taken in conjunction with the accompanying drawings and this background of the disclosure.

SUMMARY

[6] Non-limiting and exemplary embodiments facilitate providing communication apparatuses and communication methods for control signaling in context of EHT WLAN.

[7] According to an embodiment of the present disclosure, there is provided a communication apparatus comprising: circuitry, which, in operation, generates an Extremely High Throughput (EHT) basic Physical layer Protocol Data Unit (PPDU) comprising a Universal Signal (U-SIG) field and an EHT Signal (EHT-SIG) field, wherein the U-SIG field comprises punctured channel information and the EHT-SIG field comprises supplemental punctured channel information; and a transmitter, which, in operation, transmits the EHT basic PPDU, wherein when the EHT basic PPDU is used for punctured single-user (SU) or multi-user (MU) multiple input multiple output (MIMO) transmission and the punctured channel information is able to indicate a channel puncturing pattern that is applied to the EHT basic PPDU, the EHT-SIG field does not comprise the supplemental punctured channel information.

[8] According to another embodiment of the present disclosure, there is provided a communication apparatus comprising: a receiver, which, in operation, receives an Extremely High Throughput (EHT) basic Physical layer Protocol Data Unit (PPDU) comprising a Universal Signal (U-SIG) field and an EHT Signal (EHT-SIG) field, wherein the U-SIG field comprises punctured channel information and the EHT-SIG field comprises supplemental punctured channel information; and circuitry, which, in operation, processes the EHT basic PPDU, wherein when the EHT basic PPDU is used for punctured SU or MU-MIMO transmission and the punctured channel information is able to indicate a channel puncturing pattern that is applied to the EHT basic PPDU, the EHT-SIG field does not comprise the supplemental punctured channel information.

[9] According to yet another embodiment of the present disclosure, there is provided a communication method comprising: generating an Extremely High Throughput (EHT) basic Physical layer Protocol Data Unit (PPDU) comprising a Universal Signal (U-SIG) field and a EHT Signal (EHT-SIG) field, wherein the U-SIG field comprises punctured channel information and the EHT-SIG field comprises supplemental punctured channel information; and transmitting the EHT basic PPDU, wherein when the

EHT basic PPDU is used for punctured SU or MU-MIMO transmission and the punctured channel information is able to indicate a channel puncturing pattern that is applied to the EHT basic PPDU, the EHT-SIG field does not comprise the supplemental punctured channel information.

[10] It should be noted that general or specific embodiments may be implemented as a system, a method, an integrated circuit, a computer program, a storage medium, or any selective combination thereof.

[11] Additional benefits and advantages of the disclosed embodiments will become apparent from the specification and drawings. The benefits and/or advantages may be individually obtained by the various embodiments and features of the specification and drawings, which need not all be provided in order to obtain one or more of such benefits and/or advantages.

BRIEF DESCRIPTION OF THE DRAWINGS

[12] Embodiments of the disclosure will be better understood and readily apparent to one of ordinary skilled in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

[13] Fig. 1A depicts a schematic diagram of uplink and downlink single-user (SU) multiple input multiple output (MIMO) communication between an access point (AP) and a station (STA) in a MIMO wireless network.

[14] Fig. 1B depicts a schematic diagram of downlink multi-user (MU) communication between an AP and multiple STAs in a MIMO wireless network.

[15] Fig. 1C depicts a schematic diagram of trigger-based uplink MU communication between an AP and multiple STAs in a MIMO wireless network.

[16] Fig. 1D depicts a schematic diagram of trigger-based downlink multi-AP communication between multiple APs and a STA in a MIMO wireless network.

[17] Fig. 2A depicts an example format of a PPDU (physical layer protocol data unit) used for uplink and downlink SU communications between an AP and a STA in an HE WLAN.

