting, transmitting) using or otherwise in cooperation with the receiver **410**, the transmitter **415**, or both. For example, the communications manager **420** may receive information from the receiver **410**, send information to the transmitter **415**, or be integrated in combination with the receiver **410**, the transmitter **415**, or both to obtain information, output information, or perform various other operations as described herein.

[0143] The communications manager **420** may support wireless communications in accordance with examples as disclosed herein. For example, the communications manager **420** is capable of, configured to, or operable to support a means for receiving one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The communications manager **420** is capable of, configured to, or operable to support a means for performing a procedure that complies with the transmission restriction policy based on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.

[0144] By including or configuring the communications manager **420** in accordance with examples as described herein, the device **405** (e.g., at least one processor controlling or otherwise coupled with the receiver **410**, the transmitter **415**, the communications manager **420**, or a combination thereof) may support techniques for efficiently signaling transmission policies to UEs **115** within restricted geographic areas, where the UEs are current and older generation models.

[0145] FIG. **5** shows a block diagram **500** of a device **505** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The device **505** may be an example of aspects of a device **405** or a UE **115** as described herein. The device **505** may include a receiver **510**, a transmitter **515**, and a communications manager **520**. The device **505**, or one or more components of the device **505** (e.g., the receiver **510**, the transmitter **515**, the communications manager **520**), may include at least one processor, which may be coupled with at least one memory, to support the described techniques. Each of these components may be in communication with one another (e.g., via one or more buses).

[0146] The receiver **510** may provide a means for receiving information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to coordinate signaling for a restricted

geographic area). Information may be passed on to other components of the device **505**. The receiver **510** may utilize a single antenna or a set of multiple antennas.

[0147] The transmitter **515** may provide a means for transmitting signals generated by other components of the device **505**. For example, the transmitter **515** may transmit information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to coordinate signaling for a restricted geographic area). In some examples, the transmitter **515** may be co-located with a receiver **510** in a transceiver module. The transmitter **515** may utilize a single antenna or a set of multiple antennas.

[0148] The device **505**, or various components thereof, may be an example of means for performing various aspects of coordinate signaling for a restricted geographic area as described herein. For example, the communications manager **520** may include a message communication manager **525** a transmission procedure manager **530**, or any combination thereof. The communications manager **520** may be an example of aspects of a communications manager **420** as described herein. In some examples, the communications manager **520**, or various components thereof, may be configured to perform various operations (e.g., receiving, obtaining, monitoring, outputting, transmitting) using or otherwise in cooperation with the receiver **510**, the transmitter **515**, or both. For example, the communications manager **520** may receive information from the receiver **510**, send information to the transmitter **515**, or be integrated in combination with the receiver **510**, the transmitter **515**, or both to obtain information, output information, or perform various other operations as described herein.

[0149] The communications manager **520** may support wireless communications in accordance with examples as disclosed herein. The message communication manager **525** is capable of, configured to, or operable to support a means for receiving one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The transmission procedure manager **530** is capable of, configured to, or operable to support a means for performing a procedure that complies with the transmission restriction policy based on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.

[0150] FIG. **6** shows a block diagram **600** of a communications manager **620** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The communications manager **620** may be an example of aspects of a communications manager **420**, a communications manager **520**, or both, as described herein. The communications manager **620**, or various components thereof, may be an example of means for performing various aspects of coordinate signaling for a restricted geographic area as described herein. For example, the communications manager **620** may include a message communication manager **625**, a transmission procedure manager **630**, a bit field communication manager **635**, a network signaling field manager **640**, or any combination thereof. Each of these components, or components or subcomponents thereof (e.g., one or more processors, one or more memories), may communicate, directly or indirectly, with one another (e.g., via one or more buses).

[0151] The communications manager **620** may support wireless communications in accordance with examples as disclosed herein. The message communication manager **625** is capable of, configured to, or operable to support a means for receiving one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The transmission procedure manager **630** is capable of, configured

to, or operable to support a means for performing a procedure that complies with the transmission restriction policy based on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.

[0152] In some examples, the message communication manager **625** is capable of, configured to, or operable to support a means for receiving one or more messages indicating an area type indicator. The area type indicator may indicate that the restricted geographic area is an NFZ, an NTZ (e.g., no uplink transmission zone), or an NLZ (e.g., no departure zone).

[0153] In some examples, receiving the one or more messages indicating the geographic coordinates is based on a capability of the UE.

[0154] In some examples, the one or more messages indicates a time period during which the transmission restriction policy applies.

[0155] In some examples, the message communication manager **625** is capable of, configured to, or operable to support a means for receiving a control message that enables or disables the transmission restriction policy for the restricted geographic area.

[0156] In some examples, the transmission restriction policy indicates a restriction prohibiting transmission using at least a first frequency band within the restricted geographic area, permits transmission using a second frequency band within the restricted geographic area, or both.

[0157] In some examples, to support performing the procedure, the message communication manager **625** is capable of, configured to, or operable to support a means for transmitting a first message in accordance with the transmission power limit.

[0158] In some examples, to support receiving the one or more messages, the message communication manager **625** is capable of, configured to, or operable to support a means for receiving a RRC message, a SIB, a DCI message, or a MAC-CE message, based on the UE being disposed inside of a coverage area associated with a network entity.

[0159] In some examples, to support receiving the one or more messages, the message communication manager **625** is capable of, configured to, or operable to support a means for receiving one or more application layer messages or one or more sidelink messages based on the UE being disposed outside of a coverage area associated with a network entity.

[0160] In some examples, to support receiving the one or more messages, the bit field communication manager **635** is capable of, configured to, or operable to support a means for receiving a bit field including a barring bit indicating whether establishing connectivity with a cell within the restricted geographic area is barred.

[0161] In some examples, to support receiving the one or more messages, the network signaling field manager **640** is capable of, configured to, or operable to support a means for receiving a network signaling field including a value indicating that establishing connectivity with a cell is permitted when the UE is located outside of the restricted geographic area and that establishing connectivity with the cell is not permitted when the UE is located within the restricted geographic area.

[0162] In some examples, the network signaling field includes a first network signaling value indicating an area type or a second network signaling value indicating the geographic coordinates.

