CLAIMS

1. A method of wireless communication, comprising:

transmitting, by a transmitter, on shared communication spectrum using a set of allocated resources, wherein the set of allocated resources spans a plurality of transmission channels within a plurality of transmission opportunities; and

adjusting, by the transmitter, a contention window size of one or more of the plurality of transmission channels for a subsequent transmission opportunity based on acknowledgement information from a receiver for the plurality of transmission channels~~.~~, wherein adjusting the contention window size of the one or more of the plurality of transmission channels for a subsequent transmission opportunity includes:

calculating, based on the acknowledgement information from the receiver for the plurality of transmission channels, an adjustment rate using a negative acknowledgement (NACK) rate for the acknowledgement information for adjusting the contention window size; and

adjusting the contention window size of the one or more of the plurality of transmission channels for the subsequent transmission opportunity by a value of the adjustment rate.

2. The method of claim 1, wherein ~~the adjusting~~ adjusting the contention window size of the one or more of the plurality of transmission channels includes:

~~determining, by~~calculating the ~~transmitter, a negative acknowledgement (~~adjustment rate to be equal to the NACK~~)~~ rate for the acknowledgement information; and

adjusting, by the transmitter, the contention window size for each of the plurality of transmission channels of the subsequent transmission opportunity ~~according to~~based on the ~~NACK~~adjustment rate.

3. The method of claim 1, wherein ~~the adjusting~~ adjusting the contention window size of the one or more of the plurality of transmission channels includes:

determining, by the transmitter, ~~a negative acknowledgement (~~the NACK~~)~~ rate for the acknowledgement information associated with each channel of the plurality of transmission channels;

generating, by the transmitter, a weighted NACK rate as the NACK rate multiplied by a ratio of one transmission channel to a number of the plurality of transmission channels;

calculating, by the transmitter, a composite adjustment number based on a combination of weighted NACK rate for each channel of the plurality of transmission channels; ~~and~~

calculating the adjustment rate to be equal to the composite adjustment number; and

adjusting, by the transmitter, the contention window size for each of the plurality of transmission channels of the subsequent transmission opportunity ~~according to~~based on the ~~composite~~ adjustment number.

4. The method of claim 1, wherein ~~the~~ adjusting the contention window size of the one or more of the plurality of transmission channels includes:

determining, by the transmitter, ~~a negative acknowledgement (~~the NACK~~)~~ rate for the acknowledgement information associated with each channel of the plurality of transmission channels;

generating, by the transmitter, a weighted NACK rate as the NACK rate for the each channel multiplied by a ratio of a number of resource blocks allocated to the each channel to a total number of resource blocks allocated to the set of allocated resources;

calculating, by the transmitter, a composite adjustment number based on a combination of the weighted NACK rate for the each channel of the plurality of transmission channels; ~~and~~

calculating the adjustment rate to be equal to the composite adjustment number; and

adjusting, by the transmitter, the contention window size for each of the plurality of transmission channels of the subsequent transmission opportunity ~~according to~~based on the ~~composite~~ adjustment number.

5. The method of claim 1, further including:

identifying, by the transmitter, a primary channel of the plurality of transmission channels, wherein the adjusting the contention window size of the one or more of the plurality of transmission channels for a subsequent transmission opportunity includes adjusting the primary channel.

6. The method of claim 5, wherein the identifying the primary channel is performed one of: semi-statically, or dynamically.

7. The method of claim 5, wherein the identifying the primary channel includes:

determining a transmission channel of the plurality of transmission channels having a highest number of resource blocks of the set of allocated resources; and

designating the transmission channel as the primary channel.

~~8. A method of wireless communication, comprising:~~

~~receiving, by a user equipment (UE), a repetition configuration signal from a serving base station, wherein the repetition configuration signal identifies a number of transmission repetitions for autonomous uplink (AUL) transmissions of the UE;~~

~~transmitting, by the UE, AUL transmission data in a plurality of uplink transmission slots across one or more transmission opportunities of a shared communication spectrum, wherein the plurality of uplink transmission slots correspond to the number of transmission repetitions;~~

~~receiving, by the UE, acknowledgement information associated with AUL transmission data; and~~

~~updating, by the UE, a contention window size for a subsequent transmission opportunity based on the acknowledgement information.~~

~~9. The method of claim 8,~~

~~wherein the transmitting includes transmitting the AUL transmission data in the plurality of uplink transmission slots across one transmission opportunity, and~~

