IEEE P802.11
Wireless LANs

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| **Proposed Resolution of TGax draft specification** |
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TGax Editor: Insert the following new subclauses after the last subclause in 9.4.2:

#### 9.4.2.213 HE Capabilities element

An HE STA declares that it is an HE STA by transmitting the HE Capabilities element.

The HE Capabilities element contains a number of fields that are used to advertise the HE capabilities of an HE STA. The HE Capabilities element is defined in Figure 9-554aa (HE Capabilities element format).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | HE PHY Capabilities Information | Tx Rx HE MCS Support | HE MAC Capabilities Information | PPE Thresholds(optional) |
| Octets: | 1 | 1 | 9 | 2 or more | - | variable |

Figure 9‑554aa - HE Capabilities element format

The Element ID and Length fields are defined in 9.4.2.1 (General).

The format of the HE PHY Capabilities Information field is defined in Figure 9-bbbab (HE PHY Capabilities field format).



Figure 9‑bbbab - HE PHY Capabilities field format

The subfields of the HE PHY Capabilities Information field are defined as follows:

|  |  |  |
| --- | --- | --- |
| Subfield | Definition | Encoding |
| Dual band support | Indicates support of both 2.4 GHz and 5 GHz frequency bands | Set to 0 if not supported. Set to 1 if supported. |
| Channel width set | B1: Indicates STA support 40 MHz channel width in 2.4 GHzB2: Indicates STA support 40 MHz and 80 MHz channel width in 5 GHzB3: Indicates STA supports 160 MHz channel width in 5 GHzB4: Indicates STA supports 160/80+80 MHz channel width in 5 GHzB5: If B1 is set to 0, then B5 indicates support of 242/106/52/26-tone RU mapping in 40 MHz channel width in 2.4 GHz. Otherwise Reserved.B6: If B2, B3, and B4 are set to 0, then B6 indicates support of 242-tone RU mapping in 40 MHz and 80 MHz channel width in 5 GHz. Otherwise Reserved.B7: Reserved | B1 set to 0 if not supported. B1 set to 1 if supported.B2 set to 0 if not supported, i.e., it indicates 20 MHz only device in 5 GHz. B2 set to 1 if supported. Note AP always sets B2 to 1.B3 set to 0 if not supported. B3 set to 1 if supported. If B3 set to 1 then B2 is set to 1.B4 set to 0 if not supported. B4 set to 1 if supported. If B4 set to 1 then B3 is set to 1.B5 set to 0 if not supported. B5 set to 1 if supported.B6 set to 0 if not supported. B6 set to 1 if supported.NOTE: B1 and B5 are only applicable to 2.4 GHz and ignored at the receiver when HE PHY capabilities advertised on 5 GHz.B2, B3, B4, and B6 are only applicable to 5 GHz and ignored at the receiver when HE PHY capabilities advertised of 2.4 GHz. |
| Preamble Puncturing Rx | B8: Indicates STA supports reception of preamble puncturing in 80 MHz, where in the preamble only the secondary 20 MHz is puncturedB9: Indicates STA supports reception of preamble puncturing in 80 MHz, where in the preamble only one of the two 20 MHz sub-channels in the secondary 40 MHz is puncturedB10: Indicates STA supports reception of preamble puncturing in 160 MHz or 80+80 MHz, where in the primary 80 MHz of the preamble only the secondary 20 MHz is puncturedB11: Indicates STA supports reception of preamble puncturing in 160 MHz or 80+80 MHz, where in the primary 80 MHz of the preamble, the primary 40 MHz is present | B8 set to 0 if not supported. B8 set to 1 if supported.B9 set to 0 if not supported. B9 set to 1 if supported.B10 set to 0 if not supported. B10 set to 1 if supported.B11 set to 0 if not supported. B11 set to 1 if supported. |
| Class of Device | Indicates transmitting STA is a Class A or a Class B device. | Set to 1 to indicate STA is a Class A device.Set to 0 to indicate STA is a Class B device.Note: This field is reserved when transmitting STA is an AP STA. |
| LDPC Coding in Payload | Indicates support of transmission and reception of LDPC encoded packets | Set to 1 if supported by the STA. Set to 0 otherwise. |
| HE-LTF and GI combination for HE PPDUs | B14: Indicates support of reception of 1x LTF and 0.8 us guard interval duration for HE SU PPDUs.B15: Indicates support of reception of 1x LTF and 1.6 us guard interval duration for HE Trigger-based PPDUs. | Set to 1 if supported by the STA.Set to 0 otherwise.  |
