

signal received over the network-side interface 2002 into a baseband signal. The signal processor 2010 may include any component or collection of components adapted to convert a baseband signal into a data signal suitable for communication over the device-side interface(s) 2012, or vice-versa. The device-side interface(s) 2012 may include any component or
5 collection of components adapted to communicate data-signals between the signal processor 2010 and components within the host device (e.g., the processing system 1900, local area network (LAN) ports, etc.).

[0053] The transceiver 2000 may transmit and receive signaling over any type of communications medium. In some embodiments, the transceiver 2000 transmits and receives
10 signaling over a wireless medium. For example, the transceiver 2000 may be a wireless transceiver adapted to communicate in accordance with a wireless telecommunications protocol, such as a cellular protocol (e.g., long-term evolution (LTE), etc.), a wireless local area network (WLAN) protocol (e.g., Wi-Fi, etc.), or any other type of wireless protocol (e.g., Bluetooth, near field communication (NFC), etc.). In such embodiments, the network-side
15 interface 2002 comprises one or more antenna/radiating elements. For example, the network-side interface 2002 may include a single antenna, multiple separate antennas, or a multi-antenna array configured for multi-layer communication, e.g., single input multiple output (SIMO), multiple input single output (MISO), multiple input multiple output (MIMO), etc. In other embodiments, the transceiver 1900 transmits and receives signaling over a wireline
20 medium, e.g., twisted-pair cable, coaxial cable, optical fiber, etc. Specific processing systems and/or transceivers may utilize all of the components shown, or only a subset of the components, and levels of integration may vary from device to device.

[0054] In accordance with an example of the invention, a system and method for carrier bandwidth extension is disclosed.

[0055] Example 1: A method for transmitting signals, the method comprising: transmitting, by a transmit point, a first orthogonal frequency division multiplexing (OFDM)-based signal over a first frequency sub-band of a carrier and a second OFDM-based signal over a second frequency sub-band of the carrier, the first frequency sub-band having a first bandwidth and a first numerology based on the first bandwidth, the second frequency sub-band having a second bandwidth and a second numerology based on the second bandwidth.

[0056] Example 2: The method of example 1, wherein the first numerology is different than the second numerology.

[0057] Example 3: The method of example 1, wherein the first OFDM-based signal and the second OFDM-base signal are filtered orthogonal frequency division multiplexed (f-OFDM) signals.

[0058] Example 4: The method of example 3, wherein a first filter associated with the first OFDM-based signal contains at least the first frequency sub-band, and a second filter associated with the second OFDM-based signal contains at least the second frequency sub-band.

[0059] Example 5: The method of example 1, wherein the first OFDM-based signal and the second OFDM-base signal are single carrier frequency division multiple access (SC-FDMA) signals.

[0060] Example 6: The method of example 1, wherein transmitting the first OFDM-based signal over the first frequency sub-band of the carrier and the second OFDM-based signal over the second frequency sub-band of the carrier comprises: transmitting a first OFDM-based symbol over the first frequency sub-band of the carrier and a second OFDM-based symbol over the second frequency sub-band of the carrier, the first OFDM-based symbol being communicated during the same time period as the second OFDM-based symbol.

[0061] Example 7: The method of example 1, wherein the first numerology of the first frequency band is different than the second numerology of the second frequency band such that the first OFDM-based signal is communicated in accordance with at least one different physical layer parameter than the second OFDM-based signal.

[0062] Example 8: The method of example 7, wherein the first OFDM-based signal is communicated in accordance with a different transmission time interval (TTI) than the second OFDM-based signal.

[0063] Example 9: The method of example 7, wherein the first OFDM-based signal carries symbols having a different symbol duration than symbols carried by the second OFDM-based signal.

[0064] Example 10: The method of example 7, wherein the first OFDM-based signal carries symbols having a different cyclic prefix (CP) length than symbols carried by the second OFDM-based signal.

[0065] Example 11: The method of example 7, wherein the first OFDM-based signal and the second OFDM-based signal are communicated over sub-carriers that have a different sub-carrier spacing than one another.

