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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY DOCKET NO	TOT CLAIMS	IND CLAIMS
62/462,872	02/23/2017		260	030284.14372/172947P1		

CONFIRMATION NO. 7881

FILING RECEIPT



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15142

Arent Fox, LLP and Qualcomm, Incorporated
1717 K Street, NW
Washington, DC 20006-5344

Date Mailed: 03/06/2017

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Inventor(s)

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Applicant(s)

QUALCOMM Incorporated, San Diego, CA;

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Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

Title

USAGE OF SYNCHRONIZATION SIGNAL BLOCK INDEX IN NEW RADIO

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

page 1 of 3

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Application Number	To be assigned
Filing Date	Filed concurrently herewith
First Named Inventor	Tao LUO
Title	USAGE OF SYNCHRONIZATION SIGNAL BLOCK INDEX IN NEW RADIO
Art Unit	To be assigned
Examiner Name	To be assigned
Attorney Docket Number	030284.14372/172947P1

SIGNATURE of Applicant or Patent Practitioner

Signature	/Jonas J. Hodges/	Date (Optional)	2017-02-23
Name	Jonas J. Hodges	Registration Number	58898
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.



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15142

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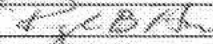
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SIGNATURE of Applicant for Patent

Signature		Date	9/26/2012
Name	Raymond B. Hon	Telephone	858-651-3679
Title and Company	Vice President, Patent Counsel and QUALCOMM Incorporated		

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Appendix

Usage of SS block index in NR

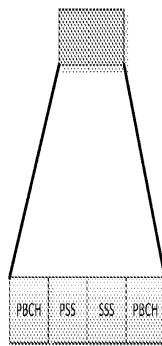
-
- PSS, SSS and/or PBCH can be transmitted within a 'SS block'
 - FFS: details how to compose PSS, SSS and/or PBCH
 - Multiplexing other signals are not precluded within a 'SS block'
 - One or multiple 'SS block(s)' compose an 'SS burst'
 - FFS: Number of 'SS block(s)' (defined as duration of 'SS burst')
 - FFS: whether or not 'SS block(s)' are consecutive
 - FFS: whether or not 'SS block(s)' within a 'SS burst' are the same
 - One or multiple 'SS burst(s)' compose a 'SS burst set'
 - FFS: Periodicity and the number of 'SS burst' within a SS burst set
 - Number of SS bursts within a SS burst set is finite.
 - FFS: Transmission instances of 'SS burst set'
 - E.g., periodic/aperiodic transmission of SS burst sets.

• SS block

- Multiple signals can be multiplexed within a SS block
- Multiplexing among signals can be TDM, FDM or a mixed of TDM/FDM
- Example below shows TDM multiplexing among PSS/SSS/PBCH
 - Note that additional signals can be added in a SS block

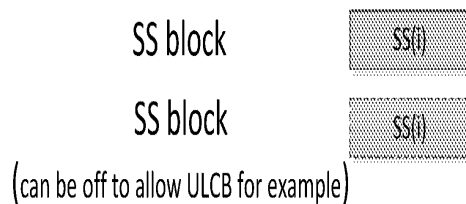
SS block

Examples



• SS Burst

- Multiple SS blocks can be multiplexed within a SS burst
- A gap may be used in a SS burst between SS blocks
 - This gap can be the same gap for a SS block
- Note that we can permute signal within a SS block such that different SS blocks in a SS burst may use the same signal but in different orders

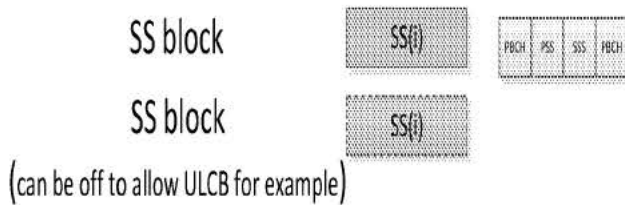


One SS burst

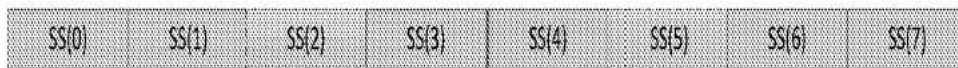


• SS Burst

- Variations of SS burst as a function of Bands



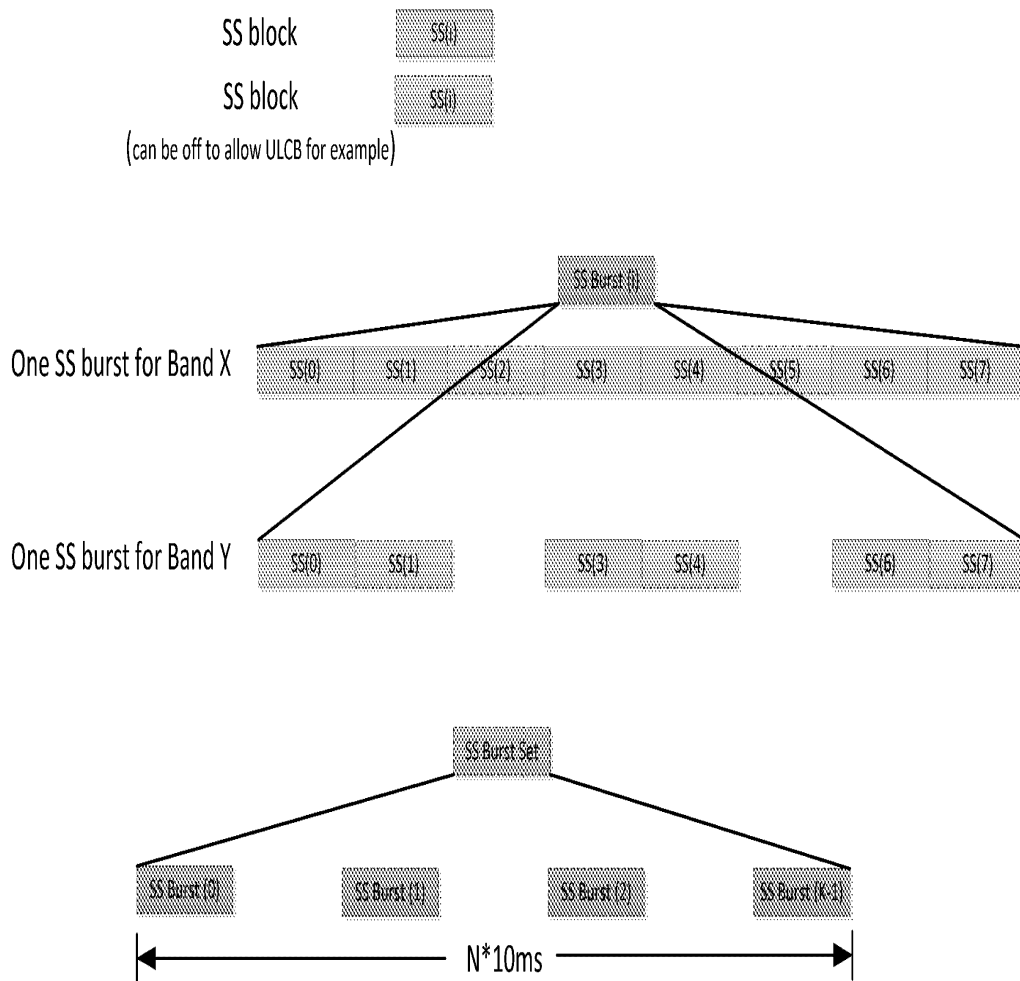
One SS burst for Band X



One SS burst for Band Y



• SS Burst Set



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- Periodicity of a SS burst in a SS burst set

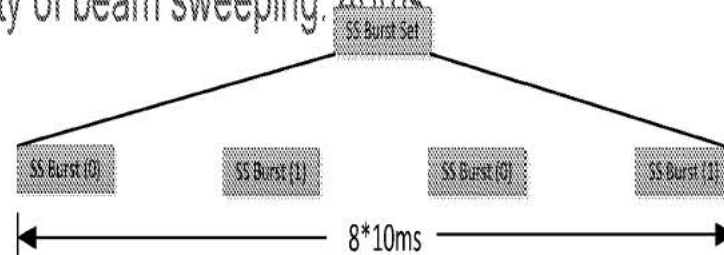
- It means how often a SS burst is transmitted in a SS burst set

- Periodicity of Beam sweeping in a SS burst set

- It means how often a beam sweeping burst repeats itself in a SS burst set
- Used by UE to filter RSRP over time for the same beam direction
- Used by UE to train sub-arrays

- Example

- 80 ms for a SS burst set
- Periodicity of a SS burst in a SS burst: every 20ms in this example
- Periodicity of beam sweeping: 40ms



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SS block index

- SS block index is used to indicate a SS block in a SS burst or burst set
- We may also have SS block index in a SS burst and have a burst index in a burst set
- In the rest document, we use
 - SS block index to indicate both cases
 - We may have a mapping function to map SS block index to some logic index and such logic index is used for the rest of document
 - We may have one to one mapping: one SS block index to one logic index
 - We may have many to one mapping: multiple SS block indexes can be mapped to one logic index

Proposals

- SS block index is used in part of scrambling seeds for
 - CSI-RS/MRS, DMRS for PDCCH, DMRS for PDSCH, DMRS for PUSCH, DMRS for PUCCH, PTRS
 - Data scrambling for PDSCH/PUSCH, paging channel, PUCCH, PDCCH, broadcast channel
- SS block index can be used as part of QCL configuration

Proposals

- SS block index can be used to scrambling CRC when encoding control payload (DL control, UL control)
 - This can be used to convey QCL parameters for control channel without explicit signaling
 - By decoding control channel and obtaining SS index, UE can figure out the QCI parameter: which SS block index is linked to this control channel link
 - Control channel may include common control channel and/or UE specific control channel
- When UE decodes such downlink control channel, it may use it or discard it depending on whether it is configured to receive such control channel scrambled by the SS block index

