

CLAIMS

What is claimed is:

- 1 1. A method for wireless communications, comprising:
2 receiving, from a base station, an indication for transmission of a first
3 sounding reference signal (SRS) on a first component carrier (CC) and a second SRS on a
4 second CC, wherein the first CC is associated with a first numerology and the second CC is
5 associated with a second numerology different from the first numerology;
6 determining a first timing gap between receipt of the indication and
7 transmission of the first SRS on the first CC based at least in part on the first numerology;
8 determining a timing for transmission of the second SRS on the second CC
9 after receipt of the indication and after the transmission of the first SRS on the first CC based
10 at least in part on the first timing gap and the second numerology; and
11 transmitting the first SRS based at least in part on the first timing gap and the
12 second SRS based at least in part on the timing for the transmission of the second SRS.
- 1 2. The method of claim 1, further comprising:
2 determining a first time duration corresponding to a first number of symbols
3 associated with the first numerology, wherein the first timing gap is determined based at least
4 in part on the first time duration.
- 1 3. The method of claim 2, wherein the first number of symbols
2 corresponds to a time between receipt of an uplink grant and transmission of uplink data for
3 the first numerology.
- 1 4. The method of claim 2, wherein the first number of symbols
2 corresponds to a time between receipt of a physical downlink control channel (PDCCH) and
3 transmission of the first SRS for the first numerology.
- 1 5. The method of claim 2, further comprising:
2 determining a second time duration corresponding to a second number of
3 symbols associated with the second numerology, wherein the timing for the transmission of
4 the second SRS on the second CC is determined based at least in part on the first time
5 duration and the second time duration.

- 1 6. The method of claim 5, further comprising:
2 determining the second time duration based at least in part on a retune time
3 associated with retuning from the first CC to the second CC and a transmission time
4 associated with transmission of the first SRS on the first CC.
- 1 7. The method of claim 5, wherein the second number of symbols
2 corresponds to a time between receipt of an uplink grant and transmission of uplink data for
3 the second numerology, a time between receipt of a channel state information reference
4 signal (CSIRS) and transmission of a channel state feedback (CSF) message for the second
5 numerology, or a time between receipt of a physical downlink control channel (PDCCH)
6 message and transmission of the second SRS for the second numerology.
- 1 8. The method of claim 1, wherein receiving the indication comprises:
2 receiving an indication for transmission of a third SRS on a third CC
3 associated with a third numerology different from the first and second numerologies.
- 1 9. The method of claim 8, further comprising:
2 determining a timing for transmission of the third SRS on the third CC after
3 receipt of the indication for transmission of the third SRS on the third CC and after the
4 transmission of the second SRS on the second CC based at least in part on the timing for the
5 transmission of the second SRS on the second CC and the third numerology; and
6 transmitting the third SRS based at least in part on the timing for the
7 transmission of the third SRS.
- 1 10. The method of claim 1, wherein receiving the indication comprises:
2 receiving an indication for transmission of additional SRSs on respective CCs.
- 1 11. The method of claim 10, further comprising:
2 determining respective transmission timings for the additional SRSs based at
3 least in part on numerologies associated with the respective CCs; and
4 transmitting the additional SRSs on the respective CCs based at least in part
5 on the respective transmission timings.

1 12. The method of claim 1, wherein the indication comprises a grant
2 scheduling the first and second SRS transmissions and is received via a physical downlink
3 control channel (PDCCH).

1 13. A method for wireless communications, comprising:
2 receiving, from a base station, an indication for transmission of a first
3 sounding reference signal (SRS) on a first component carrier (CC) and a second SRS on a
4 second CC, wherein the first CC is associated with a first numerology and the second CC is
5 associated with a second numerology different from the first numerology;
6 determining a first timing gap between receipt of the indication and
7 transmission of the first SRS on the first CC based at least in part on the first numerology and
8 the second numerology;
9 determining a timing for transmission of the second SRS on the second CC
10 after receipt of the indication and after the transmission of the first SRS on the first CC based
11 at least in part on the first timing gap; and
12 transmitting the first SRS based at least in part on the first timing gap and the
13 second SRS based at least in part on the timing for the transmission of the second SRS.

1 14. The method of claim 13, wherein determining the first timing gap
2 comprises:
3 determining a first time duration associated with the first numerology;
4 determining a second time duration associated with the second numerology;
5 and
6 determining a maximum of the first time duration and the second time
7 duration.

1 15. The method of claim 13, further comprising:
2 determining a first time duration corresponding to a first number of symbols
3 associated with the first numerology; and
4 determining a second time duration corresponding to a second number of
5 symbols associated with the second numerology, wherein the first timing gap is determined
6 based at least in part on the first and second time durations.