[0066] Example 12: The method of example 7, wherein numerologies of the first frequency band and the second frequency band are based on bandwidths of the respective frequency bands, the first frequency band having a different bandwidth than the second frequency band.

[0067] Example 13: The method of example 7, wherein the first frequency band and the second frequency band have the same bandwidth.

[0068] Example 14: The method of example 1, wherein the first frequency band and the second frequency band are separated by a guard band that is less than or equal to twenty multiples of a sub-carrier spacing of one of the first frequency band and the second frequency band.

[0069] Example 15: The method of example 14, wherein the guard band is less than or equal to ten multiples of the sub-carrier spacing of one of the first frequency band and the second frequency band.

[0070] Example 16: The method of example 14, wherein the guard band is less than or equal to five multiples of the sub-carrier spacing of one of the first frequency band and the second frequency band.

[0071] Example 17: The method of example 14, wherein the guard band is less than or equal to three multiples of the sub-carrier spacing of one of the first frequency band and the second frequency band.

[0072] Example 18: The method of example 14, wherein the guard band is equal to the sub-carrier spacing of one of the first frequency band and the second frequency band.

[0073] Example 19: The method of example 1, wherein the first frequency band and the second frequency band are contiguous in the frequency domain such that the first frequency band and the second frequency band are not separated by a guard band.

[0074] Example 20: The method of example 19, wherein the first frequency band and the second frequency band have different bandwidths.

[0075] Example 21: The method of example 1, wherein the method further comprises aggregating the first OFDM-based signal and the second OFDM-based signal into one signal spanning both the first frequency band and the second frequency band prior to transmitting the first OFDM-based signal and the second OFDM-based signal.

[0076] Example 22: The method of example 21, wherein a bandwidth of the frequency band is equal to or greater than 40 megahertz (MHz).

[0077] Example 23: A transmit point comprising: a processor; and a computer readable storage medium storing programming for execution by the processor, the programming including instructions to: transmit a first orthogonal frequency division multiplexing (OFDM)-based signal over a first frequency sub-band of a carrier and a second OFDM-based signal over a second frequency sub-band of the carrier, the first frequency sub-band having a first bandwidth and a first numerology based on the first bandwidth, the second frequency sub-band having a second bandwidth and a second numerology based on the second bandwidth.

[0078] Example 24: A method for receiving signals, the method comprising:
receiving, by a receive point, a first orthogonal frequency division multiplexing (OFDM)-based signal over a first frequency sub-band of a carrier and a second OFDM-based signal over a second frequency sub-band of the carrier, the first frequency sub-band having a first bandwidth and a first numerology based on the first bandwidth, the second frequency sub-band having a second bandwidth and a second numerology based on the second bandwidth.

[0079] Example 25: The method of example 24, wherein the first numerology is different than the second numerology.

[0080] Example 26: The method of example 24, wherein the first OFDM-based signal and the second OFDM-base signal are filtered orthogonal frequency division multiplexed (f-OFDM) signals.

[0081] Example 27: The method of example 26, wherein a first filter associated with the first OFDM-based signal contains at least the first frequency sub-band, and a second filter associated with the second OFDM-based signal contains at least the second frequency sub-band.

[0082] Example 28: The method of example 24, wherein the first OFDM-based signal and the second OFDM-based signal are single carrier frequency division multiple access (SC-FDMA) signals.

[0083] Example 29: The method of example 24, wherein receiving the first OFDM-based signal over the first frequency sub-band of the carrier and the second OFDM-based signal over the second frequency sub-band of the carrier comprises: receiving a first OFDM-based symbol over the first frequency sub-band of the carrier and a second OFDM-based symbol over the second frequency sub-band of the carrier, the first OFDM-based symbol being communicated during the same time period as the second OFDM-based symbol.

[0084] Example 30: The method of example 24, wherein the first numerology of the first frequency band is different than the second numerology of the second frequency band such that the first OFDM-based signal is communicated in accordance with at least one different physical layer parameter than the second OFDM-based signal.

[0085] Example 31: The method of example 30, wherein the first OFDM-based signal is communicated in accordance with a different transmission time interval (TTI) than the second OFDM-based signal.