~~wherein the updating the contention window size includes:~~

~~determining a negative acknowledgement (NACK) rate of the acknowledgement information for each of the plurality of uplink transmission slots of AUL transmission data;~~

~~combining the NACK rate of each of the plurality of uplink transmission slots of AUL transmission data into a combined NACK rate; and~~

~~determining, at a last uplink transmission slot of the plurality of uplink transmission slots of AUL transmission data, an adjustment to the contention window size based on a relationship of the combined NACK rate to a threshold rate.~~

10. The method of claim 9, wherein the receiving the acknowledgement information includes receiving portions of the acknowledgement information during a plurality of downlink slots of the one transmission opportunity.

11. The method of claim 8,

wherein the transmitting includes transmitting the AUL transmission data across a plurality of transmission opportunities, and

wherein the updating the contention window size includes:

determining a negative acknowledgement (NACK) rate of the acknowledgement information for each of the plurality of uplink transmission slots of AUL transmission data of each of the plurality of transmission opportunities; and

determining, for each subsequent transmission opportunity of the plurality of transmission opportunities, an adjustment to the contention window size based on the NACK rate associated with a previous transmission opportunity of the plurality of transmission opportunities.

12. The method of claim 8,

wherein the transmitting includes transmitting the AUL transmission data across a plurality of transmission opportunities, and

wherein the updating the contention window size includes:

determining a negative acknowledgement (NACK) rate of the acknowledgement information for each of the plurality of uplink transmission slots of AUL transmission data across the plurality of transmission opportunities;

combining the NACK rate of each of the plurality of uplink transmission slots of AUL transmission data across the plurality of transmission opportunities into a combined NACK rate; and

determining, at a last uplink transmission slot of the plurality of uplink transmission slots of AUL transmission data of a last transmission opportunity of the plurality of transmission opportunities, an adjustment to the contention window size based on a relationship of the combined NACK rate to a threshold rate.

~~13. The method of claim 12, wherein each transmission opportunity of the plurality of transmission opportunities with the plurality of uplink transmission slots of AUL transmission data includes a contention window sized according to an initial contention window of a first transmission opportunity of the plurality of transmission opportunities.~~

~~14. The method of claim 12, wherein a contention window for each subsequent transmission opportunity of the plurality of transmission opportunities with the plurality of uplink transmission slots of AUL transmission data is scaled by a fixed scaling factor.~~

~~15. The method of claim 14, further including:~~

~~receiving, by the UE, configuration of the fixed scaling factor from the serving base station.~~

~~16~~8. An apparatus configured for wireless communication, the apparatus comprising:

at least one processor; and

a memory coupled to the at least one processor,

wherein the at least one processor is configured:

to transmit, by a transmitter, on shared communication spectrum using a set of allocated resources, wherein the set of allocated resources spans a plurality of transmission channels within a plurality of transmission opportunities; and

to adjust, by the transmitter, a contention window size of one or more of the plurality of transmission channels for a subsequent transmission opportunity based on acknowledgement information from a receiver for each of the plurality of transmission channels~~.~~, wherein the configuration of the at least one processor to adjust the contention window size of the one or more of the plurality of transmission channels for a subsequent transmission opportunity includes configuration of the at least one processor:

~~17. The apparatus of claim 16, wherein the configuration of the at least one processor to adjust includes configuration of the at least one processor:~~

~~to determine, by the transmitter,~~ to calculate, based on the acknowledgement information from the receiver for the plurality of transmission channels, an adjustment rate using a negative acknowledgement (NACK) rate for the acknowledgement information for adjusting

the contention window size; and

to adjust the contention window size of the one or more of the plurality of transmission channels for the subsequent transmission opportunity by a value of the adjustment rate.

9. The apparatus of claim 8, wherein the configuration of the at least one processor to adjust the contention window size of the one or more of the plurality of transmission channels includes configuration of the at least one processor:

to calculate the adjustment rate to be equal to the NACK rate for the acknowledgement information; and

to adjust, by the transmitter, the contention window size for each of the plurality of transmission channels of the subsequent transmission opportunity ~~according to~~based on the ~~NACK~~adjustment rate.