[0163] FIG. **7** shows a diagram of a system **700** including a device **705** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The device **705** may be an example of or include components of a device **405**, a device **505**, or a UE **115** as described herein. The device **705** may communicate (e.g., wirelessly) with one or more other devices (e.g., network entities **105**, UEs **115**, or a combination thereof). The device **705** may include components for bi-directional voice and data communications including components for transmitting and receiving communications, such as a communications manager **720**, an input/output (I/O) controller, such as an I/O controller **710**, a transceiver **715**, one or more antennas **725**, at least one memory **730**, code **735**, and at least one processor **740**. These

components may be in electronic communication or otherwise coupled (e.g., operatively, communicatively, functionally, electronically, electrically) via one or more buses (e.g., a bus **745**).
[0164] The I/O controller **710** may manage input and output signals for the device **705**. The I/O controller **710** may also manage peripherals not integrated into the device **705**. In some cases, the I/O controller **710** may represent a physical connection or port to an external peripheral. In some cases, the I/O controller **710** may utilize an operating system such as iOS®, ANDROID®, MS-DOS®, MS-WINDOWS®, OS/2®, UNIX®, LINUX®, or another known operating system. Additionally, or alternatively, the I/O controller **710** may represent or interact with a modem, a keyboard, a mouse, a touchscreen, or a similar device. In some cases, the I/O controller **710** may be implemented as part of one or more processors, such as the at least one processor **740**. In some cases, a user may interact with the device **705** via the I/O controller **710** or via hardware components controlled by the I/O controller **710**.
[0165] In some cases, the device **705** may include a single antenna. However, in some other cases, the device **705** may have more than one antenna, which may be capable of concurrently transmitting or receiving multiple wireless transmissions. The transceiver **715** may communicate bi-directionally via the one or more antennas **725** using wired or wireless links as described herein. For example, the transceiver **715** may represent a wireless transceiver and may communicate bi-directionally with another wireless transceiver. The transceiver **715** may also include a modem to modulate the packets, to provide the modulated packets to one or more antennas **725** for transmission, and to demodulate packets received from the one or more antennas **725**. The transceiver **715**, or the transceiver **715** and one or more antennas **725**, may be an example of a transmitter **415**, a transmitter **515**, a receiver **410**, a receiver **510**, or any combination thereof or component thereof, as described herein.
[0166] The at least one memory **730** may include random access memory (RAM) and read-only memory (ROM). The at least one memory **730** may store computer-readable, computer-executable, or processor-executable code, such as the code **735**. The code **735** may include instructions that, when executed by the at least one processor **740**, cause the device **705** to perform various functions described herein. The code **735** may be stored in a non-transitory computer-readable medium such as system memory or another type of memory. In some cases, the code **735** may not be directly executable by the at least one processor **740** but may cause a computer (e.g., when compiled and executed) to perform functions described herein. In some cases, the at least one memory **730** may include, among other things, a basic I/O system (BIOS) which may control basic hardware or software operation such as the interaction with peripheral components or devices.
[0167] The at least one processor **740** may include one or more intelligent hardware devices (e.g., one or more general-purpose processors, one or more DSPs, one or more central processing units (CPUs), one or more graphics processing units (GPUs), one or more neural processing units (NPUs) (also referred to as neural network processors or deep learning processors (DLPs)), one or more microcontrollers, one or more ASICs, one or more FPGAs, one or more programmable logic devices, discrete gate or transistor logic, one or more discrete hardware components, or any combination thereof). In some cases, the at least one processor **740** may be configured to operate a memory array using a memory controller. In some other cases, a memory controller may be integrated into the at least one processor **740**. The at least one processor **740** may be configured to execute computer-readable instructions stored in a memory (e.g., the at least one memory **730**) to cause the device **705** to perform various functions (e.g., functions or tasks supporting coordinate signaling for a restricted geographic area). For example, the device **705** or a component of the device **705** may include at least one processor **740** and at least one memory **730** coupled with or to the at least one processor **740**, the at least one processor **740** and the at least one memory **730** configured to perform various functions described herein. In some examples, the at least one processor **740** may include multiple processors and the at least one memory **730** may include multiple memories. One or more of the multiple processors may be coupled with one or more of the

multiple memories, which may, individually or collectively, be configured to perform various functions described herein. In some examples, the at least one processor **740** may be a component of a processing system, which may refer to a system (such as a series) of machines, circuitry (including, for example, one or both of processor circuitry (which may include the at least one processor **740**) and memory circuitry (which may include the at least one memory **730**)), or components, that receives or obtains inputs and processes the inputs to produce, generate, or obtain a set of outputs. The processing system may be configured to perform one or more of the functions described herein. For example, the at least one processor **740** or a processing system including the at least one processor **740** may be configured to, configurable to, or operable to cause the device **705** to perform one or more of the functions described herein. Further, as described herein, being "configured to," being "configurable to," and being "operable to" may be used interchangeably and may be associated with a capability, when executing code **735** (e.g., processor-executable code) stored in the at least one memory **730** or otherwise, to perform one or more of the functions described herein.

[0168] The communications manager **720** may support wireless communications in accordance with examples as disclosed herein. For example, the communications manager **720** is capable of, configured to, or operable to support a means for receiving one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The communications manager **720** is capable of, configured to, or operable to support a means for performing a procedure that complies with the transmission restriction policy based on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.

[0169] By including or configuring the communications manager **720** in accordance with examples as described herein, the device **705** may support techniques for efficiently signaling transmission policies to UEs **115** within restricted geographic areas, where the UEs **115** may be current and/or older generation models.

[0170] In some examples, the communications manager **720** may be configured to perform various operations (e.g., receiving, monitoring, transmitting) using or otherwise in cooperation with the transceiver **715**, the one or more antennas **725**, or any combination thereof. Although the communications manager **720** is illustrated as a separate component, in some examples, one or more functions described with reference to the communications manager **720** may be supported by or performed by the at least one processor **740**, the at least one memory **730**, the code **735**, or any combination thereof. For example, the code **735** may include instructions executable by the at least one processor **740** to cause the device **705** to perform various aspects of coordinate signaling for a restricted geographic area as described herein, or the at least one processor **740** and the at least one memory **730** may be otherwise configured to, individually or collectively, perform or support such operations.

[0171] FIG. **8** shows a block diagram **800** of a device **805** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The device **805** may be an example of aspects of a network entity **105** as described herein. The device **805** may include a receiver **810**, a transmitter **815**, and a communications manager **820**. The device **805**, or one or more components of the device **805** (e.g., the receiver **810**, the transmitter **815**, the communications manager **820**), may include at least one processor, which may be coupled with at least one memory, to, individually or collectively, support or enable the described techniques. Each of these components may be in communication with one another (e.g., via one or more buses).

[0172] The receiver **810** may provide a means for obtaining (e.g., receiving, determining, identifying) information such as user data, control information, or any combination thereof (e.g.,

I/Q samples, symbols, packets, protocol data units, service data units) associated with various channels (e.g., control channels, data channels, information channels, channels associated with a protocol stack). Information may be passed on to other components of the device **805**. In some examples, the receiver **810** may support obtaining information by receiving signals via one or more antennas. Additionally, or alternatively, the receiver **810** may support obtaining information by receiving signals via one or more wired (e.g., electrical, fiber optic) interfaces, wireless interfaces, or any combination thereof.