[0086] Example 32: The method of example 30, wherein the first OFDM-based signal carries symbols having a different symbol duration than symbols carried by the second OFDM-based signal.

[0087] Example 33: The method of example 30, wherein the first OFDM-based signal carries symbols having a different cyclic prefix (CP) length than symbols carried by the second OFDM-based signal.

[0088] Example 34: The method of example 30, wherein the first OFDM-based signal and the second OFDM-based signal are communicated over sub-carriers that have a different sub-carrier spacing than one another.

[0089] Example 35: The method of example 30, wherein numerologies of the first frequency band and the second frequency band are based on bandwidths of the respective

frequency bands, the first frequency band having a different bandwidth than the second frequency band.

[0090] Example 36: The method of example 30, wherein the first frequency band and the second frequency band have the same bandwidth.

[0091] Example 37: The method of example 24, wherein the first frequency band and the second frequency band are separated by a guard band that is less than or equal to twenty multiples of a sub-carrier spacing of one of the first frequency band and the second frequency band.

[0092] Example 38: The method of example 37, wherein the guard band is less than or equal to ten multiples of the sub-carrier spacing of one of the first frequency band and the second frequency band.

[0093] Example 39: The method of example 37, wherein the guard band is less than or equal to five multiples of the sub-carrier spacing of one of the first frequency band and the second frequency band.

[0094] Example 40: The method of example 37, wherein the guard band is less than or equal to three multiples of the sub-carrier spacing of one of the first frequency band and the second frequency band.

[0095] Example 41: The method of example 37, wherein the guard band is equal to the sub-carrier spacing of one of the first frequency band and the second frequency band.

[0096] Example 42: The method of example 24, wherein the first frequency band and the second frequency band are contiguous in the frequency domain such that the first frequency band and the second frequency band are not separated by a guard band.

[0097] Example 43: The method of example 42, wherein the first frequency band and the second frequency band have different bandwidths.

[0098] Example 44: The method of example 42, wherein a bandwidth of the frequency band is equal to or greater than 40 megahertz (MHz).

Example 45: A receive point comprising: a processor; and a computer readable storage medium storing programming for execution by the processor, the programming including instructions to: receive a first orthogonal frequency division multiplexing (OFDM)-based signal over a first frequency sub-band of a carrier and a second OFDM-based signal over a second frequency sub-band of the carrier, the first frequency sub-band having a first bandwidth and a first

numerology based on the first bandwidth, the second frequency sub-band having a second bandwidth and a second numerology based on the second bandwidth.

[0099] Although this invention has been described with reference to illustrative embodiments, this description is not intended to be construed in a limiting sense. Various modifications and combinations of the illustrative embodiments, as well as other embodiments of the invention, will be apparent to persons skilled in the art upon reference to the description. It is therefore intended that the appended claims encompass any such modifications or embodiments.

CLAIMS:

1. A method for transmitting signals, the method comprising:
transmitting, by a transmit point, a first orthogonal frequency division multiplexing (OFDM)-based signal over a first carrier of a plurality of aggregated carriers; and
transmitting, by the transmit point, a second OFDM-based signal over a second carrier of the plurality of aggregated carriers, wherein
the first carrier has a first carrier bandwidth associated with a first set of numerologies,
the second carrier has a second carrier bandwidth associated with a second set of numerologies,
the first set of numerologies comprises a first numerology associated with a first sub-carrier spacing and a second numerology associated with a second sub-carrier spacing different from the first sub-carrier spacing, and
the second set of numerologies comprises a third numerology associated with a third sub-carrier spacing, and wherein
the first carrier bandwidth is wider than the second carrier bandwidth, and both of the first sub-carrier spacing and the second sub-carrier spacing are larger than the third sub-carrier spacing.
2. The method of claim 1, wherein the second carrier has a 5 MHz carrier bandwidth.
3. The method of any one of claims 1 or 2, wherein the first carrier has a carrier bandwidth larger than 5 MHz, and the first sub-carrier spacing and the second sub-carrier spacing are 30 kHz and 60 kHz, respectively.
4. The method of any one of claims 1 to 3, wherein the first carrier has a 10 MHz, 15 MHz or 20 MHz carrier bandwidth, and the first set of numerologies further comprises a fourth sub-carrier spacing of 15 kHz or a fifth sub-carrier spacing of 120 kHz.
5. The method of any one of claims 1 to 4, wherein the first carrier and the second carrier are separated by a guard band that is less than or equal to twenty multiples of any of the first sub-carrier spacing, the second sub-carrier spacing, or the third sub-carrier spacing.
6. The method of claim 5, wherein the guard band is less than or equal to: ten multiples of any of the first sub-carrier spacing, the second sub-carrier spacing, or the third sub-carrier