| HE-LTF and GI combination for NDP | B16: For a transmitting STA acting as beamformer, it indicates support of NDP transmission using 4x LTF and 3.2 us guard interval durationB17: For a transmitting STA acting as beamformee, it indicates support of NDP reception using 4x LTF and 3.2 us guard interval duration | If the SU Beamformer Capable field is set to 1 then B16 set to 1 if supported by the STA. Set B16 to 0 otherwise.If SU Beamformer Capable field is set to 0 then B16 is reserved.If the SU Beamformee Capable field is set to 1 the B17 set to 1 if supported by the STA.Set B17 to 0 otherwise. |
| STBC Tx and Rx | B18 indicates support for the transmission of HE PPDUs using STBC with one spatial streamB19 indicates support for the reception of HE PPDUs using STBC with one spatial stream | B18 set to 1 if supported by the STA. Set to 0 otherwise.B19 set to 1 if supported by the STA. Set to 0 otherwise. |
| Doppler | B20 indicates transmitting STA supports transmitting HE PPDUs with Doppler procedureB21 indicates transmitting STA supports receiving HE PPDUs with Doppler procedure | B20 set to 1 if supported by the STA. Set to 0 otherwise.B21 set to 1 if supported by the STA. Set to 0 otherwise. |
| Uplink MU | If the transmitting STA is an AP:B22 indicates STA supports of reception of full bandwidth UL MU-MIMO transmission.B23 indicates STA supports of reception of UL MU-MIMO transmission on an RU in an HE MU PPDU where the RU does not span the entire PPDU bandwidth.If the transmitting STA is a non-AP STA:B22 indicates STA supports of transmission of full bandwidth UL MU-MIMO transmission. B23 indicates STA supports of transmission of UL MU-MIMO transmission on an RU in an HE MU PPDU where the RU does not span the entire PPDU bandwidth. | B22 set to 1 if supported by the STA. Set to 0 otherwise.B23 set to 1 if supported by the STA. Set to 0 otherwise.NOTE:If the non-AP STA sets B23 (Uplink MU-MIMO on Partial Bandwidth) to 0, it shall support transmitting SU RU within an HE MU PPDU where some other RU is employing DL MU-MIMO |
| DCM encoding at Tx and Rx | B24 - B26 Signals support of Tx of (i) packet payload with dual sub-carrier modulation at a STA and (ii) DCM encoded HE-SIG-B in an HE MU PPDU at a STA. The signaling includes maximum constellation and the maximum number of spatial streams that are supported with DCM.B27 – B29 Signals support of reception of (i) packet payload with dual sub-carrier modulation at a STA and (ii) DCM encoded HE-SIG-B in an HE MU PPDU at a STA. The signaling includes maximum constellation and the maximum number of spatial streams that are supported with DCM. | B25:B24 signals Maximum Constellation00: Does not support DCM, 01: BPSK , 10: QPSK, 11: 16-QAM B26 signals maximum number of spatial streams with DCM0: 1 spatial stream, 1: 2 spatial streams.B28:B27 signals Maximum Constellation00: Does not support DCM, 01: BPSK , 10: QPSK, 11: 16-QAM B29 signals maximum number of spatial streams with DCM0: 1 spatial stream, 1: 2 spatial streams |
| UL HE MU PPDU Payload over 106-tone RU | It indicates STA supports of reception of HE MU PPDU payload over a 106-tone RU within 20 MHz | Set to 1 if supported by the STA. Set to 0 otherwise |
| SU Beamformer Capable | Indicates support for operation as an SU beamformer. | Set to 0 if not supported. Set to 1 if supported.Set to 1 if sent by an HE AP with supported spatial streams $\geq 4.$ |
| SU Beamformee Capable | Indicates support for operation as an SU beamformee. | Set to 0 if not supported. Set to 1 if supported.Set to 1 if sent by a non-AP STA. |
| MU Beamformer Capable | Indicates support for operation as an MU Beamformer. | Set to 0 if not supported.Set to 0 if SU beamformer Capable is set to 0.Set to 0 if sent by a non-AP STA. Set to 1 if supported.Set to 1 if SU beamformer Capable is set to 1.Set to 1 if sent by an AP. |
| Beamformee STS Capability for BW $\leq 80 MHz$  | The maximum number of space-time streams that the STA can receive in an HE NDP | If SU beamformee capable, set to maximum number of space-time streams that the STA can receive in an HE NDP minus 1. The minimum value of this field is 3. Otherwise, reserved. |