[0173] The transmitter **815** may provide a means for outputting (e.g., transmitting, providing, conveying, sending) information generated by other components of the device **805**. For example, the transmitter **815** may output information such as user data, control information, or any combination thereof (e.g., I/Q samples, symbols, packets, protocol data units, service data units) associated with various channels (e.g., control channels, data channels, information channels, channels associated with a protocol stack). In some examples, the transmitter **815** may support outputting information by transmitting signals via one or more antennas. Additionally, or alternatively, the transmitter **815** may support outputting information by transmitting signals via one or more wired (e.g., electrical, fiber optic) interfaces, wireless interfaces, or any combination thereof. In some examples, the transmitter **815** and the receiver **810** may be co-located in a transceiver, which may include or be coupled with a modem.

[0174] The communications manager **820**, the receiver **810**, the transmitter **815**, or various combinations or components thereof may be examples of means for performing various aspects of coordinate signaling for a restricted geographic area as described herein. For example, the communications manager **820**, the receiver **810**, the transmitter **815**, or various combinations or components thereof may be capable of performing one or more of the functions described herein.

[0175] In some examples, the communications manager **820**, the receiver **810**, the transmitter **815**, or various combinations or components thereof may be implemented in hardware (e.g., in communications management circuitry). The hardware may include at least one of a processor, a DSP, a CPU, an ASIC, an FPGA or other programmable logic device, a microcontroller, discrete gate or transistor logic, discrete hardware components, or any combination thereof configured as or otherwise supporting, individually or collectively, a means for performing the functions described in the present disclosure. In some examples, at least one processor and at least one memory coupled with the at least one processor may be configured to perform one or more of the functions described herein (e.g., by one or more processors, individually or collectively, executing instructions stored in the at least one memory).

[0176] Additionally, or alternatively, the communications manager **820**, the receiver **810**, the transmitter **815**, or various combinations or components thereof may be implemented in code (e.g., as communications management software or firmware) executed by at least one processor (e.g., referred to as a processor-executable code). If implemented in code executed by at least one processor, the functions of the communications manager **820**, the receiver **810**, the transmitter **815**, or various combinations or components thereof may be performed by a general-purpose processor, a DSP, a CPU, an ASIC, an FPGA, a microcontroller, or any combination of these or other programmable logic devices (e.g., configured as or otherwise supporting, individually or collectively, a means for performing the functions described in the present disclosure).

[0177] In some examples, the communications manager **820** may be configured to perform various operations (e.g., receiving, obtaining, monitoring, outputting, transmitting) using or otherwise in cooperation with the receiver **810**, the transmitter **815**, or both. For example, the communications manager **820** may receive information from the receiver **810**, send information to the transmitter **815**, or be integrated in combination with the receiver **810**, the transmitter **815**, or both to obtain information, output information, or perform various other operations as described herein.

[0178] The communications manager **820** may support wireless communications in accordance with examples as disclosed herein. For example, the communications manager **820** is capable of,

configured to, or operable to support a means for generating one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The communications manager **820** is capable of, configured to, or operable to support a means for outputting the one or more messages to a UE, such as an aerial UE.

[0179] By including or configuring the communications manager **820** in accordance with examples as described herein, the device **805** (e.g., at least one processor controlling or otherwise coupled with the receiver **810**, the transmitter **815**, the communications manager **820**, or a combination thereof) may support techniques for efficiently signaling transmission policies to UEs **115** within restricted geographic areas, where the UEs **115** may be current and/or older generation models.

[0180] FIG. **9** shows a block diagram **900** of a device **905** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The device **905** may be an example of aspects of a device **805** or a network entity **105** as described herein. The device **905** may include a receiver **910**, a transmitter **915**, and a communications manager **920**. The device **905**, or one or more components of the device **905** (e.g., the receiver **910**, the transmitter **915**, the communications manager **920**), may include at least one processor, which may be coupled with at least one memory, to support the described techniques. Each of these components may be in communication with one another (e.g., via one or more buses).

[0181] The receiver **910** may provide a means for obtaining (e.g., receiving, determining, identifying) information such as user data, control information, or any combination thereof (e.g., I/Q samples, symbols, packets, protocol data units, service data units) associated with various channels (e.g., control channels, data channels, information channels, channels associated with a protocol stack). Information may be passed on to other components of the device **905**. In some examples, the receiver **910** may support obtaining information by receiving signals via one or more antennas. Additionally, or alternatively, the receiver **910** may support obtaining information by receiving signals via one or more wired (e.g., electrical, fiber optic) interfaces, wireless interfaces, or any combination thereof.

[0182] The transmitter **915** may provide a means for outputting (e.g., transmitting, providing, conveying, sending) information generated by other components of the device **905**. For example, the transmitter **915** may output information such as user data, control information, or any combination thereof (e.g., I/Q samples, symbols, packets, protocol data units, service data units) associated with various channels (e.g., control channels, data channels, information channels, channels associated with a protocol stack). In some examples, the transmitter **915** may support outputting information by transmitting signals via one or more antennas. Additionally, or alternatively, the transmitter **915** may support outputting information by transmitting signals via one or more wired (e.g., electrical, fiber optic) interfaces, wireless interfaces, or any combination thereof. In some examples, the transmitter **915** and the receiver **910** may be co-located in a transceiver, which may include or be coupled with a modem.

[0183] The device **905**, or various components thereof, may be an example of means for performing various aspects of coordinate signaling for a restricted geographic area as described herein. For example, the communications manager **920** may include a message generation manager **925** a message communication manager **930**, or any combination thereof. The communications manager **920** may be an example of aspects of a communications manager **820** as described herein. In some examples, the communications manager **920**, or various components thereof, may be configured to perform various operations (e.g., receiving, obtaining, monitoring, outputting, transmitting) using or otherwise in cooperation with the receiver **910**, the transmitter **915**, or both. For example, the communications manager **920** may receive information from the receiver **910**, send information to the transmitter **915**, or be integrated in combination with the receiver **910**, the transmitter **915**, or both to obtain information, output information, or perform various other