1 16. The method of claim 15, wherein the first number of symbols
2 corresponds to a time between receipt of an uplink grant and transmission of uplink data for
3 the first numerology.

1 17. The method of claim 15, wherein the first number of symbols
2 corresponds to a time between receipt of a physical downlink control channel (PDCCH)
3 message and transmission of the first SRS for the first numerology.

1 18. The method of claim 15, wherein the second number of symbols
2 corresponds to a time between receipt of an uplink grant and transmission of uplink data for
3 the second numerology, a time between receipt of a channel state information reference
4 signal (CSIRS) and transmission of a channel state feedback (CSF) message for the second
5 numerology, or a time between receipt of a physical downlink control channel (PDCCH)
6 message and transmission of the second SRS for the second numerology.

1 19. The method of claim 13, further comprising:
2 determining the timing for the transmission of the second SRS on the second
3 CC based at least in part on a retune time associated with retuning from the first CC to the
4 second CC and a transmission time associated with transmission of the first SRS on the first
5 CC.

1 20. The method of claim 13, wherein receiving the indication comprises:
2 receiving an indication for transmission of a third SRS on a third CC
3 associated with a third numerology different from the first and second numerologies.

1 21. The method of claim 20, further comprising:
2 determining a first time duration corresponding to a first number of symbols
3 associated with the first numerology;
4 determining a second time duration corresponding to a second number of
5 symbols associated with the second numerology; and
6 determining a third time duration corresponding to a third number of symbols
7 associated with the third numerology, wherein the first timing gap is determined based at
8 least in part on the first, second, and third time durations.

1 22. The method of claim 21, further comprising:

2 determining a timing for transmission of the third SRS on the third CC after
3 receipt of the indication for transmission of the third SRS on the third CC and after the
4 transmission of the second SRS on the second CC based at least in part on the timing for the
5 transmission of the second SRS on the second CC; and
6 transmitting the third SRS based at least in part on the timing for the
7 transmission of the third SRS on the third CC.

1 23. The method of claim 13, wherein receiving the indication comprises:
2 receiving an indication for transmission of additional SRSs on respective CCs
3 associated with respective numerologies.

1 24. The method of claim 23, further comprising:
2 determining additional time durations corresponding to respective numbers of
3 symbols associated with the respective numerologies, wherein the first timing gap is
4 determined based at least in part on the additional time durations.

1 25. The method of claim 13, wherein the indication comprises a grant
2 scheduling the first and second SRS transmissions and is received via a physical downlink
3 control channel (PDCCH).

1 26. A method for wireless communications, comprising:
2 transmitting, to a user equipment (UE), an indication for transmission of a first
3 sounding reference signal (SRS) on a first component carrier (CC) and a second SRS on a
4 second CC, wherein the first CC is associated with a first numerology and the second CC is
5 associated with a second numerology different from the first numerology;
6 receiving, after a first timing gap based at least in part on the first numerology,
7 the first SRS on the first CC; and
8 receiving, after a transmission timing for the second SRS based at least in part
9 on the first timing gap, the second SRS on the second CC.

1 27. The method of claim 26, wherein:
2 the first timing gap is based at least in part on a first number of symbols
3 associated with the first numerology; and
4 the transmission timing for the second SRS is based at least in part on a
5 second number of symbols associated with the second numerology.

1 28. The method of claim 26, wherein the first timing gap is based at least
2 in part on the second numerology.

1 29. The method of claim 26, wherein the transmission timing for the
2 second SRS is based at least in part on a retune time associated with retuning from the first
3 CC to the second CC and a transmission time associated with transmission of the first SRS on
4 the first CC.

1 30. The method of claim 26, wherein transmitting the indication
2 comprises:
3 transmitting an indication for transmission of a third SRS on a third CC
4 associated with a third numerology different from the first and second numerologies.

1 31. The method of claim 30, further comprising:
2 receiving, after a transmission timing for the third SRS based at least in part
3 on the transmission timing for the second SRS, the third SRS on the third CC.

1 32. The method of claim 26, wherein the indication comprises a grant
2 scheduling the first and second SRS transmissions and is transmitted via a physical downlink
3 control channel (PDCCH).