| Nsts\_Total support for BW $\leq 80 MHz$ | The maximum value for $N\_{STS,total}$ that can be sent to the STA in an DL MU-MIMO transmission on full or partial bandwidth | If SU beamformee capable, set to maximum number of total space-time streams that the STA can receive minus 1. The minimum value of this field is 3. Otherwise reserved. |
| Beamformee STS Capability for BW $>80 MHz$ | The maximum number of space-time streams that the STA can receive in an HE NDP | If SU beamformee capable, set to maximum number of space-time streams that the STA can receive in an HE NDP minus 1. The minimum value of this field is 3. Otherwise, reserved. |
| Nsts\_Total support for BW $>80 MHz$ | The maximum value for $N\_{STS,total}$ that can be sent to the STA in an DL MU-MIMO transmission on full or partial bandwidth | If SU beamformee capable, set to maximum number of total space-time streams that the STA can receive minus 1. The minimum value of this field is 3. Otherwise reserved. |
| Number of Sounding Dimensions for BW $\leq 80 MHz$ | Beamformer’s capability indicating the maximum value of the TXVECTOR parameter NUM\_STS for an HE NDP | If SU beamformer capable, set to the maximum supported value of the TXVECTOR parameter NUM\_STS minus 1. Otherwise, reserved |
| Number of Sounding Dimensions for BW $>80 MHz $ | Beamformer’s capability indicating the maximum value of the TXVECTOR parameter NUM\_STS for an HE NDP | If SU beamformer capable, set to the maximum supported value of the TXVECTOR parameter NUM\_STS minus 1. Otherwise, reserved |
| Ng = 16 Capable for SU-Type Feedback | Indicates if HE Beamformee is capable of feedback with tone grouping of 16 in the HE Compressed Beamforming Report field for a SU-type feedback. | Set to 1 if supported by the STA. Set to 0 otherwise. |
| Ng = 16 Capable for MU-Type Feedback | Indicates if HE Beamformee is capable of feedback with tone grouping of 16 in the HE Compressed Beamforming Report field for a MU-type feedback | Set to 1 if supported by the STA. Set to 0 otherwise. |
| Codebook size (4,2) Capable for SU-Type Feedback | Indicates if HE Beamformee is capable of feedback with codebook size (4, 2) in the HE Compressed Beamforming Report field for a SU-type feedback. | Set to 1 if supported by the STA. Set to 0 otherwise. |
| Codebook size (7,5) Capable for MU-Type Feedback | Indicates if HE Beamformee is capable of feedback with codebook size (7, 5) in the HE Compressed Beamforming Report field for a MU-type feedback. | Set to 1 if supported by the STA. Set to 0 otherwise. |
| Tx Beamforming Feedback with Trigger frame | If the transmitting STA is an AP STA:B56: indicates support of reception of SU-Type partial and full bandwidth feedback B57: indicates support of reception of MU-Type partial bandwidth feedbackB58 indicates support of reception of CQI-Only partial and full bandwidth feedbackIf the transmitting STA is a non-AP STA:B56: indicates support of transmission of SU-Type partial and full bandwidth feedbackB57: indicates support of transmission of MU-Type partial bandwidth feedbackB58: indicates support of transmission of CQI-Only partial and full bandwidth feedback | Set B56 to 1 if SU-Type partial and full bandwidth feedback supported by the STA. Set to 0 otherwise.Set B57 to 1 if MU-Type partial bandwidth feedback supported by the STA. Set to 0 otherwise.Set B58 to 1 if CQI-Only partial and full bandwidth feedback supported by the STA. Set to 0 otherwise. |
| HE Extension SU Payload | Indicates the support of transmission and reception of HE EXT SU PPDU payload transmitted over the right 106-tone RU within Primary 20 MHz. | Set to 1 if supported by the STA. Otherwise, set to 0. |
| DL MU-MIMO on Partial BW | It indicates non-AP STA supports reception of DL MU-MIMO transmission on an RU in an HE MU PPDU where the RU does not span the entire PPDU bandwidth. | Set to 1 if supported by the non-AP STA. Set to 0 if not supported by non-AP STA.This field is reserved for an AP. |
| PPE Threshold Present | It indicates if the PPE Threshold field is present or not. | Set to 1 if PPE Threshold field is present. Set to 0, otherwise |
| SRP-based SR Support | It indicates if the STA supports SRP-based SR operation | Set to 1 if supported. Set to 0 otherwise. |

**References**

1. **IEEE P802.11axTM/D0.4, Aug 2016.**