What is claimed is:

1. A method implemented by a wireless transmit/receive unit (WTRU) for transmission of symbols over a plurality of single carrier (SC) channels, comprising:

receiving, at the WTRU, a set of bits;

generating at least two complex-valued symbols based on the set of bits using a pipelined modulation at least in part by (i) mapping the set of bits to a first symbol using a first constellation mapping and (ii) mapping the set of bits to a second symbol using a second constellation mapping, wherein the first constellation mapping and the second constellation mapping each map the set of bits to different constellation signal points;

selecting a first channel resource in a first SC channel for the first symbol and selecting a second channel resource in a second SC channel for the second symbol; and

transmitting, by the WTRU, the first and second symbols using the respective selected channel resources.

2. The method of claim 1, wherein the first SC channel and the second SC channel have a same center frequency and the first channel resource is a first spatial stream of a MIMO transmission and the second channel resource is a second spatial stream of the MIMO transmission.

3. The method of claim 2, wherein the second channel resource is temporally offset from the first channel resource.

4. The method of claim 1, wherein the first SC channel and the second SC channel have different center frequencies and together constitute a carrier-aggregated channel.

5. The method of claim 1, wherein the first constellation mapping and the second constellation mapping are selected such that adjacent constellations point pairs in the first mapping are non-adjacent in the second mapping.

6. The method of claim 1, wherein the generating of the at least two complex-valued symbols using the pipelined modulation further comprises, performing any one of: (i) a bit-wise operation to the set of bits prior to the mapping of the set of bits to the second symbol; or (ii) a symbol-wise operation performed on the first symbol to obtain the second symbol.

7. The method of claim 6, wherein the symbol wise operation is time-varying.

8. The method of claim 1, wherein the mapping of the set of bits to the second symbol using the second constellation mapping comprises at least modifying IQ values of the first symbol to generate the second symbol.

9. The method of claim 1, wherein at least one of the first constellation mapping and the second constellation mapping is a square 64-QAM constellation mapping.

10. The method of claim 1, further comprising allocating the second channel resource for the second symbol, wherein the allocating of the second channel resource for the second symbol is carried out according to a function that is based on parameters of the first channel resource.

11. The method of claim 10, wherein a signaling field is used to indicate a predefined function and the parameters.

12. The method of claim 10, wherein the function is based on any of: (1) a chip index of the first channel resource and allocates a chip index for the second channel resource that is separated by a coherence time from the first channel resource; (2) a spatial sample stream index of the first channel resource; (3) a spatial time stream index of the first channel resource; or (4) a processing-time difference between a first signal processing path that corresponds with the first symbol and a second signal processing path that corresponds with the second symbol.

13. A wireless transmit/receive unit (WTRU) configured to transmit symbols over a plurality of single carrier (SC) channels, comprising:

a processor configured to:

receive a set of bits,

generate complex baseband symbols from the set of bits at least in part by (i) mapping the set of bits to a first symbol using a first constellation mapping and by (ii) mapping the set of bits to a second symbol using a second constellation mapping, wherein the first constellation mapping and the second constellation mapping each map the set of bits to different constellation signal points, and

select a first channel resource in a first SC channel for the first symbol and a second channel resource in a second SC channel for the second symbol; and

transmitter circuitry configured to transmit the first and second symbols using the respective selected channel resources.

14. The WTRU of claim 13, wherein the first SC channel and the second SC channel have a same center frequency and the first channel resource is a first spatial stream of a MIMO transmission and the second channel resource is a second spatial stream of the MIMO transmission.

15. The WTRU of claim 14, wherein the second channel resource is temporally offset from the first channel resource.

16. The WTRU of claim 13, wherein the processor is configured to perform at least one of (i) a bit-wise operation to the set of bits prior to the mapping of the set of bits to the second symbol or (ii) a time-varying symbol-wise operation performed on the first symbol to obtain the second symbol.

17. The WTRU of claim 13, wherein the processor is configured to any of: (1) at least modify IQ values of the first symbol to generate the second symbol; or (2) interleave the first symbol and the second symbol prior to selection of the first and second channel resources.

18. The WTRU of claim 13, wherein any of: the first constellation mapping or the second constellation mapping is a square 64-QAM constellation mapping.