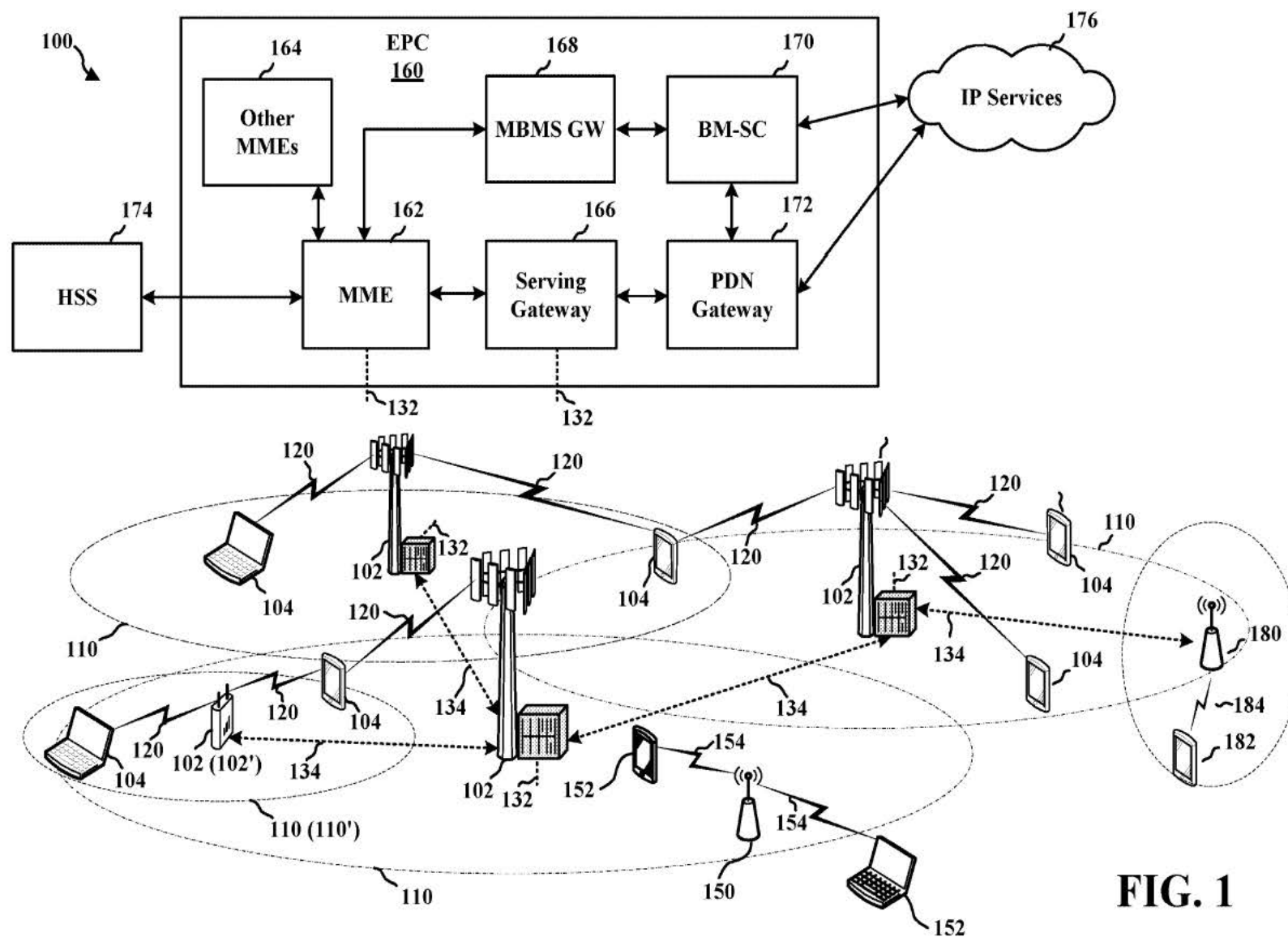


FIG. 1

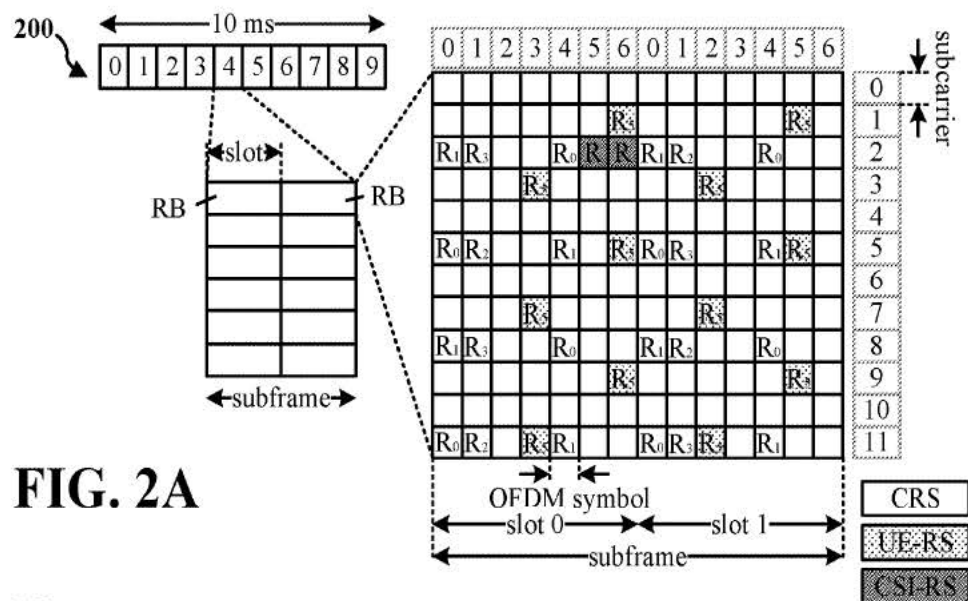


FIG. 2A

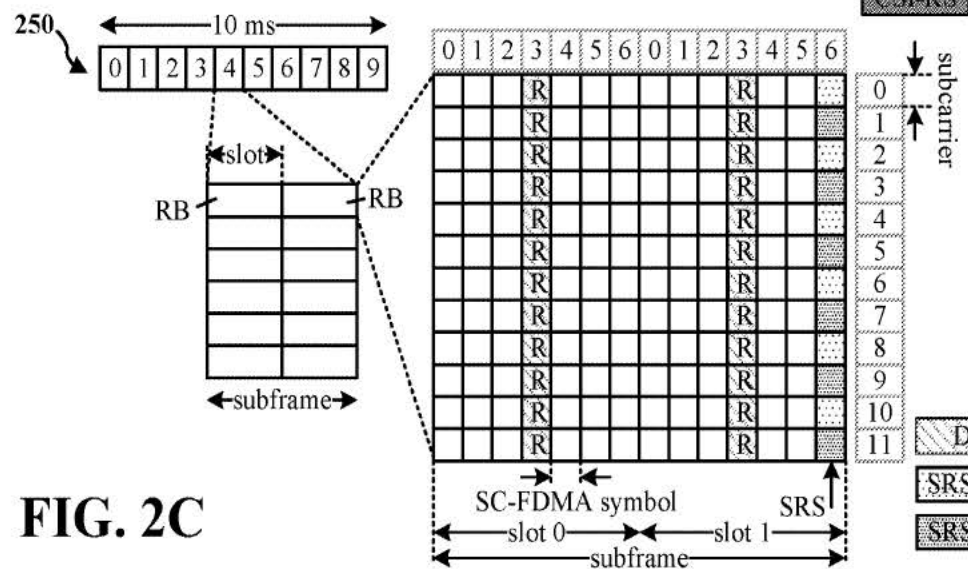


FIG. 2C

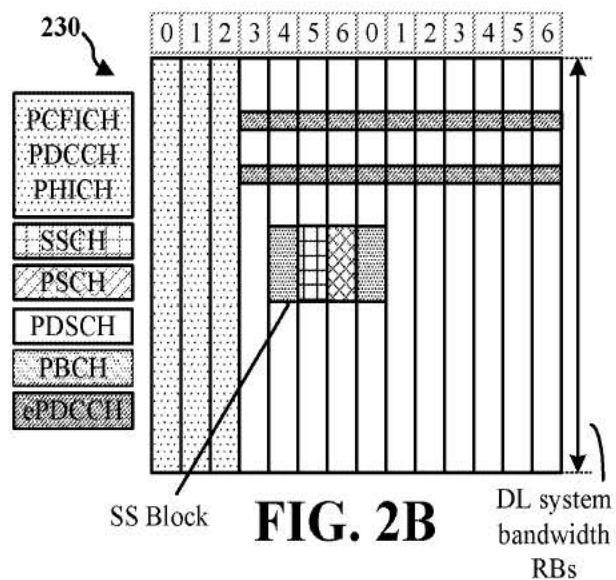


FIG. 2B

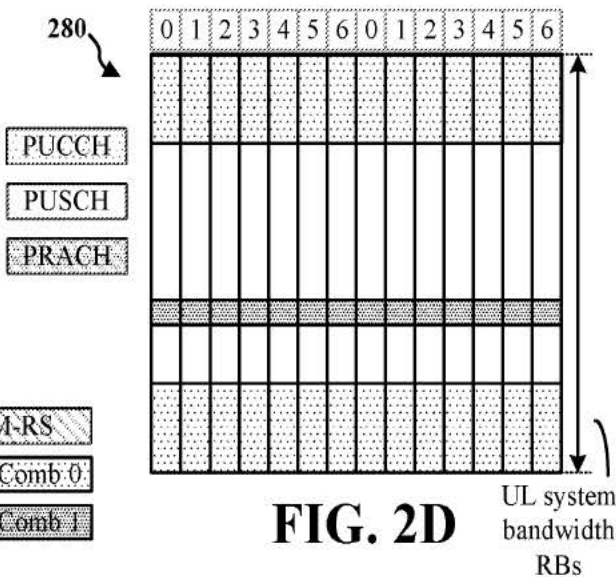


FIG. 2D

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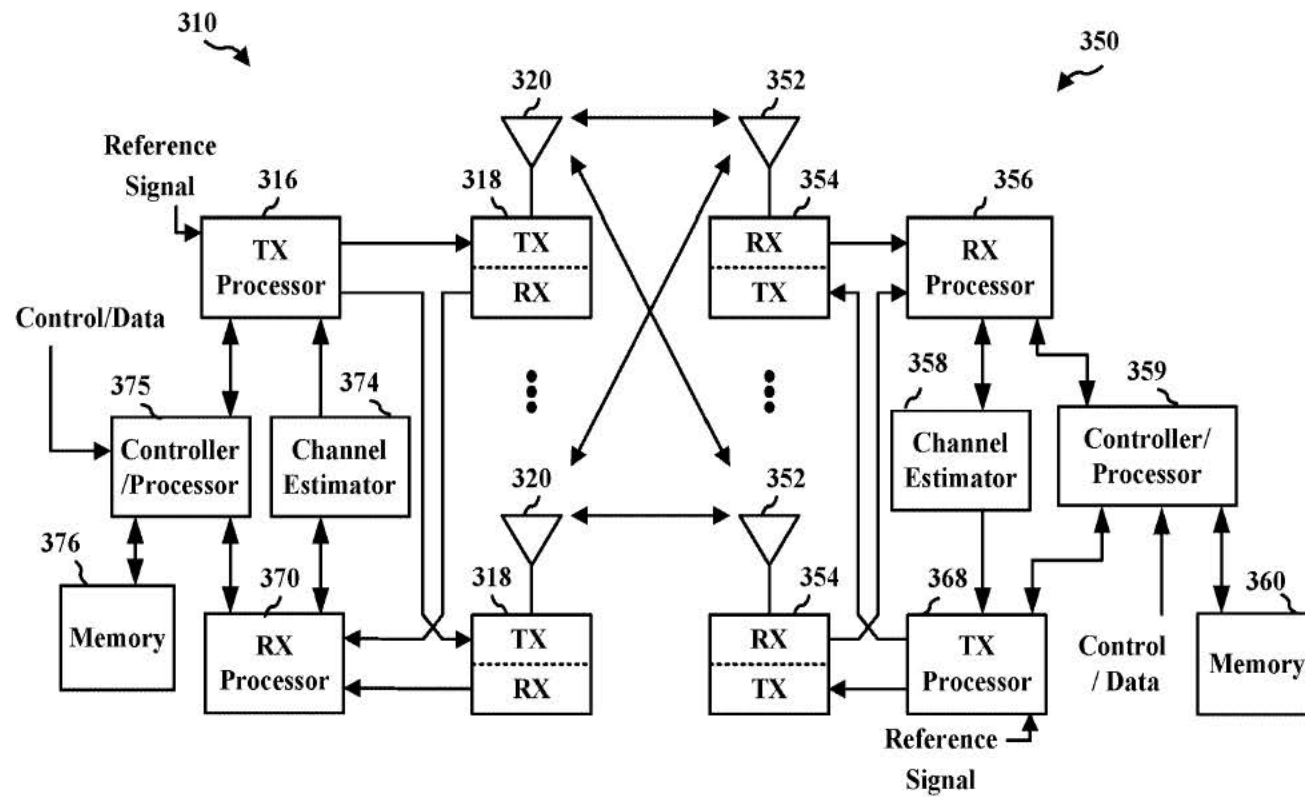


FIG. 3

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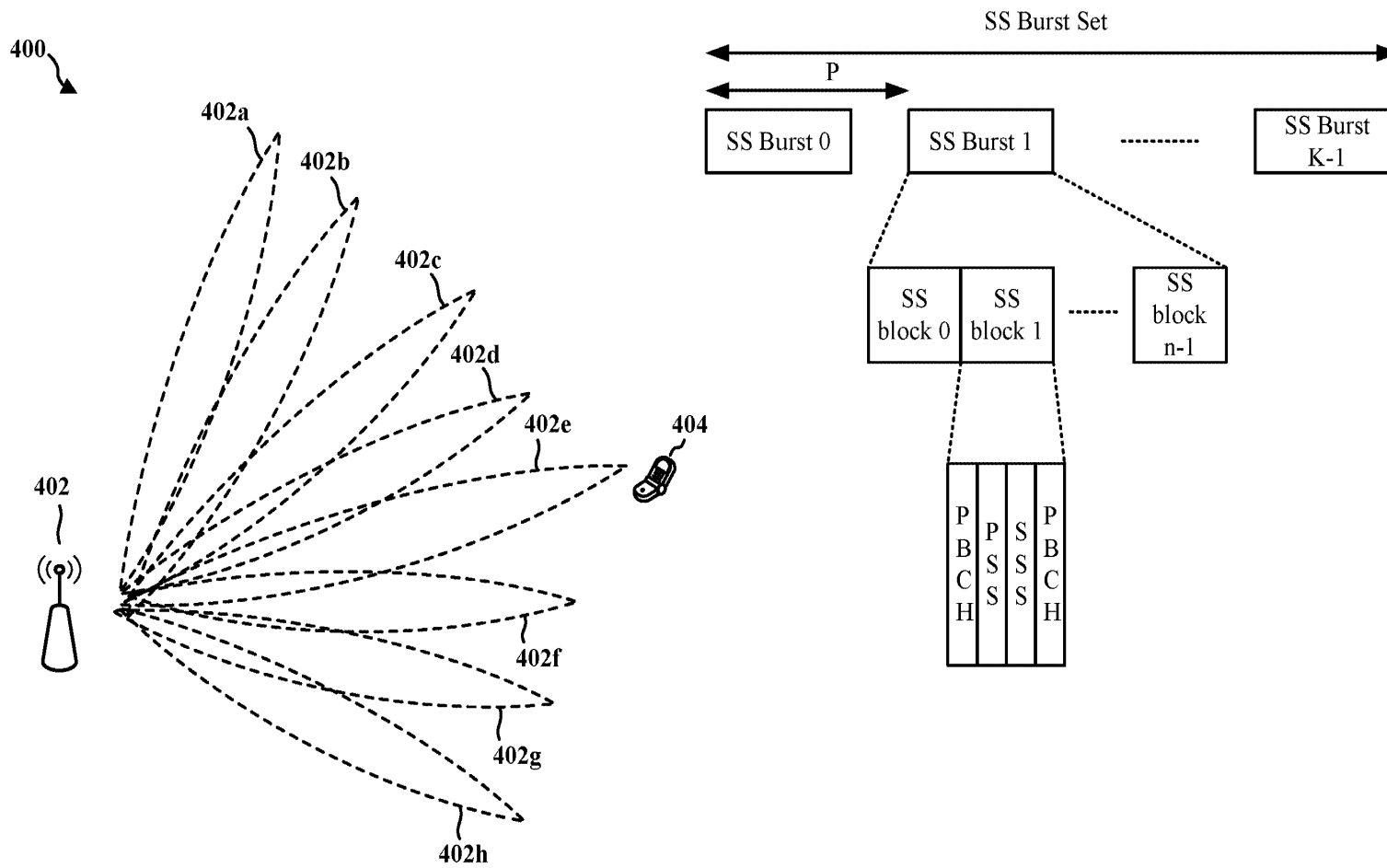