1 33. An apparatus for wireless communications, comprising:
2 means for receiving, from a base station, an indication for transmission of a
3 first sounding reference signal (SRS) on a first component carrier (CC) and a second SRS on
4 a second CC, wherein the first CC is associated with a first numerology and the second CC is
5 associated with a second numerology different from the first numerology;
6 means for determining a first timing gap between receipt of the indication and
7 transmission of the first SRS on the first CC based at least in part on the first numerology;
8 means for determining a timing for transmission of the second SRS on the
9 second CC after receipt of the indication and after the transmission of the first SRS on the
10 first CC based at least in part on the first timing gap and the second numerology; and
11 means for transmitting the first SRS based at least in part on the first timing
12 gap and second SRS based at least in part on the timing for the transmission of the second
13 SRS.

1 34. The apparatus of claim 33, further comprising:
2 means for determining a first time duration corresponding to a first number of
3 symbols associated with the first numerology, wherein the first timing gap is determined
4 based at least in part on the first time duration.

1 35. The apparatus of claim 34, wherein the first number of symbols
2 corresponds to a time between receipt of an uplink grant and transmission of uplink data for
3 the first numerology.

1 36. The apparatus of claim 34, wherein the first number of symbols
2 corresponds to a time between receipt of a physical downlink control channel (PDCCH)
3 message and transmission of the first SRS for the first numerology.

1 37. The apparatus of claim 34, further comprising:
2 means for determining a second time duration corresponding to a second
3 number of symbols associated with the second numerology, wherein the timing for the
4 transmission of the second SRS on the second CC is determined based at least in part on the
5 first time duration and the second time duration.

1 38. The apparatus of claim 37, further comprising:
2 means for determining the second time duration based at least in part on a
3 retune time associated with retuning from the first CC to the second CC and a transmission
4 time associated with transmission of the first SRS on the first CC.

1 39. The apparatus of claim 37, wherein the second number of symbols
2 corresponds to a time between receipt of an uplink grant and transmission of uplink data for
3 the second numerology, a time between receipt of a channel state information reference
4 signal (CSIRS) and transmission of a channel state feedback (CSF) message for the second
5 numerology, or a time between receipt of a physical downlink control channel (PDCCH)
6 message and transmission of the second SRS for the second numerology.

1 40. The apparatus of claim 33, wherein the means for receiving the
2 indication further comprise:
3 means for receiving an indication for transmission of a third SRS on a third
4 CC associated with a third numerology different from the first and second numerologies.

1 41. The apparatus of claim 40, further comprising:
2 means for determining a timing for transmission of the third SRS on the third
3 CC after receipt of the indication for transmission of the third SRS on the third CC and after
4 the transmission of the second SRS based at least in part on the timing for the transmission of
5 the second SRS and the third numerology; and
6 means for transmitting the third SRS based at least in part on the timing for the
7 transmission of the third SRS.

1 42. The apparatus of claim 33, wherein the means for receiving the
2 indication further comprise:
3 means for receiving an indication for transmission of additional SRSs on
4 respective CCs.

1 43. The apparatus of claim 42 further comprising:
2 means for determining respective transmission timings for the additional SRSs
3 based at least in part on numerologies associated with the respective CCs; and
4 means for transmitting the additional SRSs on the respective CCs based at
5 least in part on the respective transmission timings.

1 44. The apparatus of claim 33, wherein the indication comprises a grant
2 scheduling the first and second SRS transmissions and is received via a physical downlink
3 control channel (PDCCH).

1 45. An apparatus for wireless communications, comprising:
2 means for receiving, from a base station, an indication for transmission of a
3 first sounding reference signal (SRS) on a first component carrier (CC) and a second SRS on
4 a second CC, wherein the first CC is associated with a first numerology and the second CC is
5 associated with a second numerology different from the first numerology;
6 means for determining a first timing gap between receipt of the indication and
7 transmission of the first SRS on the first CC based at least in part on the first numerology and
8 the second numerology;
9 means for determining a timing for transmission of the second SRS on the
10 second CC after receipt of the indication and after the transmission of the first SRS on the
11 first CC based at least in part on the first timing gap; and

12 means for transmitting the first SRS based at least in part on the first timing
13 gap and the second SRS based at least in part on the timing for the transmission of the second
14 SRS.

1 46. The apparatus of claim 45, further comprising:
2 means for determining a first time duration associated with the first
3 numerology;
4 means for determining a second time duration associated with the second
5 numerology; and
6 means for determining a maximum of the first time duration and the second
7 time duration.

1 47. The apparatus of claim 45, further comprising:
2 means for determining a first time duration corresponding to a first number of
3 symbols associated with the first numerology; and
4 means for determining a second time duration corresponding to a second
5 number of symbols associated with the second numerology, wherein the first timing gap is
6 determined based at least in part on the first and second time durations.