operations as described herein.
[0184] The communications manager **920** may support wireless communications in accordance with examples as disclosed herein. The message generation manager **925** is capable of, configured to, or operable to support a means for generating one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The message communication manager **930** is capable of, configured to, or operable to support a means for outputting the one or more messages to a UE, such as an aerial UE.
[0185] FIG. **10** shows a block diagram **1000** of a communications manager **1020** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The communications manager **1020** may be an example of aspects of a communications manager **820**, a communications manager **920**, or both, as described herein. The communications manager **1020**, or various components thereof, may be an example of means for performing various aspects of coordinate signaling for a restricted geographic area as described herein. For example, the communications manager **1020** may include a message generation manager **1025**, a message communication manager **1030**, a handover procedure manager **1035**, a bit field manager **1040**, a network signaling field manager **1045**, or any combination thereof. Each of these components, or components or subcomponents thereof (e.g., one or more processors, one or more memories), may communicate, directly or indirectly, with one another (e.g., via one or more buses). The communications may include communications within a protocol layer of a protocol stack, communications associated with a logical channel of a protocol stack (e.g., between protocol layers of a protocol stack, within a device, component, or virtualized component associated with a network entity **105**, between devices, components, or virtualized components associated with a network entity **105**), or any combination thereof.
[0186] The communications manager **1020** may support wireless communications in accordance with examples as disclosed herein. The message generation manager **1025** is capable of, configured to, or operable to support a means for generating one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The message communication manager **1030** is capable of, configured to, or operable to support a means for outputting the one or more messages to a UE, such as an aerial UE.
[0187] In some examples, the handover procedure manager **1035** is capable of, configured to, or operable to support a means for outputting, during a handover procedure, an indication of the area type indicator and the transmission restriction policy associated with the restricted geographic area, to a handover candidate network entity.
[0188] In some examples, the handover procedure manager **1035** is capable of, configured to, or operable to support a means for obtaining an indication an area type capability associated with the handover candidate network entity, where transmitting the indication of the area type indicator and the transmission restriction policy is based on the area type capability associated with the handover candidate network entity.
[0189] In some examples, the handover procedure manager **1035** is capable of, configured to, or operable to support a means for obtaining, during the handover procedure, an indication of handover failure based on the area type capability being incompatible with the transmission restriction policy associated with the area type.
[0190] In some examples, outputting the one or more messages indicating the geographic coordinates is based on a capability of the UE.

[0191] In some examples, the one or more messages indicates a time period during which the transmission restriction policy applies.
[0192] In some examples, the message communication manager **1030** is capable of, configured to, or operable to support a means for outputting a control message that enables or disables the transmission restriction policy for the restricted geographic area.
[0193] In some examples, the transmission restriction policy indicates a restriction prohibiting transmission using at least a first frequency band within the restricted geographic area, permits transmission using a second frequency band within the restricted geographic area, or both.
[0194] In some examples, the transmission restriction policy indicates a transmission power limit for transmissions within the restricted geographic area.
[0195] In some examples, to support outputting the one or more messages, the message communication manager **1030** is capable of, configured to, or operable to support a means for outputting a RRC message, a SIB, a DCI message, or a MAC-CE message, based on the UE being disposed inside of a coverage area associated with a network entity.
[0196] In some examples, to support outputting the one or more messages, the message communication manager **1030** is capable of, configured to, or operable to support a means for outputting one or more application layer messages or one or more sidelink messages based on the UE being disposed outside of a coverage area associated with a network entity.
[0197] In some examples, to support outputting the one or more messages, the bit field manager **1040** is capable of, configured to, or operable to support a means for outputting a bit field including a barring bit indicating whether establishing connectivity with a cell within the restricted geographic area is barred.
[0198] In some examples, to support outputting the one or more messages, the network signaling field manager **1045** is capable of, configured to, or operable to support a means for outputting a network signaling field including a value indicating that establishing connectivity with a cell is permitted when the UE is located outside of the restricted geographic area and that establishing connectivity with the cell is not permitted when the UE is located within the restricted geographic area.
[0199] In some examples, the network signaling field includes a first network signaling value indicating an area type or a second network signaling value indicating the geographic coordinates.
[0200] FIG. **11** shows a diagram of a system **1100** including a device **1105** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The device **1105** may be an example of or include components of a device **805**, a device **905**, or a network entity **105** as described herein. The device **1105** may communicate with other network devices or network equipment such as one or more of the network entities **105**, UEs **115**, or any combination thereof. The communications may include communications over one or more wired interfaces, over one or more wireless interfaces, or any combination thereof. The device **1105** may include components that support outputting and obtaining communications, such as a communications manager **1120**, a transceiver **1110**, one or more antennas **1115**, at least one memory **1125**, code **1130**, and at least one processor **1135**. These components may be in electronic communication or otherwise coupled (e.g., operatively, communicatively, functionally, electronically, electrically) via one or more buses (e.g., a bus **1140**).
[0201] The transceiver **1110** may support bi-directional communications via wired links, wireless links, or both as described herein. In some examples, the transceiver **1110** may include a wired transceiver and may communicate bi-directionally with another wired transceiver. Additionally, or alternatively, in some examples, the transceiver **1110** may include a wireless transceiver and may communicate bi-directionally with another wireless transceiver. In some examples, the device **1105** may include one or more antennas **1115**, which may be capable of transmitting or receiving wireless transmissions (e.g., concurrently). The transceiver **1110** may also include a modem to modulate signals, to provide the modulated signals for transmission (e.g., by one or more antennas

**1115**, by a wired transmitter), to receive modulated signals (e.g., from one or more antennas **1115**, from a wired receiver), and to demodulate signals. In some implementations, the transceiver **1110** may include one or more interfaces, such as one or more interfaces coupled with the one or more antennas **1115** that are configured to support various receiving or obtaining operations, or one or more interfaces coupled with the one or more antennas **1115** that are configured to support various transmitting or outputting operations, or a combination thereof. In some implementations, the transceiver **1110** may include or be configured for coupling with one or more processors or one or more memory components that are operable to perform or support operations based on received or obtained information or signals, or to generate information or other signals for transmission or other outputting, or any combination thereof. In some implementations, the transceiver **1110**, or the transceiver **1110** and the one or more antennas **1115**, or the transceiver **1110** and the one or more antennas **1115** and one or more processors or one or more memory components (e.g., the at least one processor **1135**, the at least one memory **1125**, or both), may be included in a chip or chip assembly that is installed in the device **1105**. In some examples, the transceiver **1110** may be operable to support communications via one or more communications links (e.g., communication link(s) **125**, backhaul communication link(s) **120**, a midhaul communication link **162**, a fronthaul communication link **168**).

[0202] The at least one memory **1125** may include RAM, ROM, or any combination thereof. The at least one memory **1125** may store computer-readable, computer-executable, or processor-executable code, such as the code **1130**. The code **1130** may include instructions that, when executed by one or more of the at least one processor **1135**, cause the device **1105** to perform various functions described herein. The code **1130** may be stored in a non-transitory computer-readable medium such as system memory or another type of memory. In some cases, the code **1130** may not be directly executable by a processor of the at least one processor **1135** but may cause a computer (e.g., when compiled and executed) to perform functions described herein. In some cases, the at least one memory **1125** may include, among other things, a BIOS which may control basic hardware or software operation such as the interaction with peripheral components or devices. In some examples, the at least one processor **1135** may include multiple processors and the at least one memory **1125** may include multiple memories. One or more of the multiple processors may be coupled with one or more of the multiple memories which may, individually or collectively, be configured to perform various functions herein (for example, as part of a processing system).