FIG. 4

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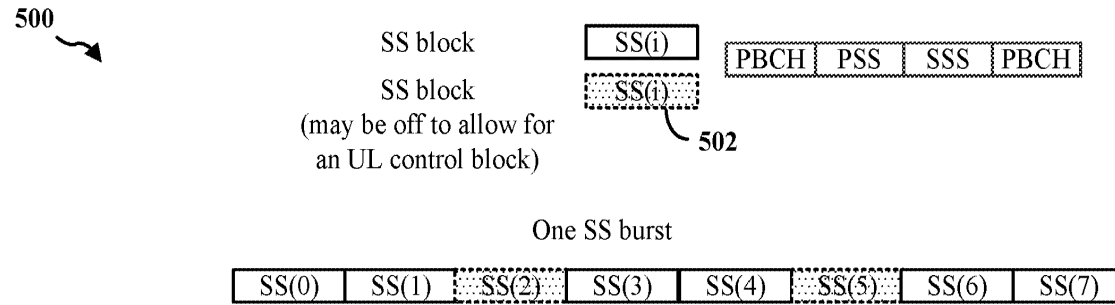


FIG. 5A

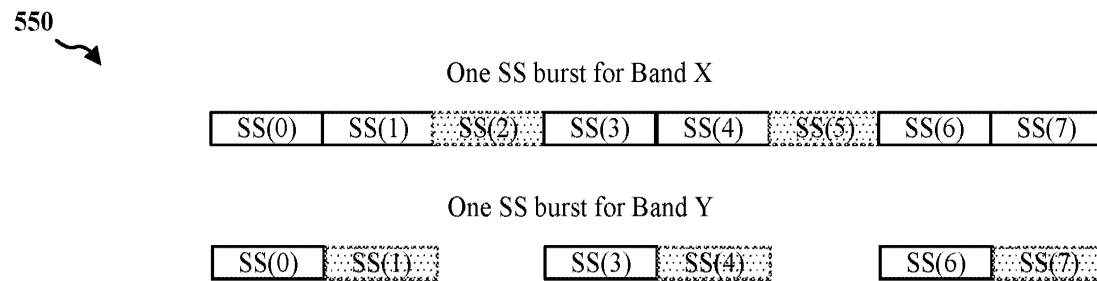


FIG. 5B

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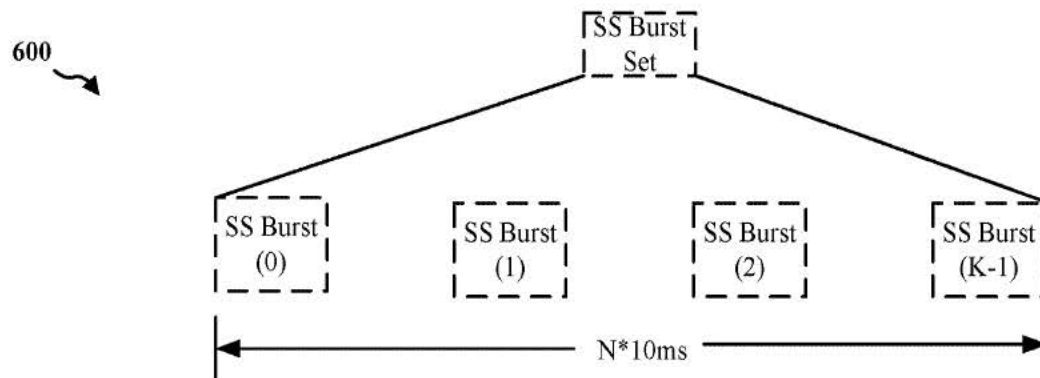


FIG. 6A

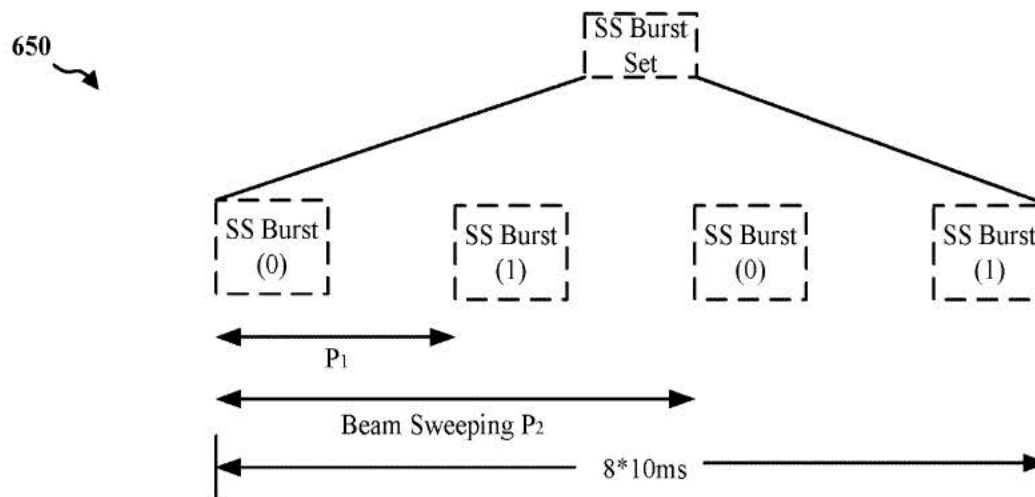


FIG. 6B

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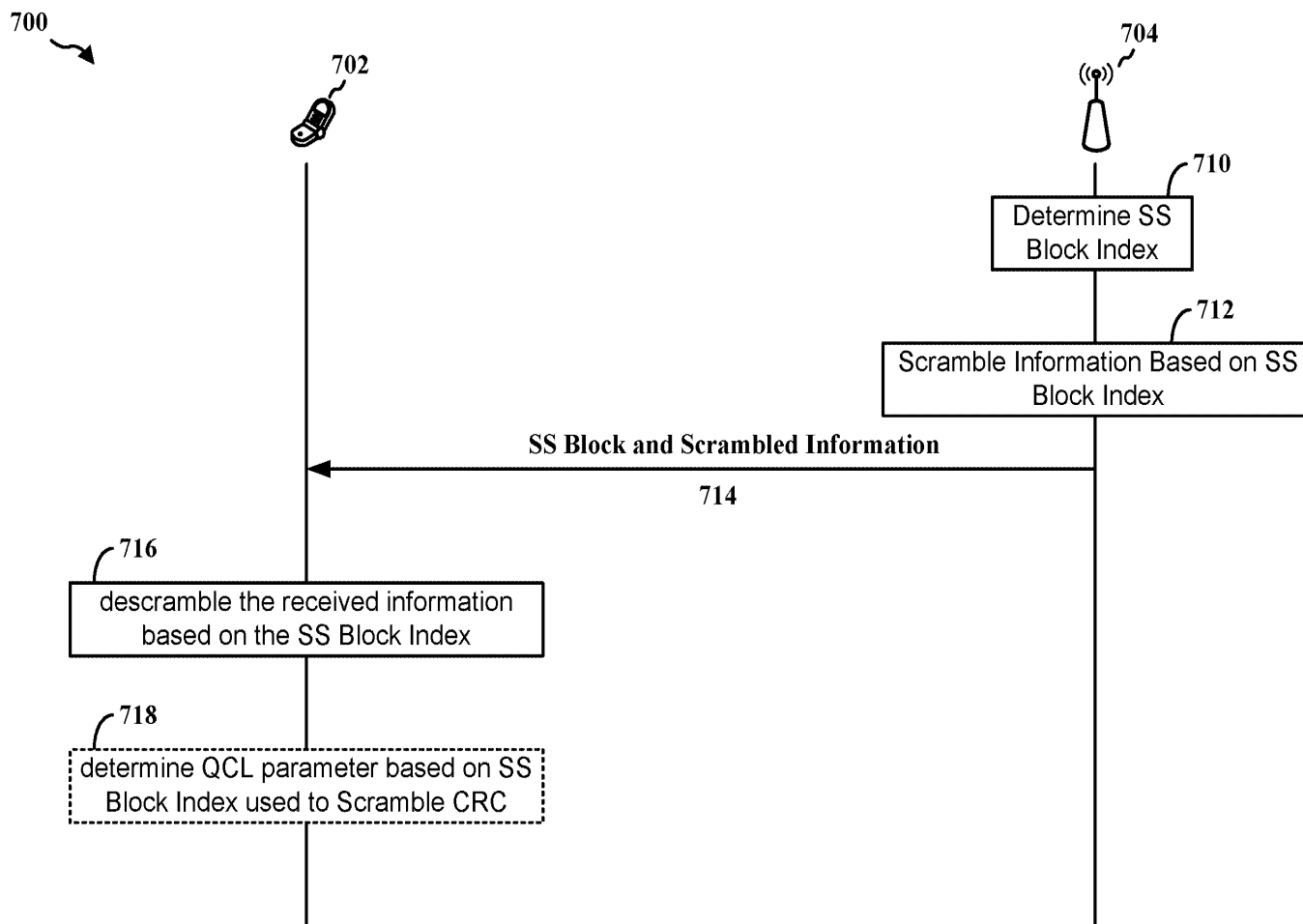


FIG. 7

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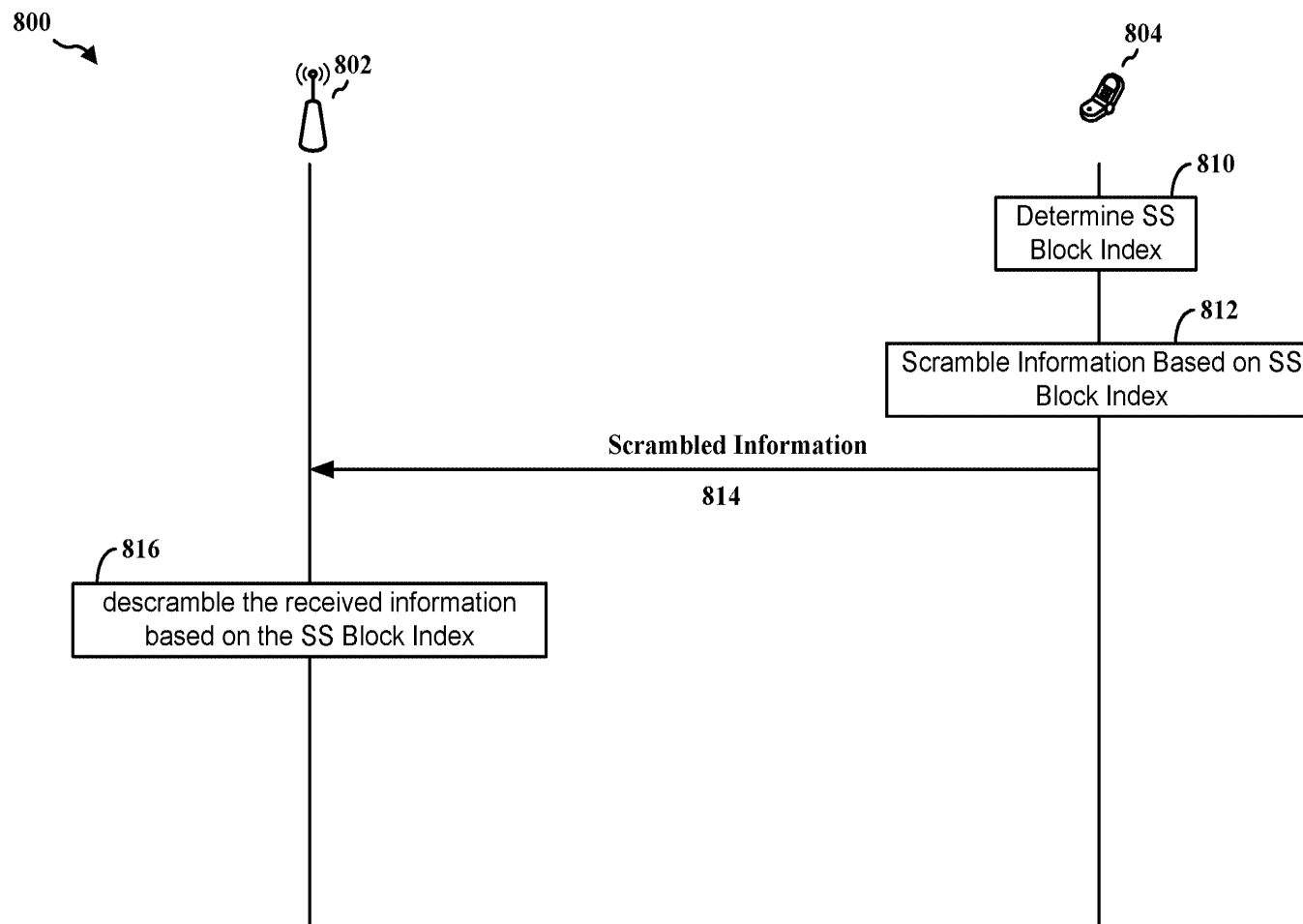