1 48. The apparatus of claim 47, wherein the first number of symbols
2 corresponds to a time between receipt of an uplink grant and transmission of uplink data for
3 the first numerology.

1 49. The apparatus of claim 47, wherein the first number of symbols
2 corresponds to a time between receipt of a physical downlink control channel (PDCCH)
3 message and transmission of the first SRS for the first numerology.

1 50. The apparatus of claim 47, wherein the second number of symbols
2 corresponds to a time between receipt of an uplink grant and transmission of uplink data for
3 the second numerology, a time between receipt of a channel state information reference
4 signal (CSIRS) and transmission of a channel state feedback (CSF) message for the second
5 numerology, or a time between receipt of a physical downlink control channel (PDCCH)
6 message and transmission of the second SRS for the second numerology.

1 51. The apparatus of claim 45, further comprising:

2 means for determining the timing for the transmission of the second SRS on
3 the second CC based at least in part on a retune time associated with retuning from the first
4 CC to the second CC and a transmission time associated with transmission of the first SRS on
5 the first CC.

1 52. The apparatus of claim 45, wherein the means for receiving the
2 indication further comprise:

3 means for receiving an indication for transmission of a third SRS on a third
4 CC associated with a third numerology different from the first and second numerologies.

1 53. The apparatus of claim 52, further comprising:

2 means for determining a first time duration corresponding to a first number of
3 symbols associated with the first numerology;

4 means for determining a second time duration corresponding to a second
5 number of symbols associated with the second numerology; and

6 means for determining a third time duration corresponding to a third number
7 of symbols associated with the third numerology, wherein the first timing gap is determined
8 based at least in part on the first, second, and third time durations.

1 54. The apparatus of claim 53, further comprising:

2 means for determining a timing for transmission of the third SRS on the third
3 CC after receipt of the indication for transmission of the third SRS on the third CC and after
4 the transmission of the second SRS on the second CC based at least in part on the timing for
5 the transmission of the second SRS on the second CC; and

6 means for transmitting the third SRS based at least in part on the timing for the
7 transmission of the third SRS.

1 55. The apparatus of claim 45, wherein the means for receiving the
2 indication further comprise:

3 means for receiving an indication for transmission of additional SRSs on
4 respective CCs associated with respective numerologies.

1 56. The apparatus of claim 55, further comprising:

2 means for determining additional time durations corresponding to respective
3 numbers of symbols associated with the respective numerologies, wherein the first timing gap
4 is determined based at least in part on the additional time durations.

1 57. The apparatus of claim 45, wherein the indication comprises a grant
2 scheduling the first and second SRS transmissions and is received via a physical downlink
3 control channel (PDCCH).

1 58. An apparatus for wireless communications, comprising:
2 means for transmitting, to a user equipment (UE), an indication for
3 transmission of a first sounding reference signal (SRS) on a first component carrier (CC) and
4 a second SRS on a second CC, wherein the first CC is associated with a first numerology and
5 the second CC is associated with a second numerology different from the first numerology;
6 means for receiving, after a first timing gap based at least in part on the first
7 numerology, the first SRS on the first CC; and
8 means for receiving, after a transmission timing for the second SRS based at
9 least in part on the first timing gap, the second SRS on the second CC.

1 59. The apparatus of claim 58, wherein:
2 the first timing gap is based at least in part on a first number of symbols
3 associated with the first numerology; and
4 the transmission timing for the second SRS is based at least in part on a
5 second number of symbols associated with the second numerology.

1 60. The apparatus of claim 58, wherein the first timing gap is based at least
2 in part on the second numerology.

1 61. The apparatus of claim 58, wherein the transmission timing for the
2 second SRS is based at least in part on a retune time associated with retuning from the first
3 CC to the second CC and a transmission time associated with transmission of the first SRS on
4 the first CC.

1 62. The apparatus of claim 58, wherein the means for transmitting the
2 indication further comprise:
3 means for transmitting an indication for transmission of a third SRS on a third
4 CC associated with a third numerology different from the first and second numerologies.

1 63. The apparatus of claim 62, further comprising:

2 means for receiving, after a transmission timing for the third SRS based at
3 least in part on the transmission timing for the second SRS, the third SRS on the third CC.

1 64. The apparatus of claim 58, wherein the indication comprises a grant
2 scheduling the first and second SRS transmissions and is transmitted via a physical downlink
3 control channel (PDCCH).