~~18~~10. The apparatus of claim ~~16~~8, wherein the configuration of the at least one processor to adjust the contention window size of the one or more of the plurality of transmission channels includes configuration of the at least one processor:

to determine, by the transmitter, ~~a negative acknowledgement (~~the NACK~~)~~ rate for the acknowledgement information associated with each channel of the plurality of transmission channels;

to generate, by the transmitter, a weighted NACK rate as the NACK rate multiplied by a ratio of one transmission channel to a number of the plurality of transmission channels;

to calculate, by the transmitter, a composite adjustment number based on a combination of weighted NACK rate for each channel of the plurality of transmission channels;~~ and~~

to calculate the adjustment rate to be equal to the composite adjustment number; and

to adjust, by the transmitter, the contention window size for each of the plurality of transmission channels of the subsequent transmission opportunity ~~according to~~based on the ~~composite~~ adjustment number.

~~19~~11. The apparatus of claim ~~16~~8, wherein the configuration of the at least one processor to adjust the contention window size of the one or more of the plurality of transmission channels includes configuration of the at least one processor:

to determine, by the transmitter, ~~a negative acknowledgement (~~the NACK~~)~~ rate for the acknowledgement information associated with each channel of the plurality of transmission channels;

to generate, by the transmitter, a weighted NACK rate as the NACK rate for the each channel multiplied by a ratio of a number of resource blocks allocated to the each channel to a total number of resource blocks allocated to the set of allocated resources;

to calculate, by the transmitter, a composite adjustment number based on a combination of the weighted NACK rate for the each channel of the plurality of transmission channels;~~ and~~

to calculate the adjustment rate to be equal to the composite adjustment number; and

to adjust, by the transmitter, the contention window size for each of the plurality of transmission channels of the subsequent transmission opportunity ~~according to~~based on the ~~composite~~ adjustment number.

~~20~~12. The apparatus of claim ~~16~~8, further including configuration of the at least one processor to identify, by the transmitter, a primary channel of the plurality of transmission channels, wherein the configuration of the at least one processor to adjust the contention window size of the one or more of the plurality of transmission channels for a subsequent transmission opportunity includes configuration to adjust the primary channel.

~~21~~13. The apparatus of claim ~~20~~12, wherein the configuration of the at least one processor to identify the primary channel is performed one of: semi-statically, or dynamically.

~~22~~14. The apparatus of claim ~~20~~12, wherein the configuration of the at least one processor to identify the primary channel includes configuration of the at least one processor:

to determine a transmission channel of the plurality of transmission channels having a highest number of resource blocks of the set of allocated resources; and

to designate the transmission channel as the primary channel.

~~23. An apparatus configured for wireless communication, the apparatus comprising:~~

~~at least one processor; and~~

~~a memory coupled to the at least one processor,~~

~~wherein the at least one processor is configured:~~

~~to receive~~15. A non-transitory computer-readable medium storing instructions that, when executed by a processor, cause the processor to perform operations comprising:

transmitting, by a ~~user equipment (UE), a repetition configuration signal from a serving base station, wherein the repetition configuration signal identifies a number of transmission repetitions for autonomous uplink (AUL) transmissions of the UE;~~

~~to transmit, by the UE, AUL transmission data in a plurality of uplink transmission slots across one or more transmission opportunities of a~~ transmitter, on shared communication spectrum~~, wherein the~~ using a set of allocated resources, wherein the set of allocated resources spans a plurality of transmission channels within a plurality of ~~uplink~~ transmission ~~slots correspond to the number of transmission repetitions;~~opportunities; and

~~to receive~~adjusting, by the ~~UE, acknowledgement information associated with AUL transmission data; and~~

~~to update, by the UE~~transmitter, a contention window size of one or more of the plurality of transmission channels for a subsequent transmission opportunity based on ~~the~~ acknowledgement information~~.~~

~~24. The apparatus of claim 23,~~

~~wherein the configuration of the at least one processor to transmit includes configuration to transmit the AUL transmission data in~~ from a receiver for the plurality of ~~uplink~~ transmission ~~slots across one transmission opportunity, and~~

channels, wherein ~~the configuration of the at least one processor to update~~adjusting the contention window size ~~includes configuration~~ of the ~~at least~~ one ~~processor:~~

~~to determine a negative acknowledgement (NACK) rate of the acknowledgement information for each of the plurality of uplink transmission slots of AUL transmission data;~~

~~to combine the NACK rate of each~~or more of the plurality of ~~uplink~~ transmission ~~slots of AUL~~channels for a subsequent transmission ~~data into a combined NACK rate; and~~opportunity includes:

~~to determine, at a last uplink transmission slot of~~ calculating, based on the acknowledgement information from the receiver for the plurality of ~~uplink~~ transmission ~~slots of AUL transmission data~~channels, an adjustment ~~to the~~ rate using a negative acknowledgement (NACK) rate for the acknowledgement information for adjusting the contention window size ~~based on a relationship of the combined NACK rate to a threshold rate.~~; and

~~25. The apparatus of claim 24, wherein the configuration of the at least one processor to receive the acknowledgement information includes configuration to receive portions of the acknowledgement information during a plurality of downlink slots of the one transmission opportunity.~~

~~26. The apparatus of claim 23,~~

~~wherein the configuration of the at least one processor to transmit includes configuration to transmit the AUL transmission data across a plurality of transmission opportunities, and~~

~~wherein the configuration of the at least one processor to update~~ adjusting the contention window size ~~include configuration of the at least one processor s:~~of the one or more of the plurality of transmission channels for the subsequent transmission opportunity by a value of the adjustment rate.

~~to determine a negative acknowledgement (NACK) rate of the acknowledgement information for each of the plurality of uplink transmission slots of AUL transmission data of each~~

16. The non-transitory computer-readable medium of claim 15, wherein adjusting the contention window size of the one or more of the plurality of transmission ~~opportunities; and~~channels includes:

~~to determine, for each subsequent transmission opportunity of the plurality of transmission opportunities, an adjustment to the contention window size based on the NACK rate associated with a previous transmission opportunity of the plurality of transmission opportunities.~~

~~27. The apparatus of claim 23,~~

~~wherein the configuration of the at least one processor to transmit includes configuration to transmit the AUL transmission data across a plurality of transmission opportunities, and~~

~~wherein the configuration of the at least one processor to update~~calculating the adjustment rate to be equal to the NACK rate for the acknowledgement information; and

adjusting, by the transmitter, the contention window size ~~include configuration of the at least one processor s:~~for each of the plurality of transmission channels of the subsequent transmission opportunity based on the adjustment rate.

~~to determine a negative acknowledgement (NACK) rate of the acknowledgement information for each~~

17. The non-transitory computer-readable medium of claim 15, wherein adjusting the contention window size of the one or more of the plurality of ~~uplink~~ transmission ~~slots~~channels includes:

determining, by the transmitter, the NACK rate for the acknowledgement information associated with each channel of ~~AUL~~the plurality of transmission ~~data across the plurality of~~channels;

generating, by the transmitter, a weighted NACK rate as the NACK rate multiplied by a ratio of one transmission ~~opportunities;~~

~~to combine the NACK rates of each~~ channel to a number of the plurality of ~~uplink~~ transmission ~~slots of AUL~~ channels;

calculating, by the transmitter, a composite adjustment number based on a combination of weighted NACK rate for each channel of the plurality of transmission ~~data across~~channels;

calculating the adjustment rate to be equal to the composite adjustment number; and

adjusting, by the transmitter, the contention window size for each of the plurality of transmission ~~opportunities into a combined NACK rate; and~~

~~to determine, at a last uplink transmission slot of the plurality of uplink transmission slots of AUL transmission data of a last~~channels of the subsequent transmission opportunity based on the adjustment number.

18. The non-transitory computer-readable medium of claim 15, wherein adjusting the contention window size of the one or more of the plurality of transmission ~~opportunities, an adjustment to the contention window size based on a relationship of the combined NACK rate to a threshold rate.~~channels includes:

~~28. The apparatus of claim 27, wherein~~ determining, by the transmitter, the NACK rate for the acknowledgement information associated with each ~~transmission opportunity~~channel of the plurality of transmission ~~opportunities with the plurality~~channels;

generating, by the transmitter, a weighted NACK rate as the NACK rate for the each channel multiplied by a ratio of a number of ~~uplink transmission slots of AUL transmission data includes a contention window sized according~~resource blocks allocated to ~~an initial contention~~

~~window~~the each channel to a total number of resource blocks allocated to the set of ~~a first transmission opportunity~~allocated resources;

calculating, by the transmitter, a composite adjustment number based on a combination of the weighted NACK rate for the each channel of the plurality of transmission ~~opportunities.~~channels;

~~29. The apparatus of claim 27, wherein a~~calculating the adjustment rate to be equal to the composite adjustment number; and

adjusting, by the transmitter, the contention window size for each of the plurality of transmission channels of the subsequent transmission opportunity based on the adjustment number.