FIG. 8

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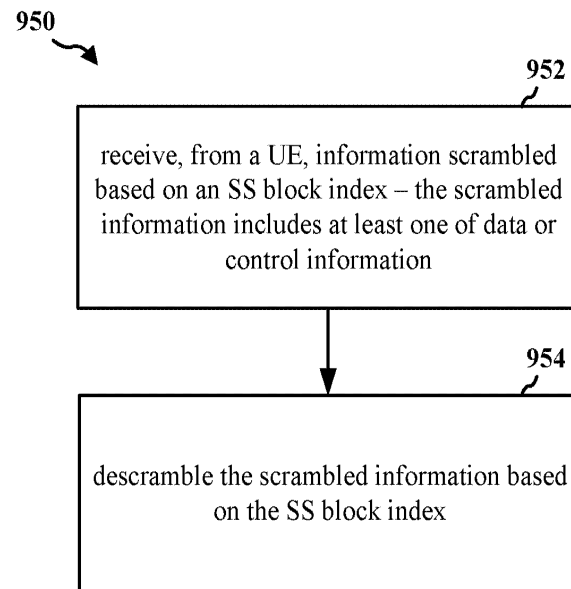
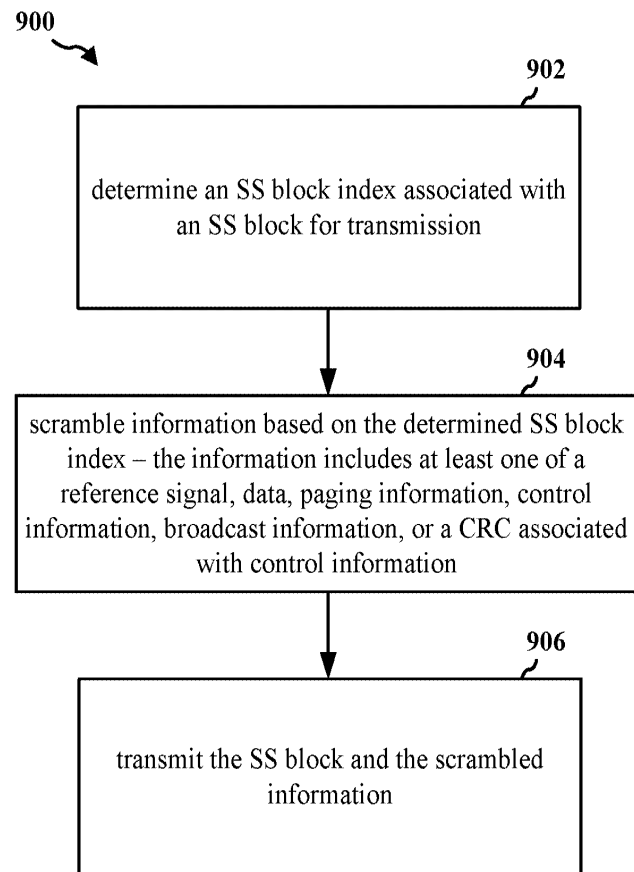


FIG. 9

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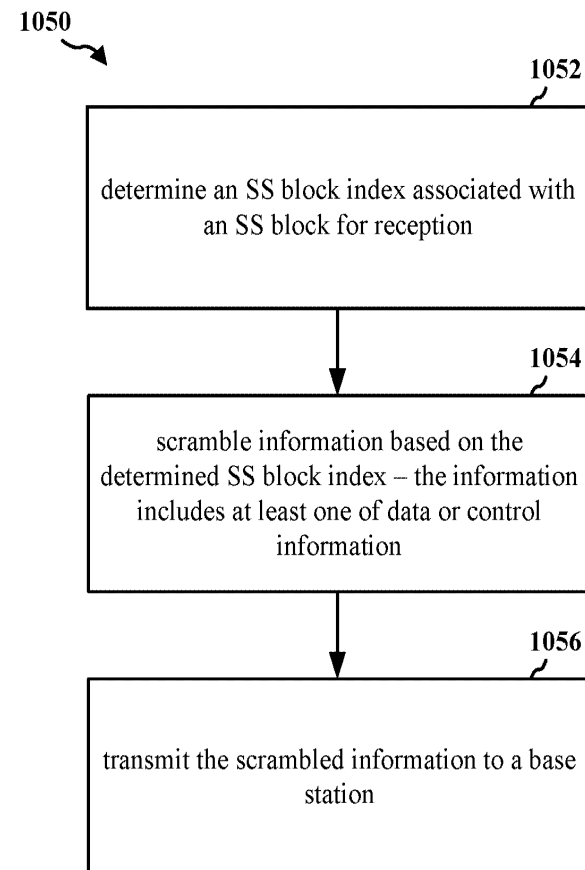
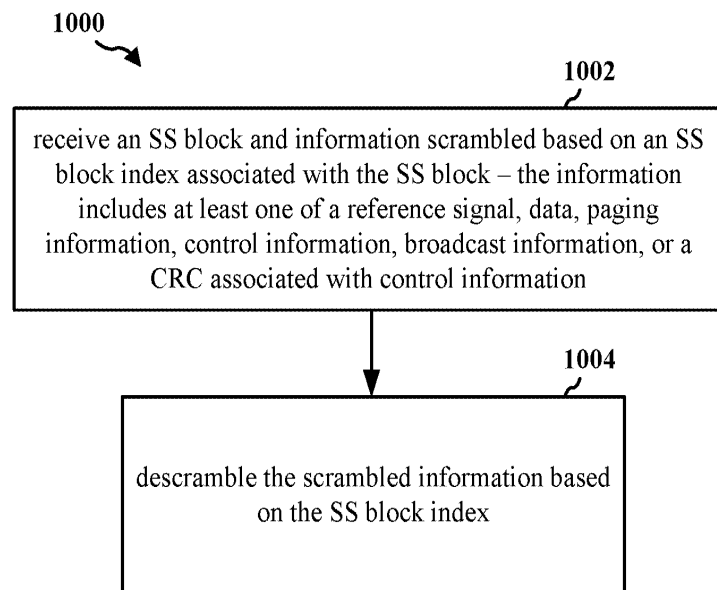


FIG. 10

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ABSTRACT

The apparatus determines an SS block index associated with an SS block for transmission. The apparatus scrambles information based on the determined SS block index. The information includes at least one of a reference signal, data, paging information, control information, broadcast information, or a CRC associated with control information. The apparatus transmits the SS block and the scrambled information.

CLAIMS

WHAT IS CLAIMED IS:

1. A method of wireless communication of a base station, comprising:
 - determining a synchronization signal (SS) block index associated with an SS block for transmission;
 - scrambling information based on the determined SS block index, the information including at least one of a reference signal, data, paging information, control information, broadcast information, or a cyclic redundancy check (CRC) associated with control information; and
 - transmitting the SS block and the scrambled information.
2. The method of claim 1, wherein the reference signal (RS) is at least one of channel state information (CSI) RS (CSI-RS), measurement RS (MRS), demodulation RS (DM-RS) for a physical downlink control channel (PDCCH), DM-RS for a physical downlink shared channel (PDSCH), or a phase-noise tracking RS (PTRS).
3. The method of claim 1, wherein the data is for a physical downlink shared channel (PDSCH), the paging information is for a paging channel (PCH), the control information is for a physical downlink control channel (PDCCH), and the broadcast information is for a physical broadcast channel (PBCH).
4. The method of claim 1, wherein the SS block includes at least one of a primary synchronization signal (PSS), a secondary synchronization signal (SSS), or a physical broadcast channel (PBCH).
5. The method of claim 1, wherein the scrambled information includes the CRC scrambled based on the SS block index, the CRC is for control information sent to the UE, the method further comprises determining an SS block to be used by a user equipment (UE) in association with quasi-co location (QCL) of reference signals, and the CRC is scrambled based on the SS block index of the determined SS block to be used by the UE in association with QCL of reference signals.

6. A method of wireless communication of a base station, comprising:
 - receiving, from a user equipment (UE), information scrambled based on a synchronization signal (SS) block index, the scrambled information including at least one of data or control information; and
 - descrambling the scrambled information based on the SS block index.
7. The method of claim 6, wherein the data is for a physical uplink shared channel (PUSCH), and the control information is for a physical uplink control channel (PUCCH).
8. The method of claim 6, further comprising sending, to the UE, an uplink grant for the information, the uplink grant being associated with the SS block index.
9. The method of claim 6, further comprising sending, to the UE, SS block index information indicating the SS block index for scrambling the information.
10. The method of claim 1, wherein the scrambling the information comprises generating a scrambling sequence based on a sequence initialization that is based at least in part on the SS block index, wherein the information before scrambling is at least one of encoded or unencoded, and is scrambled based on the generated scrambling sequence.
11. A method of wireless communication of a user equipment (UE), comprising:
 - receiving a synchronization signal (SS) block and information scrambled based on an SS block index associated with the SS block, the information including at least one of a reference signal, data, paging information, control information, broadcast information, or a cyclic redundancy check (CRC) associated with control information; and
 - descrambling the scrambled information based on the SS block index.
12. The method of claim 11, wherein the reference signal (RS) is at least one of channel state information (CSI) RS (CSI-RS), measurement RS (MRS), demodulation RS (DM-

RS) for a physical downlink control channel (PDCCH), DM-RS for a physical downlink shared channel (PDSCH), or a phase-noise tracking RS (PTRS).

13. The method of claim 11, wherein the data is for a physical downlink shared channel (PDSCH), the paging information is for a paging channel (PCH), the control information is for a physical downlink control channel (PDCCH), and the broadcast information is for a physical broadcast channel (PBCH).

14. The method of claim 11, wherein the SS block includes at least one of a primary synchronization signal (PSS), a secondary synchronization signal (SSS), or a physical broadcast channel (PBCH).

15. The method of claim 11, wherein the scrambled information includes the CRC scrambled based on the SS block index, the method further comprising:

descrambling the CRC based on the SS block index;

decoding received control information based on the descrambled CRC; and

determining a quasi-co location (QCL) parameter based on the SS block index used to descramble the CRC.

16. A method of wireless communication of a user equipment (UE), comprising:

determining a synchronization signal (SS) block index associated with an SS block for reception;

scrambling information based on the determined SS block index, the information including at least one of data, control information, or a cyclic redundancy check (CRC) associated with control information; and

transmitting the scrambled information to a base station.

17. The method of claim 16, wherein the data is for a physical uplink shared channel (PUSCH), and the control information is for a physical uplink control channel (PUCCH).

18. The method of claim 16, further comprising receiving an uplink grant from the base station, wherein the SS block index is determined based on the uplink grant.

19. The method of claim 16, further comprising receiving, from the base station, information indicating the SS block index.

20. The method of claim 16, wherein the scrambling the information comprises generating a scrambling sequence based on a sequence initialization that is based at least in part on the SS block index, wherein the information before scrambling is at least one of encoded or unencoded, and is scrambled based on the generated scrambling sequence.

21. An apparatus for wireless communication, the apparatus being a base station, comprising:

- a memory; and

- at least one processor coupled to the memory and configured to:

- determine a synchronization signal (SS) block index associated with an SS block for transmission;

- scramble information based on the determined SS block index, the information including at least one of a reference signal, data, paging information, control information, broadcast information, or a cyclic redundancy check (CRC) associated with control information; and

- transmit the SS block and the scrambled information.

22. The apparatus of claim 21, wherein the reference signal (RS) is at least one of channel state information (CSI) RS (CSI-RS), measurement RS (MRS), demodulation RS (DM-RS) for a physical downlink control channel (PDCCH), DM-RS for a physical downlink shared channel (PDSCH), or a phase-noise tracking RS (PTRS).

23. The apparatus of claim 21, wherein the data is for a physical downlink shared channel (PDSCH), the paging information is for a paging channel (PCH), the control information is for a physical downlink control channel (PDCCH), and the broadcast information is for a physical broadcast channel (PBCH).

24. The apparatus of claim 21, wherein the SS block includes at least one of a primary synchronization signal (PSS), a secondary synchronization signal (SSS), or a physical broadcast channel (PBCH).

25. The apparatus of claim 21, wherein the scrambled information includes the CRC scrambled based on the SS block index, the CRC is for control information sent to the UE, the at least one processor is further configured to determine an SS block to be used by a user equipment (UE) in association with quasi-co location (QCL) of reference signals, and the CRC is scrambled based on the SS block index of the determined SS block to be used by the UE in association with QCL of reference signals.