[0203] The at least one processor **1135** may include one or more intelligent hardware devices (e.g., one or more general-purpose processors, one or more DSPs, one or more central processing units (CPUs), one or more graphics processing units (GPUs), one or more neural processing units (NPUs) (also referred to as neural network processors or deep learning processors (DLPs)), one or more microcontrollers, one or more ASICs, one or more FPGAs, one or more programmable logic devices, discrete gate or transistor logic, one or more discrete hardware components, or any combination thereof). In some cases, the at least one processor **1135** may be configured to operate a memory array using a memory controller. In some other cases, a memory controller may be integrated into one or more of the at least one processor **1135**. The at least one processor **1135** may be configured to execute computer-readable instructions stored in a memory (e.g., one or more of the at least one memory **1125**) to cause the device **1105** to perform various functions (e.g., functions or tasks supporting coordinate signaling for a restricted geographic area). For example, the device **1105** or a component of the device **1105** may include at least one processor **1135** and at least one memory **1125** coupled with one or more of the at least one processor **1135**, the at least one processor **1135** and the at least one memory **1125** configured to perform various functions described herein. The at least one processor **1135** may be an example of a cloud-computing platform (e.g., one or more physical nodes and supporting software such as operating systems, virtual machines, or container instances) that may host the functions (e.g., by executing code **1130**) to perform the functions of the device **1105**. The at least one processor **1135** may be any one or

more suitable processors capable of executing scripts or instructions of one or more software programs stored in the device **1105** (such as within one or more of the at least one memory **1125**). In some examples, the at least one processor **1135** may include multiple processors and the at least one memory **1125** may include multiple memories. One or more of the multiple processors may be coupled with one or more of the multiple memories, which may, individually or collectively, be configured to perform various functions herein. In some examples, the at least one processor **1135** may be a component of a processing system, which may refer to a system (such as a series) of machines, circuitry (including, for example, one or both of processor circuitry (which may include the at least one processor **1135**) and memory circuitry (which may include the at least one memory **1125**)), or components, that receives or obtains inputs and processes the inputs to produce, generate, or obtain a set of outputs. The processing system may be configured to perform one or more of the functions described herein. For example, the at least one processor **1135** or a processing system including the at least one processor **1135** may be configured to, configurable to, or operable to cause the device **1105** to perform one or more of the functions described herein. Further, as described herein, being "configured to," being "configurable to," and being "operable to" may be used interchangeably and may be associated with a capability, when executing code stored in the at least one memory **1125** or otherwise, to perform one or more of the functions described herein.

[0204] In some examples, a bus **1140** may support communications of (e.g., within) a protocol layer of a protocol stack. In some examples, a bus **1140** may support communications associated with a logical channel of a protocol stack (e.g., between protocol layers of a protocol stack), which may include communications performed within a component of the device **1105**, or between different components of the device **1105** that may be co-located or located in different locations (e.g., where the device **1105** may refer to a system in which one or more of the communications manager **1120**, the transceiver **1110**, the at least one memory **1125**, the code **1130**, and the at least one processor **1135** may be located in one of the different components or divided between different components).

[0205] In some examples, the communications manager **1120** may manage aspects of communications with a core network **130** (e.g., via one or more wired or wireless backhaul links). For example, the communications manager **1120** may manage the transfer of data communications for client devices, such as one or more UEs **115**. In some examples, the communications manager **1120** may manage communications with one or more other network devices, and may include a controller or scheduler for controlling communications with UEs **115** (e.g., in cooperation with the one or more other network devices). In some examples, the communications manager **1120** may support an X2 interface within an LTE/LTE-A wireless communications network technology to provide communication between network entities **105**.

[0206] The communications manager **1120** may support wireless communications in accordance with examples as disclosed herein. For example, the communications manager **1120** is capable of, configured to, or operable to support a means for generating one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The communications manager **1120** is capable of, configured to, or operable to support a means for outputting the one or more messages to a UE, such as an aerial UE.

[0207] By including or configuring the communications manager **1120** in accordance with examples as described herein, the device **1105** may support techniques for efficiently signaling transmission policies to UEs **115** within restricted geographic areas, where the UEs **115** may be current and/or older generation models.

[0208] In some examples, the communications manager **1120** may be configured to perform various operations (e.g., receiving, obtaining, monitoring, outputting, transmitting) using or

otherwise in cooperation with the transceiver **1110**, the one or more antennas **1115** (e.g., where applicable), or any combination thereof. Although the communications manager **1120** is illustrated as a separate component, in some examples, one or more functions described with reference to the communications manager **1120** may be supported by or performed by the transceiver **1110**, one or more of the at least one processor **1135**, one or more of the at least one memory **1125**, the code **1130**, or any combination thereof (for example, by a processing system including at least a portion of the at least one processor **1135**, the at least one memory **1125**, the code **1130**, or any combination thereof). For example, the code **1130** may include instructions executable by one or more of the at least one processor **1135** to cause the device **1105** to perform various aspects of coordinate signaling for a restricted geographic area as described herein, or the at least one processor **1135** and the at least one memory **1125** may be otherwise configured to, individually or collectively, perform or support such operations.

[0209] FIG. **12** shows a flowchart illustrating a method **1200** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The operations of the method **1200** may be implemented by a UE or its components as described herein. For example, the operations of the method **1200** may be performed by a UE **115** as described with reference to FIGS. **1** through **7**. In some examples, a UE may execute a set of instructions to control the functional elements of the UE to perform the described functions. Additionally, or alternatively, the UE may perform aspects of the described functions using special-purpose hardware.

[0210] At **1205**, the method may include receiving one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The operations of **1205** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1205** may be performed by a message communication manager **625** as described with reference to FIG. **6**.

[0211] At **1210**, the method may include performing a procedure that complies with the transmission restriction policy based at least in part on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area. The operations of **1210** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1210** may be performed by a transmission procedure manager **630** as described with reference to FIG. **6**.

[0212] FIG. **13** shows a flowchart illustrating a method **1300** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The operations of the method **1300** may be implemented by a UE or its components as described herein. For example, the operations of the method **1300** may be performed by a UE **115** as described with reference to FIGS. **1** through **7**. In some examples, a UE may execute a set of instructions to control the functional elements of the UE to perform the described functions. Additionally, or alternatively, the UE may perform aspects of the described functions using special-purpose hardware.

[0213] At **1305**, the method may include receiving one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The operations of **1305** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1305** may be performed by a message communication manager **625** as described with reference to FIG. **6**.

[0214] At **1310**, the method may include receiving a control message that enables or disables the transmission restriction policy for the restricted geographic area. The operations of **1310** may be

performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1310** may be performed by a message communication manager **625** as described with reference to FIG. **6**.

[0215] At **1315**, the method may include performing a procedure that complies with the transmission restriction policy based at least in part on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area. The operations of **1315** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1315** may be performed by a transmission procedure manager **630** as described with reference to FIG. **6**.