1 65. An apparatus for wireless communications, comprising:
2 a processor;
3 memory in electronic communication with the processor; and
4 instructions stored in the memory and executable by the processor to cause the
5 apparatus to:

6 receive, from a base station, an indication for transmission of a first
7 sounding reference signal (SRS) on a first component carrier (CC) and a second SRS
8 on a second CC, wherein the first CC is associated with a first numerology and the
9 second CC is associated with a second numerology different from the first
10 numerology;

11 determine a first timing gap between receipt of the indication and
12 transmission of the first SRS on the first CC based at least in part on the first
13 numerology;

14 determine a timing for transmission of the second SRS on the second
15 CC after receipt of the indication and after the transmission of the first SRS on the
16 first CC based at least in part on the first timing gap and the second numerology; and
17 transmit the first SRS based at least in part on the first timing gap and
18 second SRS based at least in part on the timing for the transmission of the second
19 SRS.

1 66. An apparatus for wireless communications, comprising:
2 a processor;
3 memory in electronic communication with the processor; and
4 instructions stored in the memory and executable by the processor to cause the
5 apparatus to:

6 receive, from a base station, an indication for transmission of a first
7 sounding reference signal (SRS) on a first component carrier (CC) and a second SRS
8 on a second CC, wherein the first CC is associated with a first numerology and the

9 second CC is associated with a second numerology different from the first
10 numerology;
11 determine a first timing gap between receipt of the indication and
12 transmission of the first SRS on the first CC based at least in part on the first
13 numerology and the second numerology;
14 determine a timing for transmission of the second SRS on the second
15 CC after receipt of the indication and after the transmission of the first SRS on the
16 first CC based at least in part on the first timing gap; and
17 transmit the first SRS based at least in part on the first timing gap and
18 the second SRS based at least in part on the timing for the transmission of the second
19 SRS.

1 67. An apparatus for wireless communications, comprising:
2 a processor;
3 memory in electronic communication with the processor; and
4 instructions stored in the memory and executable by the processor to cause the
5 apparatus to:
6 transmit, to a user equipment (UE), an indication for transmission of a
7 first sounding reference signal (SRS) on a first component carrier (CC) and a second
8 SRS on a second CC, wherein the first CC is associated with a first numerology and
9 the second CC is associated with a second numerology different from the first
10 numerology;
11 receive, after a first timing gap based at least in part on the first
12 numerology, the first SRS on the first CC; and
13 receive, after a transmission timing for the second SRS based at least
14 in part on the first timing gap, the second SRS on the second CC.

1 68. A non-transitory computer-readable medium storing code for wireless
2 communications, the code comprising instructions executable by a processor to:
3 receive, from a base station, an indication for transmission of a first sounding
4 reference signal (SRS) on a first component carrier (CC) and a second SRS on a second CC,
5 wherein the first CC is associated with a first numerology and the second CC is associated
6 with a second numerology different from the first numerology;

7 determine a first timing gap between receipt of the indication and transmission
8 of the first SRS on the first CC based at least in part on the first numerology;
9 determine a timing for transmission of the second SRS on the second CC after
10 receipt of the indication and after the between transmission of the first SRS on the first CC
11 based at least in part on the first timing gap and the second numerology; and
12 transmit the first SRS based at least in part on the first timing gap and the
13 second SRS based at least in part on the timing for the transmission of the second SRS.

1 69. A non-transitory computer-readable medium storing code for wireless
2 communications, the code comprising instructions executable by a processor to:

3 receive, from a base station, an indication for transmission of a first sounding
4 reference signal (SRS) on a first component carrier (CC) and a second SRS on a second CC,
5 wherein the first CC is associated with a first numerology and the second CC is associated
6 with a second numerology different from the first numerology;

7 determine a first timing gap between receipt of the indication and transmission
8 of the first SRS on the first CC based at least in part on the first numerology and the second
9 numerology;

10 determine a timing for transmission of the second SRS on the second CC after
11 receipt of the indication and after the transmission of the first SRS on the first CC based at
12 least in part on the first timing gap; and

13 transmit the first SRS based at least in part on the first timing gap and the
14 second SRS based at least in part on the timing for the transmission of the second SRS.

1 70. A non-transitory computer-readable medium storing code for wireless
2 communications, the code comprising instructions executable by a processor to:

3 transmit, to a user equipment (UE), an indication for transmission of a first
4 sounding reference signal (SRS) on a first component carrier (CC) and a second SRS on a
5 second CC, wherein the first CC is associated with a first numerology and the second CC is
6 associated with a second numerology different from the first numerology;

7 receive, after a first timing gap based at least in part on the first numerology,
8 the first SRS on the first CC; and

9 receive, after a transmission timing for the second SRS based at least in part
10 on the first timing gap, the second SRS on the second CC.