spacing; five multiples of any of the first sub-carrier spacing, the second sub-carrier spacing, or the third sub-carrier spacing; or three multiples of any of the first sub-carrier spacing, the second sub-carrier spacing, or the third sub-carrier spacing, or wherein the guard band is equal to any of the first sub-carrier spacing, the second sub-carrier spacing, or the third sub-carrier spacing.

7. The method of any one of claims 1 to 6, wherein the first set of numerologies comprises a first transmission time interval (TTI) and a second TTI, and the second set of numerologies comprises a third TTI, and wherein both the first TTI and the second TTI are shorter than the third TTI.

8. A transmit point comprising:
a processor; and
a computer readable storage medium storing programming for execution by the processor, the programming including instructions to implement steps in accordance with any one of claims 1 to 7.

9. A method for receiving signals, the method comprising:
receiving, by a receive point, a first orthogonal frequency division multiplexing (OFDM)-based signal over a first carrier of a plurality of aggregated carriers; and
receiving, by the receive point, a second OFDM-based signal over a second carrier of the plurality of aggregated carriers, wherein
the first carrier has a first carrier bandwidth associated with a first set of numerologies,
the second carrier has a second carrier bandwidth associated with a second set of numerologies
the first set of numerologies comprises a first numerology associated with a first sub-carrier spacing and a second numerology associated with a second sub-carrier spacing different from the first sub-carrier spacing, and
the second set of numerologies comprises a third numerology associated with a third sub-carrier spacing, and wherein
the first carrier bandwidth is wider than the second carrier bandwidth, and both of the first sub-carrier spacing and the second sub-carrier spacing are larger than the third sub-carrier spacing.

10. The method of claim 9, wherein the second carrier has a 5 MHz carrier bandwidth.

11. The method of any one of claims 9 or 10, wherein the first carrier has a carrier bandwidth larger than 5 MHz, and the first sub-carrier spacing and the second sub-carrier spacing are 30 kHz and 60 kHz, respectively.

12. The method of any one of claims 9 to 11, wherein the first carrier has a 10 MHz, 15 MHz or 20 MHz carrier bandwidth, and the first set of numerologies further comprises a fourth sub-carrier spacing of 15 kHz or a fifth sub-carrier spacing of 120 kHz.

13. The method of any one of claims 9 to 12, wherein the first carrier and the second carrier are separated by a guard band that is less than or equal to twenty multiples of any one of the first sub-carrier spacing, the second sub-carrier spacing, or the third sub-carrier spacing.

14. The method of claim 13, wherein the guard band is less than or equal to: ten multiples of any of the first sub-carrier spacing, the second sub-carrier spacing, or the third sub-carrier spacing; five multiples of any of the first sub-carrier spacing, the second sub-carrier spacing, or the third sub-carrier spacing; or three multiples of any of the first sub-carrier spacing, the second sub-carrier spacing, or the third sub-carrier spacing, or wherein the guard band is equal to any of the first sub-carrier spacing, the second sub-carrier spacing, or the third sub-carrier spacing.

15. The method of any one of claims 9 to 14, wherein the first set of numerologies comprises a first transmission time interval (TTI) and a second TTI, and the second set of numerologies comprises a third TTI, and wherein both the first TTI and the second TTI are shorter than the third TTI.

16. A receive point comprising:
a processor; and
a computer readable storage medium storing programming for execution by the processor, the programming including instructions to implement steps in accordance with any one of claims 9 to 15.