

CLAIMS

What is claimed is:

1. A method of communication in a wireless network, comprising:
 - transmitting, from a transmitting device to a receiving device, a first message that indicates a puncturing pattern that will be used to puncture a punctured sounding message via a wireless channel;
 - transmitting, from the transmitting device to the receiving device, the punctured sounding message via the wireless channel, wherein the punctured sounding message omits portions of a signal on the wireless channel based on the puncturing pattern;
 - receiving, from the receiving device, a feedback message that includes feedback information based on non-punctured portions of the punctured sounding message.
2. The method of claim 1, wherein the puncturing pattern includes a disallowed subchannel bitmap that identifies which subchannels or resource units (RUs) are punctured.
3. The method of claim 2, wherein the subchannels indicated in the puncturing pattern are identified based on 20 MHz channels in a tone map for a frequency band.
4. The method of claim 2, wherein the RUs indicated in the puncturing pattern are identified based on groups of subcarriers in a tone map for a frequency band.
5. The method of claim 1, further comprising:
 - transmitting a management frame that indicates a puncturing pattern for the wireless channel, wherein the management frame is a beacon frame from an access point to one or more stations.
6. The method of claim 1, wherein the feedback information includes beamforming feedback determined by the receiving device based on the punctured sounding message.
7. The method of claim 6, wherein the beamforming feedback is a compressed beamforming metric that is based on an average of signal to noise measurements for the non-punctured portions of the wireless channel.

8. The method of claim 1, further comprising:
before sending the first message with the puncturing pattern, determining that the receiving device supports puncturing sounding.
9. The method of claim 8, wherein determining that the receiving device supports puncturing sounding includes receiving a punctured sounding capability indicator from the receiving device.
10. The method of claim 1, further comprising:
determining a beamforming parameter for a subsequent data communication from the transmitting device to the receiving device based, at least in part, on the feedback information.
11. The method of claim 1, wherein the first message is a null data packet announcement (NDPA) and the punctured sounding message is a null data packet (NDP).
12. A method of communication in a wireless network, comprising:
receiving, from a transmitting device by a receiving device, a first message that indicates a puncturing pattern that will be used to puncture a punctured sounding message via a wireless channel;
receiving, from the transmitting device by the receiving device, the punctured sounding message via the wireless channel, wherein the punctured sounding message omits portions of a signal on the wireless channel based on the puncturing pattern; and
transmitting, from the receiving device to the transmitting device, a feedback message that includes feedback information determined based on non-punctured portions of the punctured sounding message.
13. The method of claim 12, wherein the puncturing pattern includes a disallowed subchannel bitmap that identifies which subchannels or resource units are punctured.
14. The method of claim 13, wherein the subchannels indicated in the puncturing pattern are identified either based on 20 MHz channels in a tone map for a frequency band or based on groups of subcarriers in a tone map for a frequency band.

15. The method of claim 12, further comprising:
determining beamforming feedback based on the punctured sounding message; and
including the beamforming feedback in the feedback information.
16. The method of claim 15, wherein the feedback information includes a compressed beamforming metric that is based on an average of signal to noise measurements for the non-punctured portions of the wireless channel.
17. The method of claim 12, further comprising:
transmitting, from the receiving device to the transmitting device, a punctured sounding capability indicator that indicates the receiving device supports punctured sounding.
18. A first wireless device for communication in a wireless network, comprising:
a processor;
memory in electronic communication with the processor; and
instructions stored in the memory and executable by the processor to cause the first wireless device to:
output for transmission a first message to a second wireless device, the first message indicating a puncturing pattern that will be used to puncture a punctured sounding message via a wireless channel;
output for transmission to the second wireless device the punctured sounding message via the wireless channel, wherein the punctured sounding message omits portions of a signal on the wireless channel based on the puncturing pattern;
obtain from the second wireless device a feedback message that includes feedback information based on non-punctured portions of the punctured sounding message.
19. The first wireless device of claim 18, wherein the puncturing pattern includes a disallowed subchannel bitmap that identifies which subchannels or resource units are punctured.
20. The first wireless device of claim 19, wherein the subchannels indicated in the puncturing pattern are identified either based on 20 MHz channels in a tone map for a frequency band or based on groups of subcarriers in a tone map for a frequency band.

21. The first wireless device of claim 18, wherein the instructions are further executable by the processor to cause the first wireless device to:

output for transmission a management frame that indicates a puncturing pattern for the wireless channel, wherein the management frame is a beacon frame from an access point to one or more stations.

22. The first wireless device of claim 18, wherein the feedback information includes beamforming feedback determined by the second wireless device based on the punctured sounding message.

23. The first wireless device of claim 22, wherein the beamforming feedback is a compressed beamforming metric that is based on an average of signal to noise measurements for the non-punctured portions of the wireless channel.

24. The first wireless device of claim 18, wherein the instructions are further executable by the processor to cause the first wireless device to:

determine a beamforming parameter for a subsequent data communication from the first wireless device to the second wireless device based, at least in part, on the feedback information.

25. The first wireless device of claim 18, wherein the first message is a null data packet announcement (NDPA) and the punctured sounding message is a null data packet (NDP).

26. A first wireless device for communication in a wireless network, comprising:
a processor;

memory in electronic communication with the processor; and

instructions stored in the memory and executable by the processor to cause the first wireless device to:

obtain a first message from a second wireless device, wherein the first message indicates a puncturing pattern that will be used to puncture a punctured sounding message via a wireless channel;

obtain from the second wireless device the punctured sounding message via the wireless channel, wherein the punctured sounding message omits portions of a signal on the wireless channel based on the puncturing pattern; and

output for transmission to the second wireless device, a feedback message that includes feedback information determined based on non-punctured portions of the punctured sounding message.

27. The first wireless device of claim 26, wherein the puncturing pattern includes a disallowed subchannel bitmap that identifies which subchannels or resource units are punctured.

28. The first wireless device of claim 27, wherein the subchannels indicated in the puncturing pattern are identified either based on 20 MHz channels in a tone map for a frequency band or based on groups of subcarriers in a tone map for a frequency band.

29. The first wireless device of claim 26, wherein the instructions are further executable by the processor to cause the first wireless device to:

determine beamforming feedback based on the punctured sounding message; and
include the beamforming feedback in the feedback information.

30. The first wireless device of claim 29, wherein the feedback information includes a compressed beamforming metric that is based on an average of signal to noise measurements for the non-punctured portions of the wireless channel.