26. The apparatus of claim 21, wherein the at least one processor is configured to scramble the information by generating a scrambling sequence based on a sequence initialization that is based at least in part on the SS block index, wherein the information before scrambling is at least one of encoded or unencoded, and is scrambled based on the generated scrambling sequence.

27. An apparatus for wireless communication, the apparatus being a base station, comprising:

- a memory; and

- at least one processor coupled to the memory and configured to:

- receive, from a user equipment (UE), information scrambled based on a synchronization signal (SS) block index, the scrambled information including at least one of data or control information; and

- descramble the scrambled information based on the SS block index.

28. The apparatus of claim 27, wherein the data is for a physical uplink shared channel (PUSCH), and the control information is for a physical uplink control channel (PUCCH).

29. The apparatus of claim 27, wherein the at least one processor is further configured to send, to the UE, an uplink grant for the information, the uplink grant being associated with the SS block index.

30. The apparatus of claim 27, wherein the at least one processor is further configured to send, to the UE, SS block index information indicating the SS block index for scrambling the information.

31. An apparatus for wireless communication, the apparatus being a user equipment (UE), comprising:

a memory; and

at least one processor coupled to the memory and configured to:

receive a synchronization signal (SS) block and information scrambled based on an SS block index associated with the SS block, the information including at least one of a reference signal, data, paging information, control information, broadcast information, or a cyclic redundancy check (CRC) associated with control information; and

descramble the scrambled information based on the SS block index.

32. The apparatus of claim 31, wherein the reference signal (RS) is at least one of channel state information (CSI) RS (CSI-RS), measurement RS (MRS), demodulation RS (DM-RS) for a physical downlink control channel (PDCCH), DM-RS for a physical downlink shared channel (PDSCH), or a phase-noise tracking RS (PTRS).

33. The apparatus of claim 31, wherein the data is for a physical downlink shared channel (PDSCH), the paging information is for a paging channel (PCH), the control information is for a physical downlink control channel (PDCCH), and the broadcast information is for a physical broadcast channel (PBCH).

34. The apparatus of claim 31, wherein the SS block includes at least one of a primary synchronization signal (PSS), a secondary synchronization signal (SSS), or a physical broadcast channel (PBCH).

35. The apparatus of claim 31, wherein the scrambled information includes the CRC scrambled based on the SS block index, and the at least one processor is further configured to:

descramble the CRC based on the SS block index;
decode received control information based on the descrambled CRC; and
determine a quasi-co location (QCL) parameter based on the SS block index
used to descramble the CRC.

36. An apparatus for wireless communication, the apparatus being a user equipment (UE), comprising:

a memory; and

at least one processor coupled to the memory and configured to:

determine a synchronization signal (SS) block index associated with an SS block
for reception;

scramble information based on the determined SS block index, the information
including at least one of data, control information, , or a cyclic redundancy check (CRC)
associated with control information; and

transmit the scrambled information to a base station.

37. The apparatus of claim 36, wherein the data is for a physical uplink shared channel (PUSCH), and the control information is for a physical uplink control channel (PUCCH).

38. The apparatus of claim 36, wherein the at least one processor is further configured to receive an uplink grant from the base station, wherein the SS block index is determined based on the uplink grant.

39. The apparatus of claim 36, wherein the at least one processor is further configured to receive, from the base station, information indicating the SS block index.

40. The apparatus of claim 36, wherein the at least one processor is configured to scramble the information by generating a scrambling sequence based on a sequence initialization that is based at least in part on the SS block index, wherein the information before scrambling is at least one of encoded or unencoded, and is scrambled based on the generated scrambling sequence.

41. An apparatus for wireless communication, the apparatus being a base station, comprising:

means for determining a synchronization signal (SS) block index associated with an SS block for transmission;

means for scrambling information based on the determined SS block index, the information including at least one of a reference signal, data, paging information, control information, broadcast information, or a cyclic redundancy check (CRC) associated with control information; and

means for transmitting the SS block and the scrambled information.

42. The apparatus of claim 41, wherein the reference signal (RS) is at least one of channel state information (CSI) RS (CSI-RS), measurement RS (MRS), demodulation RS (DM-RS) for a physical downlink control channel (PDCCH), DM-RS for a physical downlink shared channel (PDSCH), or a phase-noise tracking RS (PTRS).

43. The apparatus of claim 41, wherein the data is for a physical downlink shared channel (PDSCH), the paging information is for a paging channel (PCH), the control information is for a physical downlink control channel (PDCCH), and the broadcast information is for a physical broadcast channel (PBCH).

44. The apparatus of claim 41, wherein the SS block includes at least one of a primary synchronization signal (PSS), a secondary synchronization signal (SSS), or a physical broadcast channel (PBCH).

45. The apparatus of claim 41, wherein the scrambled information includes the CRC scrambled based on the SS block index, the CRC is for control information sent to the UE, the apparatus further comprises means for determining an SS block to be used by a user equipment (UE) in association with quasi-co location (QCL) of reference signals, and the CRC is scrambled based on the SS block index of the determined SS block to be used by the UE in association with QCL of reference signals.

46. The apparatus of claim 41, wherein the means for scrambling the information is configured to generate a scrambling sequence based on a sequence initialization that is

based at least in part on the SS block index, wherein the information before scrambling is at least one of encoded or unencoded, and is scrambled based on the generated scrambling sequence.

47. An apparatus for wireless communication, the apparatus being a base station, comprising:

means for receiving, from a user equipment (UE), information scrambled based on a synchronization signal (SS) block index, the scrambled information including at least one of data or control information; and

means for descrambling the scrambled information based on the SS block index.

48. The apparatus of claim 47, wherein the data is for a physical uplink shared channel (PUSCH), and the control information is for a physical uplink control channel (PUCCH).

49. The apparatus of claim 47, further comprising means for sending, to the UE, an uplink grant for the information, the uplink grant being associated with the SS block index.

50. The apparatus of claim 47, further comprising means for sending, to the UE, SS block index information indicating the SS block index for scrambling the information.

51. An apparatus for wireless communication, the apparatus being a user equipment (UE), comprising:

means for receiving a synchronization signal (SS) block and information scrambled based on an SS block index associated with the SS block, the information including at least one of a reference signal, data, paging information, control information, broadcast information, or a cyclic redundancy check (CRC) associated with control information; and

means for descrambling the scrambled information based on the SS block index.

52. The apparatus of claim 51, wherein the reference signal (RS) is at least one of channel state information (CSI) RS (CSI-RS), measurement RS (MRS), demodulation

RS (DM-RS) for a physical downlink control channel (PDCCH), DM-RS for a physical downlink shared channel (PDSCH), or a phase-noise tracking RS (PTRS).

53. The apparatus of claim 51, wherein the data is for a physical downlink shared channel (PDSCH), the paging information is for a paging channel (PCH), the control information is for a physical downlink control channel (PDCCH), and the broadcast information is for a physical broadcast channel (PBCH).

54. The apparatus of claim 51, wherein the SS block includes at least one of a primary synchronization signal (PSS), a secondary synchronization signal (SSS), or a physical broadcast channel (PBCH).

55. The apparatus of claim 51, wherein the scrambled information includes the CRC scrambled based on the SS block index, the apparatus further comprising:

means for descrambling the CRC based on the SS block index;

means for decoding received control information based on the descrambled CRC; and

means for determining a quasi-co location (QCL) parameter based on the SS block index used to descramble the CRC.

56. An apparatus for wireless communication, the apparatus being a user equipment (UE), comprising:

means for determining a synchronization signal (SS) block index associated with an SS block for reception;

means for scrambling information based on the determined SS block index, the information including at least one of data, control information, or a cyclic redundancy check (CRC) associated with control information; and

means for transmitting the scrambled information to a base station.

57. The apparatus of claim 56, wherein the data is for a physical uplink shared channel (PUSCH), and the control information is for a physical uplink control channel (PUCCH).

58. The apparatus of claim 56, further comprising means for receiving an uplink grant from the base station, wherein the SS block index is determined based on the uplink grant.

59. The apparatus of claim 56, further comprising means for receiving, from the base station, information indicating the SS block index.

60. The apparatus of claim 56, wherein the means for scrambling the information is configured to generate a scrambling sequence based on a sequence initialization that is based at least in part on the SS block index, wherein the information before scrambling is at least one of encoded or unencoded, and is scrambled based on the generated scrambling sequence.

61. A computer-readable medium storing computer executable code of a base station, comprising code to:

- determine a synchronization signal (SS) block index associated with an SS block for transmission;

- scramble information based on the determined SS block index, the information including at least one of a reference signal, data, paging information, control information, broadcast information, or a cyclic redundancy check (CRC) associated with control information; and

- transmit the SS block and the scrambled information.

62. A computer-readable medium storing computer executable code of a base station, comprising code to:

- receive, from a user equipment (UE), information scrambled based on a synchronization signal (SS) block index, the scrambled information including at least one of data or control information; and

- descramble the scrambled information based on the SS block index.

63. A computer-readable medium storing computer executable code of a user equipment (UE), comprising code to:

receive a synchronization signal (SS) block and information scrambled based on an SS block index associated with the SS block, the information including at least one of a reference signal, data, paging information, control information, broadcast information, or a cyclic redundancy check (CRC) associated with control information; and

descramble the scrambled information based on the SS block index.

64. A computer-readable medium storing computer executable code of a user equipment (UE), comprising code to:

determine a synchronization signal (SS) block index associated with an SS block for reception;

scramble information based on the determined SS block index, the information including at least one of data, control information, or a cyclic redundancy check (CRC) associated with control information; and

transmit the scrambled information to a base station.

USAGE OF SYNCHRONIZATION SIGNAL BLOCK INDEX IN NEW RADIO

BACKGROUND

Field

- [0001] The present disclosure relates generally to communication systems, and more particularly, to usage of a synchronization signal block index for scrambling.

Background

- [0002] Wireless communication systems are widely deployed to provide various telecommunication services such as telephony, video, data, messaging, and broadcasts. Typical wireless communication systems may employ multiple-access technologies capable of supporting communication with multiple users by sharing available system resources. Examples of such multiple-access technologies include code division multiple access (CDMA) systems, time division multiple access (TDMA) systems, frequency division multiple access (FDMA) systems, orthogonal frequency division multiple access (OFDMA) systems, single-carrier frequency division multiple access (SC-FDMA) systems, and time division synchronous code division multiple access (TD-SCDMA) systems.
- [0003] These multiple access technologies have been adopted in various telecommunication standards to provide a common protocol that enables different wireless devices to communicate on a municipal, national, regional, and even global level. An example telecommunication standard is 5G New Radio (NR). 5G NR is part of a continuous mobile broadband evolution promulgated by Third Generation Partnership Project (3GPP) to meet new requirements associated with latency, reliability, security, scalability (e.g., with Internet of Things (IoT)), and other requirements. Some aspects of 5G NR may be based on the 4G Long Term Evolution (LTE) standard. There exists a need for further improvements in 5G NR technology. These improvements may also be applicable to other multi-access technologies and the telecommunication standards that employ these technologies.

SUMMARY

- [0004] The following presents a simplified summary of one or more aspects in order to provide a basic understanding of such aspects. This summary is not an extensive

overview of all contemplated aspects, and is intended to neither identify key or critical elements of all aspects nor delineate the scope of any or all aspects. Its sole purpose is to present some concepts of one or more aspects in a simplified form as a prelude to the more detailed description that is presented later.

[0005] In an aspect of the disclosure, a method, a computer-readable medium, and an apparatus are provided. In one aspect, the apparatus may be a base station. The base station determines a synchronization signal (SS) block index associated with an SS block for transmission. The base station scrambles information based on the determined SS block index. The information includes at least one of a reference signal, data, paging information, control information, broadcast information, or a cyclic redundancy check (CRC) associated with control information. The base station transmits the SS block and the scrambled information.

[0006] In one aspect, the apparatus may be a base station. The base station receives, from a user equipment (UE), information scrambled based on an SS block index. The scrambled information includes at least one of data or control information. The base station descrambles the scrambled information based on the SS block index.

[0007] In one aspect, the apparatus may be a UE. The UE receives an SS block and information scrambled based on an SS block index associated with the SS block. The information includes at least one of a reference signal, data, paging information, control information, broadcast information, or a CRC associated with control information. The UE descrambles the scrambled information based on the SS block index.

[0008] In one aspect, the apparatus may be a UE. The UE determines an SS block index associated with an SS block for reception. The UE scrambles information based on the determined SS block index. The information includes at least one of data, control information, or a CRC associated with control information. The UE transmits the scrambled information to a base station.

[0009] To the accomplishment of the foregoing and related ends, the one or more aspects comprise the features hereinafter fully described and particularly pointed out in the claims. The following description and the annexed drawings set forth in detail certain illustrative features of the one or more aspects. These features are indicative, however, of but a few of the various ways in which the principles of

various aspects may be employed, and this description is intended to include all such aspects and their equivalents.

