CLAIMS

What is claimed is:

1. An apparatus comprising:

at least one processor; and

at least one non-transitory memory and computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to:

determine a starting position of at least one redundancy version of a transport block in a circular buffer based, at least partially, on a position of another redundancy version of the transport block in the circular buffer; and

transmit one or more of the other redundancy version and/or the at least one redundancy version using the determined starting position of the at least one redundancy version of the transport block.

2. The apparatus of claim 1, wherein determining the starting position of the at least one redundancy version comprises the at least one memory and the computer program code being configured to, with the at least one processor, cause the apparatus to:

set the starting position of the at least one redundancy version to be the same as an ending position of the other redundancy version.

3. The apparatus of claim 1, wherein determining the starting position of the at least one redundancy version comprises the at least one memory and the computer program

code being configured to, with the at least one processor, cause the apparatus to:

determine a remainder of:

a division of a starting position of the other redundancy version plus a length of the other redundancy version, and

a size of the circular buffer,

wherein the determined starting position comprises the determined remainder.

4. The apparatus of claim 1, wherein determining the starting position of the at least one redundancy version comprises the at least one memory and the computer program code being configured to, with the at least one processor, cause the apparatus to:

determine the starting position of the at least one redundancy version based, at least partially, on at least one scalar.

5. The apparatus of claim 4, wherein a number of redundancy versions of the transport block is equal to a number of physical uplink shared channel segments used for transport block over multiple segment transmission.

6. The apparatus of claim 4 or 5, wherein determining the starting position of the at least one redundancy version comprises the at least one memory and the computer program code being configured to, with the at least one processor, cause the apparatus to:

determine a remainder of a division of:

a starting position of the other redundancy version plus a size of the other redundancy version plus a scalar of the at least one scalar, and

a size of the circular buffer,

wherein the determined starting position comprises the determined remainder.

7. The apparatus of claim 6, wherein the at least one memory and the computer program code are further configured to, with the at least one processor, cause the apparatus to:

determine a first value and a second value; and

determine the scalar of the at least one scalar, wherein determining the scalar comprises multiplying the first value by a closest integer number smaller than the circular buffer size divided by the second value.

8. The apparatus of claim 7, wherein determining the first value and the second value comprises the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to at least one of:

receive a radio resource control configuration of at least one of the first value or the second value,

determine at least one of the first value or the second value based on a specification, or

receive an indication of at least one of the first value or the second value in a downlink control information field.

9. The apparatus of any of claims 4 through 6, wherein the at least one memory and the computer program code are further configured to, with the at least one processor, cause the apparatus to determine the at least one scalar based, at least partially, on an indication of a vector, wherein the vector comprises information for determining a number of scalars of the at least one scalar that is less than a number of redundancy versions of the at least one redundancy version, and wherein the determined number of the at least one scalar are cycles across the redundancy versions of the at least one redundancy version.

10. An apparatus comprising:

at least one processor; and

at least one non-transitory memory and computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to:

scale a predetermined starting position of at least one redundancy version of encoded bits of a transport block in a circular buffer based, at least partially, on a scaling factor; and

transmit at least the at least one redundancy version using the scaled starting position of the at least one redundancy version of the transport block.

11. The apparatus of claim 10, wherein scaling the predetermined starting position of the at least one redundancy version comprises the at least one memory and the computer program code being configured to, with the at least one processor, cause the apparatus to:

determine a remainder of a division of:

the predetermined starting position multiplied by the scaling factor, and

a size of the circular buffer,

wherein the scaled starting position comprises the determined remainder.

12. The apparatus of claim 10 or 11, wherein the scaling factor is configured to scale the predetermined starting position of the at least one redundancy version towards a beginning or an ending of a codeword.

13. The apparatus of any of claims 10 through 12, wherein the scaling factor comprises a single scaling factor applicable to a plurality of redundancy versions.

14. The apparatus of any of claims 10 through 13, wherein the at least one memory and the computer program code are further configured to, with the at least one processor, cause the apparatus to determine the scaling factor based on a list of values determined based on one of:

a specification,

a radio resource control configuration, or

a system information block configuration,

and a field in a scheduling downlink control information configured to select a value from the list of values.

15. The apparatus of any of claims 10 through 13, wherein the at least one memory and the computer program code are further configured to, with the at least one processor, cause the apparatus to determine the scaling factor based on a ratio between a number of bits conveyed per physical

uplink shared channel segment in the circular buffer and a size of the transport block.

16. The apparatus of any of claims 10 through 13, wherein the at least one memory and the computer program code are further configured to, with the at least one processor, cause the apparatus to determine the scaling factor based on a ratio between a number of bits conveyed per physical uplink shared channel segment in the circular buffer and one of:

a size of a gap between an ending position of a first redundancy version and an earliest predetermined starting position of the at least one redundancy version, or

a largest size of a gap between consecutive redundancy versions of a first redundancy version and the at least one redundancy version.

17. The apparatus of claim 15 or 16, wherein the number of bits conveyed per physical uplink shared channel segment in the circular buffer comprises one of:

a maximum number of bits per physical uplink shared channel segment in the circular buffer,

a minimum number of bits per physical uplink shared channel segment in the circular buffer, or

an average number of bits per physical uplink shared channel segment in the circular buffer.

18. The apparatus of any of claims 10 through 13, wherein the at least one memory and the computer program code are further configured to, with the at least one processor, cause the apparatus to determine the scaling factor based,

at least partially, on a vector of scaling factors, wherein a scaling factor of the vector of scaling factors corresponds to a redundancy version of the at least one redundancy version.

19. The apparatus of claim 18, wherein the at least one memory and the computer program code are further configured to, with the at least one processor, cause the apparatus to select the vector of scaling factors from a plurality of vectors of scaling factors based on a field of a downlink control information.

20. The apparatus of any of claims 1 through 19, wherein the at least one memory and the computer program code are further configured to, with the at least one processor, cause the apparatus to:

receive an indication to determine the starting position of one of:

all the at least one redundancy version, or

at least one of the at least one redundancy version.

21. The apparatus of claim 20, wherein the indication is based on at least one of:

a bitmap received in scheduling downlink control information,

an indication included in radio resource control signaling,

an indication included in system information block,

an indication included in a downlink control information message,

an indication included in a specification,

a percentage of codeword size not covered by at least one of the at least one redundancy version or the other redundancy version,

a number of systematic bits not covered by at least one of the at least one redundancy version or the other redundancy version,

a ratio between a size of a redundancy version of the at least one redundancy version and a size of the transport block,

a ratio between a size of a redundancy version of the at least one redundancy version and the size of the circular buffer,

a gap between two consecutive redundancy versions of the other redundancy version and the at least one redundancy version, or

a ratio between the size of the redundancy version of the at least one redundancy version and the gap between two consecutive redundancy versions.

22. The apparatus of claim 21, wherein the gap between two consecutive redundancy versions comprises one of:

a maximum gap between two consecutive redundancy versions of the other redundancy version and the at least one redundancy version, or

a minimum gap between two consecutive redundancy versions of the other redundancy version and the at least one redundancy version.

23. The apparatus of any of claims 1 through 22, wherein at least one of the at least one redundancy version or the other redundancy version is configured to transmit at least one of a plurality of physical uplink shared channel segments used for the transport block over multiple segment transmission.

24. The apparatus of claim 23, wherein at least the one of the plurality of physical uplink shared channel segments spans across multiple slots.