19. The non-transitory computer-readable medium of claim 15, further including:

identifying, by the transmitter, a primary channel of the plurality of transmission channels, wherein the adjusting the contention window size of the one or more of the plurality of transmission channels for a subsequent transmission opportunity includes adjusting the primary channel.

20. The non-transitory computer-readable medium of claim 19, wherein the identifying the primary channel is performed one of: semi-statically, or dynamically.

21. The non-transitory computer-readable medium of claim 19, wherein the identifying the primary channel includes:

determining a transmission channel of the plurality of transmission channels having a highest number of resource blocks of the set of allocated resources; and

designating the transmission channel as the primary channel.

22. An apparatus configured for wireless communication, the apparatus comprising:

means for transmitting, by a transmitter, on shared communication spectrum using a set of allocated resources, wherein the set of allocated resources spans a plurality of transmission channels within a plurality of transmission opportunities; and

means for adjusting, by the transmitter, a contention window size of one or more of the

plurality of transmission channels for a subsequent transmission opportunity based on acknowledgement information from a receiver for the plurality of transmission channels, wherein the means for adjusting the contention window size of the one or more of the plurality of transmission channels for a subsequent transmission opportunity include:

means for calculating, based on the acknowledgement information from the receiver for the plurality of transmission channels, an adjustment rate using a negative acknowledgement (NACK) rate for the acknowledgement information for adjusting the contention window size; and

means for adjusting the contention window size of the one or more of the plurality of transmission channels for the subsequent transmission opportunity by a value of the adjustment rate.

23. The apparatus of claim 22, wherein the means for adjusting the contention window size of the one or more of the plurality of transmission channels include:

means for calculating the adjustment rate to be equal to the NACK rate for the acknowledgement information; and

means for adjusting, by the transmitter, the contention window size for each of the plurality of transmission channels of the subsequent transmission opportunity based on the adjustment rate.

24. The apparatus of claim 22, wherein the means for adjusting the contention window size of the one or more of the plurality of transmission channels include:

means for determining, by the transmitter, the NACK rate for the acknowledgement information associated with each channel of the plurality of transmission channels;

means for generating, by the transmitter, a weighted NACK rate as the NACK rate multiplied by a ratio of one transmission channel to a number of the plurality of transmission channels;

means for calculating, by the transmitter, a composite adjustment number based on a combination of weighted NACK rate for each channel of the plurality of transmission ~~opportunities with~~channels;

calculating the adjustment rate to be equal to the composite adjustment number; and

means for adjusting, by the transmitter, the contention window size for each of the

plurality of ~~uplink~~ transmission ~~slots~~channels of ~~AUL~~the subsequent transmission ~~data is scaled by a fixed scaling factor~~opportunity based on the adjustment number.

~~30~~25. The apparatus of claim ~~29~~22, wherein the means for adjusting the contention window size of the one or more of the plurality of transmission channels include:

means for determining, by the transmitter, the NACK rate for the acknowledgement information associated with each channel of the plurality of transmission channels;

means for generating, by the transmitter, a weighted NACK rate as the NACK rate for the each channel multiplied by a ratio of a number of resource blocks allocated to the each channel to a total number of resource blocks allocated to the set of allocated resources;

means for calculating, by the transmitter, a composite adjustment number based on a combination of the weighted NACK rate for the each channel of the plurality of transmission channels;

calculating the adjustment rate to be equal to the composite adjustment number; and

means for adjusting, by the transmitter, the contention window size for each of the plurality of transmission channels of the subsequent transmission opportunity based on the adjustment number.

26. The apparatus of claim 22, further including ~~configuration of the at least one processor to receive, by the UE, configuration of the fixed scaling factor from the serving base station~~:

means for identifying, by the transmitter, a primary channel of the plurality of transmission channels, wherein the adjusting the contention window size of the one or more of the plurality of transmission channels for a subsequent transmission opportunity includes adjusting the primary channel.

27. The apparatus of claim 26, wherein the means for identifying the primary channel is performed one of: semi-statically, or dynamically.

28. The apparatus of claim 26, wherein the means for identifying the primary channel includes:

means for determining a transmission channel of the plurality of transmission channels

having a highest number of resource blocks of the set of allocated resources; and

means for designating the transmission channel as the primary channel.