BRIEF DESCRIPTION OF THE DRAWINGS

- [0010] FIG. 1 is a diagram illustrating an example of a wireless communications system and an access network.
- [0011] FIGs. 2A, 2B, 2C, and 2D are diagrams illustrating examples of a DL frame structure, DL channels within the DL frame structure, an UL frame structure, and UL channels within the UL frame structure, respectively.
- [0012] FIG. 3 is a diagram illustrating an example of a base station and UE in an access network.
- [0013] FIG. 4 is a diagram illustrating a base station in communication with a UE.
- [0014] FIG. 5A is a diagram illustrating an example of an SS burst.
- [0015] FIG. 5B is a diagram illustrating an example of SS bursts for different frequency bands/carriers.
- [0016] FIG. 6A is a diagram illustrating a first example of an SS burst set.
- [0017] FIG. 6B is a diagram illustrating a second example of an SS burst set.
- [0018] FIG. 7 is a diagram illustrating a first exemplary call-flow diagram for a UE and a base station.
- [0019] FIG. 8 is a diagram illustrating a second exemplary call-flow diagram for a UE and a base station.
- [0020] FIG. 9 illustrates flowcharts of first methods of wireless communication of a base station.
- [0021] FIG. 10 illustrates flowcharts of second methods of wireless communication of a UE.

DETAILED DESCRIPTION

- [0022] The detailed description set forth below in connection with the appended drawings is intended as a description of various configurations and is not intended to represent the only configurations in which the concepts described herein may be practiced. The detailed description includes specific details for the purpose of providing a thorough understanding of various concepts. However, it will be

apparent to those skilled in the art that these concepts may be practiced without these specific details. In some instances, well known structures and components are shown in block diagram form in order to avoid obscuring such concepts.

[0023] Several aspects of telecommunication systems will now be presented with reference to various apparatus and methods. These apparatus and methods will be described in the following detailed description and illustrated in the accompanying drawings by various blocks, components, circuits, processes, algorithms, etc. (collectively referred to as “elements”). These elements may be implemented using electronic hardware, computer software, or any combination thereof. Whether such elements are implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system.

[0024] By way of example, an element, or any portion of an element, or any combination of elements may be implemented as a “processing system” that includes one or more processors. Examples of processors include microprocessors, microcontrollers, graphics processing units (GPUs), central processing units (CPUs), application processors, digital signal processors (DSPs), reduced instruction set computing (RISC) processors, systems on a chip (SoC), baseband processors, field programmable gate arrays (FPGAs), programmable logic devices (PLDs), state machines, gated logic, discrete hardware circuits, and other suitable hardware configured to perform the various functionality described throughout this disclosure. One or more processors in the processing system may execute software. Software shall be construed broadly to mean instructions, instruction sets, code, code segments, program code, programs, subprograms, software components, applications, software applications, software packages, routines, subroutines, objects, executables, threads of execution, procedures, functions, etc., whether referred to as software, firmware, middleware, microcode, hardware description language, or otherwise.

[0025] Accordingly, in one or more example embodiments, the functions described may be implemented in hardware, software, or any combination thereof. If implemented in software, the functions may be stored on or encoded as one or more instructions or code on a computer-readable medium. Computer-readable media includes computer storage media. Storage media may be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-

readable media can comprise a random-access memory (RAM), a read-only memory (ROM), an electrically erasable programmable ROM (EEPROM), optical disk storage, magnetic disk storage, other magnetic storage devices, combinations of the aforementioned types of computer-readable media, or any other medium that can be used to store computer executable code in the form of instructions or data structures that can be accessed by a computer.

[0026] FIG. 1 is a diagram illustrating an example of a wireless communications system and an access network 100. The wireless communications system (also referred to as a wireless wide area network (WWAN)) includes base stations 102, UEs 104, and an Evolved Packet Core (EPC) 160. The base stations 102 may include macro cells (high power cellular base station) and/or small cells (low power cellular base station). The macro cells include base stations. The small cells include femtocells, picocells, and microcells.

[0027] The base stations 102 (collectively referred to as Evolved Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access Network (E-UTRAN)) interface with the EPC 160 through backhaul links 132 (e.g., S1 interface). In addition to other functions, the base stations 102 may perform one or more of the following functions: transfer of user data, radio channel ciphering and deciphering, integrity protection, header compression, mobility control functions (e.g., handover, dual connectivity), inter-cell interference coordination, connection setup and release, load balancing, distribution for non-access stratum (NAS) messages, NAS node selection, synchronization, radio access network (RAN) sharing, multimedia broadcast multicast service (MBMS), subscriber and equipment trace, RAN information management (RIM), paging, positioning, and delivery of warning messages. The base stations 102 may communicate directly or indirectly (e.g., through the EPC 160) with each other over backhaul links 134 (e.g., X2 interface). The backhaul links 134 may be wired or wireless.

[0028] The base stations 102 may wirelessly communicate with the UEs 104. Each of the base stations 102 may provide communication coverage for a respective geographic coverage area 110. There may be overlapping geographic coverage areas 110. For example, the small cell 102' may have a coverage area 110' that overlaps the coverage area 110 of one or more macro base stations 102. A network that includes both small cell and macro cells may be known as a heterogeneous

network. A heterogeneous network may also include Home Evolved Node Bs (eNBs) (HeNBs), which may provide service to a restricted group known as a closed subscriber group (CSG). The communication links 120 between the base stations 102 and the UEs 104 may include uplink (UL) (also referred to as reverse link) transmissions from a UE 104 to a base station 102 and/or downlink (DL) (also referred to as forward link) transmissions from a base station 102 to a UE 104. The communication links 120 may use multiple-input and multiple-output (MIMO) antenna technology, including spatial multiplexing, beamforming, and/or transmit diversity. The communication links may be through one or more carriers. The base stations 102 / UEs 104 may use spectrum up to Y MHz (e.g., 5, 10, 15, 20, 100 MHz) bandwidth per carrier allocated in a carrier aggregation of up to a total of Yx MHz (x component carriers) used for transmission in each direction. The carriers may or may not be adjacent to each other. Allocation of carriers may be asymmetric with respect to DL and UL (e.g., more or less carriers may be allocated for DL than for UL). The component carriers may include a primary component carrier and one or more secondary component carriers. A primary component carrier may be referred to as a primary cell (PCell) and a secondary component carrier may be referred to as a secondary cell (SCell).

[0029] The wireless communications system may further include a Wi-Fi access point (AP) 150 in communication with Wi-Fi stations (STAs) 152 via communication links 154 in a 5 GHz unlicensed frequency spectrum. When communicating in an unlicensed frequency spectrum, the STAs 152 / AP 150 may perform a clear channel assessment (CCA) prior to communicating in order to determine whether the channel is available.

[0030] The small cell 102' may operate in a licensed and/or an unlicensed frequency spectrum. When operating in an unlicensed frequency spectrum, the small cell 102' may employ NR and use the same 5 GHz unlicensed frequency spectrum as used by the Wi-Fi AP 150. The small cell 102', employing NR in an unlicensed frequency spectrum, may boost coverage to and/or increase capacity of the access network.

[0031] The gNodeB (gNB) 180 may operate in millimeter wave (mmW) frequencies and/or near mmW frequencies in communication with the UE 182. When the gNB 180 operates in mmW or near mmW frequencies, the gNB 180 may be referred to as an mmW base station. Extremely high frequency (EHF) is part of the RF in the

electromagnetic spectrum. EHF has a range of 30 GHz to 300 GHz and a wavelength between 1 millimeter and 10 millimeters. Radio waves in the band may be referred to as a millimeter wave. Near mmW may extend down to a frequency of 3 GHz with a wavelength of 100 millimeters. The super high frequency (SHF) band extends between 3 GHz and 30 GHz, also referred to as centimeter wave. Communications using the mmW / near mmW radio frequency band has extremely high path loss and a short range. The mmW base station 180 may utilize beamforming 184 with the UE 182 to compensate for the extremely high path loss and short range.

[0032] The EPC 160 may include a Mobility Management Entity (MME) 162, other MMEs 164, a Serving Gateway 166, a Multimedia Broadcast Multicast Service (MBMS) Gateway 168, a Broadcast Multicast Service Center (BM-SC) 170, and a Packet Data Network (PDN) Gateway 172. The MME 162 may be in communication with a Home Subscriber Server (HSS) 174. The MME 162 is the control node that processes the signaling between the UEs 104 and the EPC 160. Generally, the MME 162 provides bearer and connection management. All user Internet protocol (IP) packets are transferred through the Serving Gateway 166, which itself is connected to the PDN Gateway 172. The PDN Gateway 172 provides UE IP address allocation as well as other functions. The PDN Gateway 172 and the BM-SC 170 are connected to the IP Services 176. The IP Services 176 may include the Internet, an intranet, an IP Multimedia Subsystem (IMS), a PS Streaming Service (PSS), and/or other IP services. The BM-SC 170 may provide functions for MBMS user service provisioning and delivery. The BM-SC 170 may serve as an entry point for content provider MBMS transmission, may be used to authorize and initiate MBMS Bearer Services within a public land mobile network (PLMN), and may be used to schedule MBMS transmissions. The MBMS Gateway 168 may be used to distribute MBMS traffic to the base stations 102 belonging to a Multicast Broadcast Single Frequency Network (MBSFN) area broadcasting a particular service, and may be responsible for session management (start/stop) and for collecting eMBMS related charging information.

[0033] The base station may also be referred to as a gNB, Node B, evolved Node B (eNB), an access point, a base transceiver station, a radio base station, a radio transceiver, a transceiver function, a basic service set (BSS), an extended service set

(ESS), or some other suitable terminology. The base station 102 provides an access point to the EPC 160 for a UE 104. Examples of UEs 104 include a cellular phone, a smart phone, a session initiation protocol (SIP) phone, a laptop, a personal digital assistant (PDA), a satellite radio, a global positioning system, a multimedia device, a video device, a digital audio player (e.g., MP3 player), a camera, a game console, a tablet, a smart device, a wearable device, or any other similar functioning device. The UE 104 may also be referred to as a station, a mobile station, a subscriber station, a mobile unit, a subscriber unit, a wireless unit, a remote unit, a mobile device, a wireless device, a wireless communications device, a remote device, a mobile subscriber station, an access terminal, a mobile terminal, a wireless terminal, a remote terminal, a handset, a user agent, a mobile client, a client, or some other suitable terminology.

[0034] FIG. 2A is a diagram 200 illustrating an example of a DL frame structure. FIG. 2B is a diagram 230 illustrating an example of channels within the DL frame structure. FIG. 2C is a diagram 250 illustrating an example of an UL frame structure. FIG. 2D is a diagram 280 illustrating an example of channels within the UL frame structure. Other wireless communication technologies may have a different frame structure and/or different channels. A frame (10 ms) may be divided into 10 equally sized subframes. Each subframe may include two consecutive time slots. A resource grid may be used to represent the two time slots, each time slot including one or more time concurrent resource blocks (RBs) (also referred to as physical RBs (PRBs)). The resource grid is divided into multiple resource elements (REs). For a normal cyclic prefix, an RB contains 12 consecutive subcarriers in the frequency domain and 7 consecutive symbols (for DL, OFDM symbols; for UL, SC-FDMA symbols) in the time domain, for a total of 84 REs. For an extended cyclic prefix, an RB contains 12 consecutive subcarriers in the frequency domain and 6 consecutive symbols in the time domain, for a total of 72 REs. The number of bits carried by each RE depends on the modulation scheme.

[0035] As illustrated in FIG. 2A, some of the REs carry DL reference (pilot) signals (DL-RS) for channel estimation at the UE. The DL-RS may include cell-specific reference signals (CRS) (also sometimes called common RS), UE-specific reference signals (UE-RS), and channel state information reference signals (CSI-RS). FIG. 2A illustrates CRS for antenna ports 0, 1, 2, and 3 (indicated as R_0 , R_1 , R_2 , and R_3 ,

respectively), UE-RS for antenna port 5 (indicated as R_5), and CSI-RS for antenna port 15 (indicated as R). FIG. 2B illustrates an example of various channels within a DL subframe of a frame. The physical control format indicator channel (PCFICH) is within symbol 0 of slot 0, and carries a control format indicator (CFI) that indicates whether the physical downlink control channel (PDCCH) occupies 1, 2, or 3 symbols (FIG. 2B illustrates a PDCCH that occupies 3 symbols). The PDCCH carries downlink control information (DCI) within one or more control channel elements (CCEs), each CCE including nine RE groups (REGs), each REG including four consecutive REs in an OFDM symbol. A UE may be configured with a UE-specific enhanced PDCCH (ePDCCH) that also carries DCI. The ePDCCH may have 2, 4, or 8 RB pairs (FIG. 2B shows two RB pairs, each subset including one RB pair). The physical hybrid automatic repeat request (ARQ) (HARQ) indicator channel (PHICH) is also within symbol 0 of slot 0 and carries the HARQ indicator (HI) that indicates HARQ acknowledgement (ACK) / negative ACK (NACK) feedback based on the physical uplink shared channel (PUSCH). The primary synchronization channel (PSCH) may be within symbol 6 of slot 0 within subframes 0 and 5 of a frame. The PSCH carries a primary synchronization signal (PSS) that is used by a UE to determine subframe/symbol timing and a physical layer identity. The secondary synchronization channel (SSCH) may be within symbol 5 of slot 0 within subframes 0 and 5 of a frame. The SSCH carries a secondary synchronization signal (SSS) that is used by a UE to determine a physical layer cell identity group number and radio frame timing. Based on the physical layer identity and the physical layer cell identity group number, the UE can determine a physical cell identifier (PCI). Based on the PCI, the UE can determine the locations of the aforementioned DL-RS. The physical broadcast channel (PBCH), which carries a master information block (MIB), may be logically grouped with the PSCH and SSCH to form a synchronization signal (SS) block. The MIB provides a number of RBs in the DL system bandwidth, a PHICH configuration, and a system frame number (SFN). The physical downlink shared channel (PDSCH) carries user data, broadcast system information not transmitted through the PBCH such as system information blocks (SIBs), and paging messages.