CLAIMS

1. A communication apparatus comprising:

circuitry, which, in operation, generates an Extremely High Throughput (EHT) basic Physical layer Protocol Data Unit (PPDU) comprising a Universal Signal (U-SIG) field and an EHT Signal (EHT-SIG) field, wherein the U-SIG field comprises punctured channel information and the EHT-SIG field comprises supplemental punctured channel information; and

a transmitter, which, in operation, transmits the EHT basic PPDU,

wherein when the EHT basic PPDU is used for punctured single-user (SU) or multi-user (MU) multiple input multiple output (MIMO) transmission and the punctured channel information is able to indicate a channel puncturing pattern that is applied to the EHT basic PPDU, the EHT-SIG field does not comprise the supplemental punctured channel information.

2. The communication apparatus of claim 1, wherein the punctured channel information is able to indicate all channel puncturing patterns that are allowed for up to a determined bandwidth.

3. The communication apparatus of claim 1, wherein the punctured channel information is able to indicate all channel puncturing patterns that are allowed for up to a determined bandwidth and a part of channel puncturing patterns for bandwidths which are larger than the determined bandwidth.

4. The communication apparatus of claim 1, wherein the punctured channel information and bandwidth information are indicated in a single signalling field of the U-SIG field.

5. The communication apparatus of claim 1, wherein the punctured channel information and bandwidth information are indicated in respective signalling fields of the U-SIG field.

6. The communication apparatus of claim 1, wherein when the EHT basic PPDU is used for punctured Orthogonal Frequency Division Multiple Access (OFDMA) transmission and the punctured channel information is not able to indicate a channel puncturing pattern that is applied to the EHT basic PPDU, the EHT-SIG field comprises the supplemental punctured channel information that, together with the punctured channel information, indicates the channel puncturing pattern that is applied to the EHT basic PPDU.

7. A communication apparatus comprising:

a receiver, which, in operation, receives an Extremely High Throughput (EHT) basic Physical layer Protocol Data Unit (PPDU) comprising a Universal Signal (U-SIG) field and an EHT Signal (EHT-SIG) field, wherein the U-SIG field comprises punctured channel information and the EHT-SIG field comprises supplemental punctured channel information; and

circuitry, which, in operation, processes the EHT basic PPDU,

wherein when the EHT basic PPDU is used for punctured single-user (SU) or multi-user (MU) multiple input multiple output (MIMO) transmission and the punctured channel information is able to indicate a channel puncturing pattern that is applied to the EHT basic PPDU, the EHT-SIG field does not comprise the supplemental punctured channel information.

8. The communication apparatus of claim 7, wherein the punctured channel information is able to indicate all channel puncturing patterns that are allowed for up to a determined bandwidth.

9. The communication apparatus of claim 7, wherein the punctured channel information is able to indicate all channel puncturing patterns that are allowed for up to a determined bandwidth and a part of channel puncturing patterns for bandwidths which are larger than the determined bandwidth.

10. The communication apparatus of claim 7, wherein the punctured channel information and bandwidth information are indicated in a single signalling field of the U-SIG field.

11. The communication apparatus of claim 7, wherein the punctured channel information and bandwidth information are indicated in respective signalling fields of the U-SIG field.

12. The communication apparatus of claim 7, wherein when the EHT basic PPDU is used for punctured Orthogonal Frequency Division Multiple Access (OFDMA) transmission and the punctured channel information is not able to indicate a channel puncturing pattern that is applied to the EHT basic PPDU, the EHT-SIG field comprises the supplemental punctured channel information that, together with the punctured channel information, indicates the channel puncturing pattern that is applied to the EHT basic PPDU.

13. A communication method comprising:

generating an Extremely High Throughput (EHT) basic Physical layer Protocol Data Unit (PPDU) comprising a Universal Signal (U-SIG) field and an EHT Signal (EHT-SIG) field, wherein the U-SIG field comprises punctured channel information and the EHT-SIG field comprises supplemental punctured channel information; and

transmitting the EHT basic PPDU,

wherein when the EHT basic PPDU is used for punctured single-user (SU) or multi-user (MU) multiple input multiple output (MIMO) transmission and the punctured channel information is able to indicate a channel puncturing pattern that is applied to the EHT basic PPDU, the EHT-SIG field does not comprise the supplemental punctured channel information.