[0216] FIG. **14** shows a flowchart illustrating a method **1400** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The operations of the method **1400** may be implemented by a UE or its components as described herein. For example, the operations of the method **1400** may be performed by a UE **115** as described with reference to FIGS. **1** through **7**. In some examples, a UE may execute a set of instructions to control the functional elements of the UE to perform the described functions. Additionally, or alternatively, the UE may perform aspects of the described functions using special-purpose hardware.

[0217] At **1405**, the method may include receiving one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The operations of **1405** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1405** may be performed by a message communication manager **625** as described with reference to FIG. **6**.

[0218] At **1410**, the method may include receiving a bit field including a barring bit indicating whether establishing connectivity with a cell within the restricted geographic area is barred. The operations of **1410** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1410** may be performed by a bit field communication manager **635** as described with reference to FIG. **6**.

[0219] At **1415**, the method may include performing a procedure that complies with the transmission restriction policy based at least in part on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area. The operations of **1415** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1415** may be performed by a transmission procedure manager **630** as described with reference to FIG. **6**.

[0220] FIG. **15** shows a flowchart illustrating a method **1500** that supports coordinate signaling for a restricted geographic area in accordance with one or more aspects of the present disclosure. The operations of the method **1500** may be implemented by a network entity or its components as described herein. For example, the operations of the method **1500** may be performed by a network entity as described with reference to FIGS. **1** through **3** and **8** through **11**. In some examples, a network entity may execute a set of instructions to control the functional elements of the network entity to perform the described functions. Additionally, or alternatively, the network entity may perform aspects of the described functions using special-purpose hardware.

[0221] At **1505**, the method may include generating one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area. The operations of **1505** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1505** may be performed by a message generation manager **1025** as described with reference to FIG. **10**.

[0222] At **1510**, the method may include outputting the one or more messages to a UE, such as an aerial UE. The operations of **1510** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1510** may be performed by a message communication manager **1030** as described with reference to FIG. **10**.

[0223] The following provides an overview of aspects of the present disclosure:

[0224] Aspect 1: A method for wireless communications at a UE, comprising: receiving one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area; and performing a procedure that complies with the transmission restriction policy based at least in part on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.

[0225] Aspect 2: The method of aspect 1, further comprising: receiving one or more messages indicating an area type indicator for the restricted geographic area, the area type indicator indicating that the restricted geographic area is a no fly zone, a no uplink transmission zone, or a no departure zone.

[0226] Aspect 3: The method of any of aspects 1 through 2, wherein receiving the one or more messages indicating the geographic coordinates is based at least in part on a capability of the UE.

[0227] Aspect 4: The method of any of aspects 1 through 3, wherein the one or more messages indicates: the geographic coordinates of the restricted geographic area and at least one frequency band associated with the restricted geographic area; or the geographic coordinates of the restricted geographic area, the at least one frequency band associated with the restricted geographic area and a time period during which the transmission restriction policy applies.

[0228] Aspect 5: The method of any of aspects 1 through 4, further comprising: receiving a control message that enables or disables the transmission restriction policy for the restricted geographic area.

[0229] Aspect 6: The method of any of aspects 1 through 5, wherein the transmission restriction policy indicates a restriction prohibiting transmission using at least a first frequency band within the restricted geographic area, permits transmission using a second frequency band within the restricted geographic area, or both.

[0230] Aspect 7: The method of any of aspects 1 through 6, wherein the transmission restriction policy indicates a transmission power limit for transmissions within the restricted geographic area, wherein performing the procedure comprises: transmitting a first message in accordance with the transmission power limit.

[0231] Aspect 8: The method of any of aspects 1 through 7, wherein receiving the one or more messages further comprises: receiving a RRC message, a SIB, a DCI message, or a MAC-CE message, based at least in part on the UE being disposed inside of a coverage area associated with a network entity.

[0232] Aspect 9: The method of any of aspects 1 through 8, wherein receiving the one or more messages further comprises: receiving one or more application layer messages or one or more sidelink messages based at least in part on the UE being disposed outside of a coverage area associated with a network entity.

[0233] Aspect 10: The method of any of aspects 1 through 9, wherein receiving the one or more messages further comprises: receiving a bit field comprising a barring bit indicating whether establishing connectivity with a cell within the restricted geographic area is barred.

[0234] Aspect 11: The method of any of aspects 1 through 10, wherein receiving the one or more messages further comprises: receiving a network signaling field comprising a value indicating that establishing connectivity with a cell is permitted when the UE is located outside of the restricted geographic area and that establishing connectivity with the cell is not permitted when the aerial UE

is located within the restricted geographic area.
[0235] Aspect 12: The method of aspect 11, wherein the network signaling field comprises a first network signaling value indicating an area type, a second network signaling value indicating the geographic coordinates, or both, or wherein the geographic coordinates are associated with an altitude for the restricted geographic area.
[0236] Aspect 13: The method of any of aspects 1 through 12, wherein receiving the one or more messages further comprises: receiving signaling indicating that transmission is barred in the restricted geographic area or indicating permission to transmit in accordance with the transmission restriction policy in the restricted geographic area.
[0237] Aspect 14: A method for wireless communications at a network entity, comprising: generating one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area; and outputting the one or more messages to a UE.
[0238] Aspect 15: The method of aspect 14, further comprising: outputting, during a handover procedure, an indication of the area type indicator and the transmission restriction policy associated with the restricted geographic area, to a handover candidate network entity.
[0239] Aspect 16: The method of aspect 15, further comprising: obtaining an indication an area type capability associated with the handover candidate network entity, wherein transmitting the indication of the area type indicator and the transmission restriction policy is based at least in part on the area type capability associated with the handover candidate network entity.
[0240] Aspect 17: The method of aspect 16, further comprising: obtaining, during the handover procedure, an indication of handover failure based at least in part on the area type capability being incompatible with the transmission restriction policy associated with the area type.
[0241] Aspect 18: The method of any of aspects 14 through 17, wherein outputting the one or more messages indicating the geographic coordinates is based at least in part on a capability of the UE.
[0242] Aspect 19: The method of any of aspects 14 through 18, wherein the one or more messages indicates: the geographic coordinates of the restricted geographic area and at least one frequency band associated with the restricted geographic area; or the geographic coordinates of the restricted geographic area, the at least one frequency band associated with the restricted geographic area and a time period during which the transmission restriction policy applies.
[0243] Aspect 20: The method of any of aspects 14 through 19, further comprising: outputting a control message that enables or disables the transmission restriction policy for the restricted geographic area.
[0244] Aspect 21: The method of any of aspects 14 through 20, wherein the transmission restriction policy indicates a restriction prohibiting transmission using at least a first frequency band within the restricted geographic area, permits transmission using a second frequency band within the restricted geographic area, or both.
[0245] Aspect 22: The method of any of aspects 14 through 21, wherein the transmission restriction policy indicates a transmission power limit for transmissions within the restricted geographic area.
[0246] Aspect 23: The method of any of aspects 14 through 22, wherein outputting the one or more messages further comprises: outputting a RRC message, a SIB, a DCI message, or a MAC-CE message, based at least in part on the UE being disposed inside of a coverage area associated with a network entity.
[0247] Aspect 24: The method of any of aspects 14 through 23, wherein outputting the one or more messages further comprises: outputting one or more application layer messages or one or more sidelink messages based at least in part on the UE being disposed outside of a coverage area associated with a network entity.
[0248] Aspect 25: The method of any of aspects 14 through 24, wherein outputting the one or more