[0036] As illustrated in FIG. 2C, some of the REs carry demodulation reference signals (DM-RS) for channel estimation at the base station. The UE may additionally

transmit sounding reference signals (SRS) in the last symbol of a subframe. The SRS may have a comb structure, and a UE may transmit SRS on one of the combs. The SRS may be used by a base station for channel quality estimation to enable frequency-dependent scheduling on the UL. FIG. 2D illustrates an example of various channels within an UL subframe of a frame. A physical random access channel (PRACH) may be within one or more subframes within a frame based on the PRACH configuration. The PRACH may include six consecutive RB pairs within a subframe. The PRACH allows the UE to perform initial system access and achieve UL synchronization. A physical uplink control channel (PUCCH) may be located on edges of the UL system bandwidth. The PUCCH carries uplink control information (UCI), such as scheduling requests, a channel quality indicator (CQI), a precoding matrix indicator (PMI), a rank indicator (RI), and HARQ ACK/NACK feedback. The PUSCH carries data, and may additionally be used to carry a buffer status report (BSR), a power headroom report (PHR), and/or UCI.

[0037] FIG. 3 is a block diagram of a base station 310 in communication with a UE 350 in an access network. In the DL, IP packets from the EPC 160 may be provided to a controller/processor 375. The controller/processor 375 implements layer 3 and layer 2 functionality. Layer 3 includes a radio resource control (RRC) layer, and layer 2 includes a packet data convergence protocol (PDCP) layer, a radio link control (RLC) layer, and a medium access control (MAC) layer. The controller/processor 375 provides RRC layer functionality associated with broadcasting of system information (e.g., MIB, SIBs), RRC connection control (e.g., RRC connection paging, RRC connection establishment, RRC connection modification, and RRC connection release), inter radio access technology (RAT) mobility, and measurement configuration for UE measurement reporting; PDCP layer functionality associated with header compression / decompression, security (ciphering, deciphering, integrity protection, integrity verification), and handover support functions; RLC layer functionality associated with the transfer of upper layer packet data units (PDUs), error correction through ARQ, concatenation, segmentation, and reassembly of RLC service data units (SDUs), re-segmentation of RLC data PDUs, and reordering of RLC data PDUs; and MAC layer functionality associated with mapping between logical channels and transport channels, multiplexing of MAC SDUs onto transport blocks (TBs), demultiplexing of MAC SDUs from TBs, scheduling information

reporting, error correction through HARQ, priority handling, and logical channel prioritization.

[0038] The transmit (TX) processor 316 and the receive (RX) processor 370 implement layer 1 functionality associated with various signal processing functions. Layer 1, which includes a physical (PHY) layer, may include error detection on the transport channels, forward error correction (FEC) coding/decoding of the transport channels, interleaving, rate matching, mapping onto physical channels, modulation/demodulation of physical channels, and MIMO antenna processing. The TX processor 316 handles mapping to signal constellations based on various modulation schemes (e.g., binary phase-shift keying (BPSK), quadrature phase-shift keying (QPSK), M-phase-shift keying (M-PSK), M-quadrature amplitude modulation (M-QAM)). The coded and modulated symbols may then be split into parallel streams. Each stream may then be mapped to an OFDM subcarrier, multiplexed with a reference signal (e.g., pilot) in the time and/or frequency domain, and then combined together using an Inverse Fast Fourier Transform (IFFT) to produce a physical channel carrying a time domain OFDM symbol stream. The OFDM stream is spatially precoded to produce multiple spatial streams. Channel estimates from a channel estimator 374 may be used to determine the coding and modulation scheme, as well as for spatial processing. The channel estimate may be derived from a reference signal and/or channel condition feedback transmitted by the UE 350. Each spatial stream may then be provided to a different antenna 320 via a separate transmitter 318TX. Each transmitter 318TX may modulate an RF carrier with a respective spatial stream for transmission.

[0039] At the UE 350, each receiver 354RX receives a signal through its respective antenna 352. Each receiver 354RX recovers information modulated onto an RF carrier and provides the information to the receive (RX) processor 356. The TX processor 368 and the RX processor 356 implement layer 1 functionality associated with various signal processing functions. The RX processor 356 may perform spatial processing on the information to recover any spatial streams destined for the UE 350. If multiple spatial streams are destined for the UE 350, they may be combined by the RX processor 356 into a single OFDM symbol stream. The RX processor 356 then converts the OFDM symbol stream from the time-domain to the frequency domain using a Fast Fourier Transform (FFT). The frequency domain

signal comprises a separate OFDM symbol stream for each subcarrier of the OFDM signal. The symbols on each subcarrier, and the reference signal, are recovered and demodulated by determining the most likely signal constellation points transmitted by the base station 310. These soft decisions may be based on channel estimates computed by the channel estimator 358. The soft decisions are then decoded and deinterleaved to recover the data and control signals that were originally transmitted by the base station 310 on the physical channel. The data and control signals are then provided to the controller/processor 359, which implements layer 3 and layer 2 functionality.

[0040] The controller/processor 359 can be associated with a memory 360 that stores program codes and data. The memory 360 may be referred to as a computer-readable medium. In the UL, the controller/processor 359 provides demultiplexing between transport and logical channels, packet reassembly, deciphering, header decompression, and control signal processing to recover IP packets from the EPC 160. The controller/processor 359 is also responsible for error detection using an ACK and/or NACK protocol to support HARQ operations.

[0041] Similar to the functionality described in connection with the DL transmission by the base station 310, the controller/processor 359 provides RRC layer functionality associated with system information (e.g., MIB, SIBs) acquisition, RRC connections, and measurement reporting; PDCP layer functionality associated with header compression / decompression, and security (ciphering, deciphering, integrity protection, integrity verification); RLC layer functionality associated with the transfer of upper layer PDUs, error correction through ARQ, concatenation, segmentation, and reassembly of RLC SDUs, re-segmentation of RLC data PDUs, and reordering of RLC data PDUs; and MAC layer functionality associated with mapping between logical channels and transport channels, multiplexing of MAC SDUs onto TBs, demultiplexing of MAC SDUs from TBs, scheduling information reporting, error correction through HARQ, priority handling, and logical channel prioritization.

[0042] Channel estimates derived by a channel estimator 358 from a reference signal or feedback transmitted by the base station 310 may be used by the TX processor 368 to select the appropriate coding and modulation schemes, and to facilitate spatial processing. The spatial streams generated by the TX processor 368 may be

provided to different antenna 352 via separate transmitters 354TX. Each transmitter 354TX may modulate an RF carrier with a respective spatial stream for transmission.

[0043] The UL transmission is processed at the base station 310 in a manner similar to that described in connection with the receiver function at the UE 350. Each receiver 318RX receives a signal through its respective antenna 320. Each receiver 318RX recovers information modulated onto an RF carrier and provides the information to a RX processor 370.

[0044] The controller/processor 375 can be associated with a memory 376 that stores program codes and data. The memory 376 may be referred to as a computer-readable medium. In the UL, the controller/processor 375 provides demultiplexing between transport and logical channels, packet reassembly, deciphering, header decompression, control signal processing to recover IP packets from the UE 350. IP packets from the controller/processor 375 may be provided to the EPC 160. The controller/processor 375 is also responsible for error detection using an ACK and/or NACK protocol to support HARQ operations.

[0045] FIG. 4 is a diagram 400 illustrating a base station 402 in communication with a UE 404. Referring to FIG. 4, when the UE 404 turns on, the UE 404 searches for a nearby NR network. The UE 404 discovers the base station 402, which belongs to an NR network. The base station 402 transmits an SS block including the PSS, SSS, and the PBCH (including the MIB) periodically in different transmit directions 402a – 402h. The UE 404 receives the transmission 402e including the PSS, SSS, and PBCH. Based on the received SS block, the UE 404 synchronizes to the NR network and camps on a cell associated with the base station 402.

[0046] As discussed *supra*, the PSS, SSS, and PBCH may be transmitted within an SS block. Each SS block has a corresponding SS block index indicated in FIG. 4 as one of 0, 1, ..., n-1. The PSS, SSS, and PBCH may be time division multiplexed and/or frequency division multiplexed with the SS block (FIG. 4 shows the PSS, SSS, and PBCH time division multiplexed within an SS block). While FIG. 4 shows the PSS, SSS, and PBCH as consecutive in time, the PSS, SSS, and PBCH may be non-consecutive in time, and therefore may be spaced from each other by one or more slots/symbols (i.e., may not be adjacent to each other in time). The SS block may include other signals/channels, and therefore other signals/channels other than the

PSS, SSS, and PBCH may be multiplexed into the SS block. One or multiple SS blocks make up an SS burst. The number of SS blocks n in an SS burst may vary. SS blocks may or may not be consecutive with respect to the corresponding SS block index. SS blocks within an SS burst may or may not be the same. One or multiple SS bursts make up an SS burst set. The periodicity (period P) of SS bursts and the number of SS bursts in an SS burst set may vary. The number of SS bursts within an SS burst set is finite. The transmission of SS burst sets may be periodic or aperiodic.

[0047] FIG. 5A is a diagram 500 illustrating an example of an SS burst. FIG. 5B is a diagram 550 illustrating an example of SS bursts for different frequency bands/carriers. FIG. 6A is a diagram 600 illustrating a first example of an SS burst set. FIG. 6B is a diagram 650 illustrating a second example of an SS burst set. As illustrated in the diagram 500 of FIG. 5A, an SS burst includes a plurality of SS blocks corresponding to SS block indices 0, 1, ..., 7. A subset 502 of the SS blocks (see indices 2, 5, in this example) may be preconfigured such that they may be off (i.e., not transmitted) to allow for transmission of an UL control block instead. As illustrated in the diagram 550 of FIG. 5B, different bands may have different SS burst configurations. For example, in band X, an SS burst may include SS blocks 0, 1, ..., 7, with SS blocks 2, 5 being preconfigured for on/off to allow for transmission of an UL control block instead. For another example, in band Y, an SS burst may include SS blocks 0, 1, 3, 4, 6, 7 with SS blocks 1, 4, 7 being preconfigured for on/off to allow for transmission of an UL control block instead. The illustrated SS burst may be an i^{th} SS burst within an SS burst set. As illustrated in the diagram 600 of FIG. 6A, in a first example, an SS burst set may include K different SS bursts 0, 1, ..., $K-1$. The time length of the SS burst set may be $N \cdot 10$ ms, where N is an integer. Referring to FIG. 6B, the periodicity (period P_1) of an SS burst in an SS burst set is how often an SS burst is transmitted in an SS burst set. The periodicity of beam sweeping (period P_2) is how often a beam sweeping SS burst repeats itself in an SS burst set. A UE may use repetitive SS bursts in an SS burst set to filter a reference signal received power (RSRP) over time for the same beam direction and/or to train sub-arrays. In the example of FIG. 6, the SS burst set has a time length of 80 ms, the periodicity P_1 of the SS burst is 20 ms, and the periodicity P_2 of beam sweeping is 40 ms.

[0048] As discussed *supra*, the SS block index may be used to indicate an SS block within an SS burst or within an SS burst set. When the SS block index is used to indicate an SS block within an SS burst, SS bursts may have an SS burst index to indicate the particular SS burst within an SS burst set. As such, an SS block index can indicate an SS block within an SS burst within an SS burst set (e.g., SS block indices are 0, 1, ..., $n*m$ for SS blocks in an SS burst set, where there are n SS blocks per SS burst and m SS bursts in an SS burst set), or the combination of an SS block index and an SS burst index can indicate an SS block within an SS burst within an SS burst set (e.g., SS block indices are 0, 1, ..., n for SS blocks in each SS burst set, and SS burst indices are 0, 1, ..., m for SS bursts in an SS burst set). Herein, SS block index may refer to one or more indices for indicating an SS block within an SS burst within an SS burst set. A mapping function may be used to map an SS block index to a logic index. There may be a one to one mapping, with one SS block index mapped to one logic index. Alternatively, there may be a many to one mapping, with multiple SS block indices mapped to one logic index.