messages further comprises: outputting a bit field comprising a barring bit indicating whether establishing connectivity with a cell within the restricted geographic area is barred.
[0249] Aspect 26: The method of any of aspects 14 through 25, wherein outputting the one or more messages further comprises: outputting a network signaling field comprising a value indicating that establishing connectivity with a cell is permitted when the UE is located outside of the restricted geographic area and that establishing connectivity with the cell is not permitted when the UE is located within the restricted geographic area.
[0250] Aspect 27: The method of aspect 26, wherein the network signaling field comprises a first network signaling value indicating an area type or a second network signaling value indicating the geographic coordinates or wherein the geographic coordinates are associated with an altitude for the restricted geographic area.
[0251] Aspect 28: The method of any of aspects 14 through 27, further comprising: outputting one or more messages indicating an area type indicator for the restricted geographic area, the area type indicator indicating that the restricted geographic area is a no fly zone, a no uplink transmission zone, or a no departure zone.
[0252] Aspect 29: The method of any of aspects 14 through 28, further comprising: outputting signaling indicating that transmission is barred in the restricted geographic area or indicating permission to transmit in accordance with the transmission restriction policy in the restricted geographic area
[0253] Aspect 30: A UE for wireless communications, comprising one or more memories storing processor-executable code, and one or more processors coupled with the one or more memories and individually or collectively operable to execute the code to cause the UE to perform a method of any of aspects 1 through 13.
[0254] Aspect 31: A UE for wireless communications, comprising at least one means for performing a method of any of aspects 1 through 13.
[0255] Aspect 32: A non-transitory computer-readable medium storing code for wireless communications, the code comprising instructions executable by one or more processors to perform a method of any of aspects 1 through 13.
[0256] Aspect 33: A network entity for wireless communications, comprising one or more memories storing processor-executable code, and one or more processors coupled with the one or more memories and individually or collectively operable to execute the code to cause the network entity to perform a method of any of aspects 14 through 29.
[0257] Aspect 34: A network entity for wireless communications, comprising at least one means for performing a method of any of aspects 14 through 29.
[0258] Aspect 35: A non-transitory computer-readable medium storing code for wireless communications, the code comprising instructions executable by one or more processors to perform a method of any of aspects 14 through 29.
[0259] It should be noted that the methods described herein describe possible implementations. The operations and the steps may be rearranged or otherwise modified and other implementations are possible. Further, aspects from two or more of the methods may be combined.
[0260] Although aspects of an LTE, LTE-A, LTE-A Pro, or NR system may be described for purposes of example, and LTE, LTE-A, LTE-A Pro, or NR terminology may be used in much of the description, the techniques described herein are applicable beyond LTE, LTE-A, LTE-A Pro, or NR networks. For example, the described techniques may be applicable to various other wireless communications systems such as Ultra Mobile Broadband (UMB), Institute of Electrical and Electronics Engineers (IEEE) 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, Flash-OFDM, as well as other systems and radio technologies not explicitly mentioned herein.
[0261] Information and signals described herein may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the description may be

represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0262] The various illustrative blocks and components described in connection with the disclosure herein may be implemented or performed using a general-purpose processor, a DSP, an ASIC, a CPU, a graphics processing unit (GPU), a neural processing unit (NPU), an FPGA or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor but, in the alternative, the processor may be any processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices (e.g., a combination of a DSP and a microprocessor, multiple microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration). Any functions or operations described herein as being capable of being performed by a processor may be performed by multiple processors that, individually or collectively, are capable of performing the described functions or operations.

[0263] The functions described herein may be implemented using hardware, software executed by a processor, firmware, or any combination thereof. If implemented using software executed by a processor, the functions may be stored as or transmitted using one or more instructions or code of a computer-readable medium. Other examples and implementations are within the scope of the disclosure and appended claims. For example, due to the nature of software, functions described herein may be implemented using software executed by a processor, hardware, firmware, hardwiring, or combinations of any of these. Features implementing functions may also be physically located at various positions, including being distributed such that portions of functions are implemented at different physical locations.

[0264] Computer-readable media includes both non-transitory computer storage media and communication media including any medium that facilitates transfer of a computer program from one location to another. A non-transitory storage medium may be any available medium that may be accessed by a general-purpose or special-purpose computer. By way of example, and not limitation, non-transitory computer-readable media may include RAM, ROM, electrically erasable programmable ROM (EEPROM), flash memory, compact disk (CD) ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other non-transitory medium that may be used to carry or store desired program code means in the form of instructions or data structures and that may be accessed by a general-purpose or special-purpose computer or a general-purpose or special-purpose processor. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of computer-readable medium. Disk and disc, as used herein, include CD, laser disc, optical disc, digital versatile disc (DVD), floppy disk, and Blu-ray disc. Disks may reproduce data magnetically, and discs may reproduce data optically using lasers. Combinations of the above are also included within the scope of computer-readable media. Any functions or operations described herein as being capable of being performed by a memory may be performed by multiple memories that, individually or collectively, are capable of performing the described functions or operations.

[0265] As used herein, including in the claims, “or” as used in a list of items (e.g., a list of items prefaced by a phrase such as “at least one of” or “one or more of”) indicates an inclusive list such that, for example, a list of at least one of A, B, or C means A or B or C or AB or AC or BC or ABC (i.e., A and B and C). Also, as used herein, the phrase “based on” shall not be construed as a reference to a closed set of conditions. For example, an example step that is described as “based on condition A” may be based on both a condition A and a condition B without departing from the

scope of the present disclosure. In other words, as used herein, the phrase “based on” shall be construed in the same manner as the phrase “based at least in part on.”

[0266] As used herein, including in the claims, the article “a” before a noun is open-ended and understood to refer to “at least one” of those nouns or “one or more” of those nouns. Thus, the terms “a,” “at least one,” “one or more,” and “at least one of one or more” may be interchangeable. For example, if a claim recites “a component” that performs one or more functions, each of the individual functions may be performed by a single component or by any combination of multiple components. Thus, the term “a component” having characteristics or performing functions may refer to “at least one of one or more components” having a particular characteristic or performing a particular function. Subsequent reference to a component introduced with the article “a” using the terms “the” or “said” may refer to any or all of the one or more components. For example, a component introduced with the article “a” may be understood to mean “one or more components,” and referring to “the component” subsequently in the claims may be understood to be equivalent to referring to “at least one of the one or more components.” Similarly, subsequent reference to a component introduced as “one or more components” using the terms “the” or “said” may refer to any or all of the one or more components. For example, referring to “the one or more components” subsequently in the claims may be understood to be equivalent to referring to “at least one of the one or more components.”

[0267] The term “determine” or “determining” encompasses a variety of actions and, therefore, “determining” can include calculating, computing, processing, deriving, investigating, looking up (such as via looking up in a table, a database, or another data structure), ascertaining, and the like. Also, “determining” can include receiving (e.g., receiving information), accessing (e.g., accessing data stored in memory), and the like. Also, “determining” can include resolving, obtaining, selecting, choosing, establishing, and other such similar actions.

[0268] In the appended figures, similar components or features may have the same reference label. Further, various components of the same type may be distinguished by following the reference label by a dash and a second label that distinguishes among the similar components. If just the first reference label is used in the specification, the description is applicable to any one of the similar components having the same first reference label irrespective of the second reference label or other subsequent reference label.

[0269] The description set forth herein, in connection with the appended drawings, describes example configurations and does not represent all the examples that may be implemented or that are within the scope of the claims. The term “example” used herein means “serving as an example, instance, or illustration” and not “preferred” or “advantageous over other examples.” The detailed description includes specific details for the purpose of providing an understanding of the described techniques. These techniques, however, may be practiced without these specific details. In some figures, known structures and devices are shown in block diagram form in order to avoid obscuring the concepts of the described examples.

[0270] The description herein is provided to enable a person having ordinary skill in the art to make or use the disclosure. Various modifications to the disclosure will be apparent to a person having ordinary skill in the art, and the generic principles defined herein may be applied to other variations without departing from the scope of the disclosure. Thus, the disclosure is not limited to the examples and designs described herein but is to be accorded the broadest scope consistent with the principles and novel features disclosed herein.

## Claims

**1**. A user equipment (UE), comprising: one or more memories storing processor-executable code; and one or more processors coupled with the one or more memories and individually or collectively operable to execute the code to cause the UE to: receive one or more messages

indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area; and perform a procedure that complies with the transmission restriction policy based at least in part on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.

**2**. The UE of claim 1, wherein the one or more processors are individually or collectively further operable to execute the code to cause the UE to: receive one or more messages indicating an area type indicator for the restricted geographic area, the area type indicator indicating that the restricted geographic area is a no fly zone, a no uplink transmission zone, or a no departure zone.

**3**. The UE of claim 1, wherein receiving the one or more messages indicating the geographic coordinates is based at least in part on a capability of the UE.

**4**. The UE of claim 1, wherein the one or more messages indicates: the geographic coordinates of the restricted geographic area and at least one frequency band associated with the restricted geographic area; or the geographic coordinates of the restricted geographic area, the at least one frequency band associated with the restricted geographic area and a time period during which the transmission restriction policy applies.

**5**. The UE of claim 1, wherein the one or more processors are individually or collectively further operable to execute the code to cause the UE to: receive a control message that enables or disables the transmission restriction policy for the restricted geographic area.

**6**. The UE of claim 1, wherein the transmission restriction policy indicates a restriction prohibiting transmission using at least a first frequency band within the restricted geographic area, permits transmission using a second frequency band within the restricted geographic area, or both.

**7**. The UE of claim 1, wherein, to perform the procedure, the one or more processors are individually or collectively operable to execute the code to cause the UE to: transmit a first message in accordance with a transmission power limit.

**8**. The UE of claim 1, wherein, to receive the one or more messages, the one or more processors are individually or collectively further operable to execute the code to cause the UE to: receive a radio resource control message, a system information block, a downlink control information message, or a medium access control element message, based at least in part on the UE being disposed inside of a coverage area associated with a network entity.

**9**. The UE of claim 1, wherein, to receive the one or more messages, the one or more processors are individually or collectively further operable to execute the code to cause the UE to: receive one or more application layer messages or one or more sidelink messages based at least in part on the UE being disposed outside of a coverage area associated with a network entity.

**10**. The UE of claim 1, wherein, to receive the one or more messages, the one or more processors are individually or collectively further operable to execute the code to cause the UE to: receive a bit field comprising a barring bit indicating whether establishing connectivity with a cell within the restricted geographic area is barred.

**11**. The UE of claim 1, wherein, to receive the one or more messages, the one or more processors are individually or collectively further operable to execute the code to cause the UE to: receive a network signaling field comprising a value indicating that establishing connectivity with a cell is permitted when the UE is located outside of the restricted geographic area and that establishing connectivity with the cell is not permitted when the UE is located within the restricted geographic area.

**12**. The UE of claim 11, wherein the network signaling field comprises a first network signaling value indicating an area type, a second network signaling value indicating the geographic coordinates, or both, or wherein the geographic coordinates are associated with an altitude for the restricted geographic area.

**13**. The UE of claim 1, wherein, to receive the one or more messages, the one or more processors are individually or collectively further operable to execute the code to cause the UE to: receive signaling indicating that transmission is barred in the restricted geographic area or indicating permission to transmit in accordance with the transmission restriction policy in the restricted geographic area.

**14**. A method for wireless communications at a user equipment (UE), comprising: receiving one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area; and performing a procedure that complies with the transmission restriction policy based at least in part on a current geolocation of the UE relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.

**15**. The method of claim 14, further comprising: receiving one or more messages indicating an area type indicator for the restricted geographic area, the area type indicator indicating that the restricted geographic area is a no fly zone, a no uplink transmission zone, or a no departure zone.

**16**. The method of claim 14, wherein receiving the one or more messages indicating the geographic coordinates is based at least in part on a capability of the UE.

**17**. The method of claim 14, wherein the one or more messages indicates: the geographic coordinates of the restricted geographic area and at least one frequency band associated with the restricted geographic area; or the geographic coordinates of the restricted geographic area, the at least one frequency band associated with the restricted geographic area and a time period during which the transmission restriction policy applies or at least one frequency band associated with the restricted geographic area.

**18**. The method of claim 14, further comprising: receiving a control message that enables or disables the transmission restriction policy for the restricted geographic area.

**19**. The method of claim 14, wherein the transmission restriction policy indicates a restriction prohibiting transmission using at least a first frequency band within the restricted geographic area, permits transmission using a second frequency band within the restricted geographic area, or both.

**20**. A non-transitory computer-readable medium storing code for wireless communications, the code comprising instructions executable by one or more processors to: receive one or more messages indicating geographic coordinates of a restricted geographic area, the geographic coordinates corresponding to one or more boundaries of a polygon that defines an area or a volume of the restricted geographic area, the one or more messages further indicating a transmission restriction policy associated with the restricted geographic area; and perform a procedure that complies with the transmission restriction policy based at least in part on a current geolocation of the non-transitory computer-readable medium relative to the geographic coordinates corresponding to the one or more boundaries of the polygon associated with the restricted geographic area.