[0049] FIG. 7 is a diagram 700 illustrating a first exemplary call-flow diagram for a UE 702 and a base station 704. As illustrated in FIG. 7, at 710, the base station 704 determines an SS block index associated with an SS block for transmission at 714.

[0050] At 712, the base station 704 scrambles information based on the determined SS block index. The base station 704 may scramble the information by generating a scrambling sequence based on a sequence initialization that is based at least in part on the SS block index. The information before scrambling may be encoded and/or unencoded, and may be scrambled based on the generated scrambling sequence. The information includes at least one of a reference signal, data, paging information, control information, broadcast information, or a CRC associated with control information. In one configuration, the reference signal is at least one of CSI-RS, measurement RS (MRS) (also referred to as mobility RS), DM-RS for a PDCCH, DM-RS for a PDSCH, or a phase-noise tracking RS (PTRS). In one configuration, the data is for a PDSCH, the paging information is for a paging channel (PCH), the control information is for a PDCCH, and the broadcast information is for a PBCH. When the information includes a scrambled CRC, the control information associated with the scrambled CRC may or may not be scrambled itself based on the SS block index.

- [0051] At 714, the base station 704 transmits the SS block and the scrambled information to the UE 702. The SS block may include the scrambled information. As discussed *supra*, the SS block may include at least one of a PSS, an SSS, or a PBCH.
- [0052] The base station 704 may use the SS block index to scramble a CRC when encoding a DL control payload. The base station 704 may use the scrambled CRC to convey a quasi-co location (QCL) parameter for a control channel without explicit signaling. The QCL parameter may indicate QCL of reference signals associated with a beam pair including a beam associated with the control channel and the corresponding SS block index. By decoding the control channel and obtaining the SS block index, the UE 702 may be able to determine the QCL parameter associated with SS block index. The control channel may include a common control channel (CCCH) and/or a UE specific control channel (e.g., dedicated control channel (DCCH)). When the UE 702 decodes such DL control channel, the UE 702 may use the decoded DL control information or may discard the decoded DL control information depending on whether the UE 702 is configured to receive such control information scrambled by the SS block index. Referring again to 710, the base station 704 may determine an SS block to be used by the UE 702 in association with QCL of reference signals. In such a configuration, at 712, the base station 704 may generate a CRC based on control information to be transmitted to the UE 702, and may scramble the CRC based on the determined SS block index. At 714, the base station 704 may send the control information and the SS-block-index scrambled CRC to the UE 702.
- [0053] At 714, the UE receives the SS block including information scrambled based on the SS block index associated with the SS block.
- [0054] At 716, the UE 702 descrambles the scrambled information based on the SS block index.
- [0055] At 718, when the scrambled information 714 includes a CRC scrambled based on an SS block index, the UE 702 may descramble the CRC based on the SS block index, decode received control information based on the descrambled CRC, and determine a QCL parameter based on the SS block index used to descramble the CRC.

[0056] FIG. 8 is a diagram 800 illustrating a second exemplary call-flow diagram for a UE and a base station. At 810, a UE 804 determines an SS block index associated with an SS block for reception. The SS block associated with the SS block index may have been previously received or may be received in the future. At 810, the UE 804 may receive an uplink grant from the base station 802, and may determine the SS block index based on the uplink grant. For example, if the UE receives an UL grant and an SS block in or associated with a beam, the UE may determine the SS block index to be the SS block index associated with the same beam as the UL grant. Alternatively, the UE 804 may receive, from the base station 802, information indicating the SS block index and, at 810, may determine the SS block index based on the received information.

[0057] At 812, the UE 804 scrambles information based on the determined SS block index. The UE 804 may scramble the information by generating a scrambling sequence based on a sequence initialization that is based at least in part on the SS block index. The information before scrambling may be encoded and/or unencoded, and may be scrambled based on the generated scrambling sequence. The information includes at least one of data, control information, or a CRC associated with control information. In one configuration, the data is for a PUSCH, and the control information is for a PUCCH.

[0058] At 814, the UE 804 transmits the scrambled information to a base station 802. When the scrambled information includes a CRC scrambled by the SS block index, the UE 804 may transmit UL control information along with the SS-block-index scrambled CRC. The base station 802 receives, from the UE, the information scrambled based on the SS block index.

[0059] At 816, the base station 802 descrambles the scrambled information based on the SS block index.

[0060] FIG. 9 illustrates flowcharts 900, 950 of first methods of wireless communication of a base station. With respect to the flow chart 900, at 902, a base station determines an SS block index associated with an SS block for transmission. At 904, the base station scrambles information based on the determined SS block index. The information includes at least one of a reference signal, data, paging information, control information, broadcast information, or a CRC associated with

control information. At 906, the base station transmits the SS block and the scrambled information.

[0061] In one configuration, the reference signal (RS) is at least one of CSI-RS, MRS, DM-RS for a PDCCH, DM-RS for a PDSCH, or a PTRS. In one configuration, the data is for a PDSCH, the paging information is for a PCH, the control information is for a PDCCH, and the broadcast information is for a PBCH. In one configuration, the SS block includes at least one of a PSS, an SSS, or a PBCH. In one configuration, the scrambled information includes the CRC scrambled based on the SS block index, and the CRC is for control information sent to the UE. In such a configuration, the base station determines an SS block to be used by a UE in association with QCL of reference signals. Further, the base station scrambles the CRC based on the SS block index of the determined SS block to be used by the UE in association with QCL of reference signals.

[0062] With respect to the flow chart 950, at 952, the base station receives, from a UE, information scrambled based on an SS block index. The scrambled information includes at least one of data or control information. At 954, the base station descrambles the scrambled information based on the SS block index.

[0063] In one configuration, the data is for a PUSCH, and the control information is for a PUCCH. In one configuration, the base station sends, to the UE, an uplink grant for the information, where the uplink grant is associated with the SS block index. In one configuration, the base station sends, to the UE, SS block index information indicating the SS block index for scrambling the information.

[0064] FIG. 10 illustrates flowcharts 1000, 1050 of second methods of wireless communication of a UE. With respect to the flow chart 1000, at 1002, a UE receives an SS block and information scrambled based on an SS block index associated with the SS block. The information includes at least one of a reference signal, data, paging information, control information, broadcast information, or a CRC associated with control information. At 1004, the UE descrambles the scrambled information based on the SS block index.

[0065] In one configuration, the RS is at least one of CSI-RS, MRS, DM-RS for a PDCCH, DM-RS for a PDSCH, or a PTRS. In one configuration, the data is for a PDSCH, the paging information is for a PCH, the control information is for a PDCCH, and the broadcast information is for a PBCH. In one configuration, the SS

block includes at least one of a PSS, an SSS, or a PBCH. In one configuration, the scrambled information includes the CRC scrambled based on the SS block index. In such a configuration, the UE descrambles the CRC based on the SS block index, decodes received control information based on the descrambled CRC, and determines a QCL parameter based on the SS block index used to descramble the CRC.

[0066] With respect to the flow chart 1050, at 1052, a UE determines an SS block index associated with an SS block for reception. At 1054, the UE scrambles information based on the determined SS block index. The information includes at least one of data or control information. At 1056, the UE transmits the scrambled information to a base station. In one configuration, the data is for a PUSCH, and the control information is for a PUCCH. In one configuration, the UE receives an uplink grant from the base station and determines the SS block index based on the uplink grant. In one configuration, the UE receives, from the base station, information indicating the SS block index.

[0067] Further disclosure is included in the Appendix.

[0068] It is understood that the specific order or hierarchy of blocks in the processes / flowcharts disclosed is an illustration of exemplary approaches. Based upon design preferences, it is understood that the specific order or hierarchy of blocks in the processes / flowcharts may be rearranged. Further, some blocks may be combined or omitted. The accompanying method claims present elements of the various blocks in a sample order, and are not meant to be limited to the specific order or hierarchy presented.

[0069] The previous description is provided to enable any person skilled in the art to practice the various aspects described herein. Various modifications to these aspects will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects. Thus, the claims are not intended to be limited to the aspects shown herein, but is to be accorded the full scope consistent with the language claims, wherein reference to an element in the singular is not intended to mean “one and only one” unless specifically so stated, but rather “one or more.” The word “exemplary” is used herein to mean “serving as an example, instance, or illustration.” Any aspect described herein as “exemplary” is not necessarily to be construed as preferred or advantageous over other aspects. Unless

specifically stated otherwise, the term “some” refers to one or more. Combinations such as “at least one of A, B, or C,” “one or more of A, B, or C,” “at least one of A, B, and C,” “one or more of A, B, and C,” and “A, B, C, or any combination thereof” include any combination of A, B, and/or C, and may include multiples of A, multiples of B, or multiples of C. Specifically, combinations such as “at least one of A, B, or C,” “one or more of A, B, or C,” “at least one of A, B, and C,” “one or more of A, B, and C,” and “A, B, C, or any combination thereof” may be A only, B only, C only, A and B, A and C, B and C, or A and B and C, where any such combinations may contain one or more member or members of A, B, or C. All structural and functional equivalents to the elements of the various aspects described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the claims. Moreover, nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the claims. The words “module,” “mechanism,” “element,” “device,” and the like may not be a substitute for the word “means.” As such, no claim element is to be construed as a means plus function unless the element is expressly recited using the phrase “means for.”

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First Named Inventor/Applicant Name:		Tao LUO		
Filer:		Jonas J. Hodges/rachele wittwer		
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PROVISIONAL APPLICATION FILING	1005	1	260	260
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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	172947P1_ADS.PDF	1775107	no	8
			d1d03312c361a1ad35889875b4071427853f5f16		
Warnings:					
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2	Power of Attorney	172947P1_POA.PDF	1253557	no	2
			bd4c3ecb728753e6fd7a3da905258ef83f901ef3		
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3	Appendix to the Specification	172947P1_Appendix.pdf	300027	no	10
			7d187c1fa9f6fa280ce4ab04967b9eeabc8eaceb4		
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4	Drawings-only black and white line drawings	172947P1_Drawings.pdf	390011	no	10
			29f61a97b5e958a3298394ee293f7f4f3cbfef8a		
Warnings:					
Information:					
5		172947P1_Application.pdf	270905	yes	33
			218926e2648103640b5ae13b9236f45d95750235		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Abstract		33	33	
	Claims		21	32	

	Specification	1	20		
Warnings:					
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6	Fee Worksheet (SB06)	fee-info.pdf	30316	no	2
			3f0e111c4d1ca266d7aaaa1236b97e0f2947ea20		
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	030284.14372/172947P1
		Application Number	
Title of Invention	USAGE OF SYNCHRONIZATION SIGNAL BLOCK INDEX IN NEW RADIO		
<p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p>			

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Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	10	Suggested Figure for Publication (if any)	

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	030284.14372/172947P1
		Application Number	
Title of Invention	USAGE OF SYNCHRONIZATION SIGNAL BLOCK INDEX IN NEW RADIO		

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	<input checked="" type="radio"/> Customer Number	<input type="radio"/> US Patent Practitioner	<input type="radio"/> Limited Recognition (37 CFR 11.9)
Customer Number	15142		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	<input type="text"/>	<input type="button" value="Remove"/>	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
<input type="text"/>	<input type="text"/>		
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the <input type="button" value="Add"/> button.			

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	030284.14372/172947P1
		Application Number	
Title of Invention	USAGE OF SYNCHRONIZATION SIGNAL BLOCK INDEX IN NEW RADIO		

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)	Remove

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

- ☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
- NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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		Application Number	
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Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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		Application Number	
Title of Invention	USAGE OF SYNCHRONIZATION SIGNAL BLOCK INDEX IN NEW RADIO		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant	1	<input type="button" value="Remove"/>	
<p>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.</p>			
		<input type="button" value="Clear"/>	
<input checked="" type="radio"/> Assignee	Legal Representative under 35 U.S.C. 117		Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
<div style="border: 1px solid black; height: 20px; width: 100%;"></div>			
Name of the Deceased or Legally Incapacitated Inventor: <div style="border: 1px solid black; width: 400px; height: 20px;"></div>			
If the Applicant is an Organization check here. <input checked="" type="checkbox"/>			
Organization Name	QUALCOMM Incorporated		
Mailing Address Information For Applicant:			
Address 1	5775 Morehouse Drive		
Address 2			
City	San Diego	State/Province	CA
Country	US	Postal Code	92121-1714
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button.			<input type="button" value="Add"/>

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	030284.14372/172947P1
		Application Number	
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Assignee 1				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here. <input type="checkbox"/>				
Prefix	Given Name	Middle Name	Family Name	Suffix
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1		<input type="text"/>		
Address 2		<input type="text"/>		
City	<input type="text"/>	State/Province	<input type="text"/>	
Country ⁱ	<input type="text"/>	Postal Code	<input type="text"/>	
Phone Number	<input type="text"/>	Fax Number	<input type="text"/>	
Email Address	<input type="text"/>			
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				Add

Signature:[Remove](#)

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet must be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	Jonas Hodges/		Date (YYYY-MM-DD)	2017-02-23
First Name	Jonas	Last Name	Hodges	Registration Number
				58898
Additional Signature may be generated within this form by selecting the Add button.				Add

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	030284.14372/172947P1
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This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.