# 38.3.23 UHR receive procedure

Typical PHY receive procedures are shown in [Figure 38-78 (PHY receive procedure for an UHR MU](#_bookmark323) [PPDU)](#_bookmark323), [Figure 38-79 (PHY receive procedure for an UHR TB PPDU)](#_bookmark324), and [Figure 38-80 (PHY receive procedure for an UHR ELR PPDU)](#_bookmark324).

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## Figure 38-78—PHY receive procedure for an UHR MU PPDU



## Figure 38-79—PHY receive procedure for an UHR TB PPDU



**Figure 38-80—PHY receive procedure for an UHR ELR PPDU**

A typical state machine implementation of the receive PHY is given in [Figure 38-81 (PHY receive state](#_bookmark325) [machine)](#_bookmark325).



## Figure 38-81—PHY receive state machine

If the detected format indicates a non-HT PPDU, refer to the receive procedure and state machine in Clause 15 (DSSS PHY specification for the 2.4 GHz band designated for ISM applications), Clause 16 (High rate direct sequence spread spectrum (HR/DSSS) PHY specification), Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification), and Clause 18 (Extended Rate PHY (ERP) specification) . If the detected format indicates an HT PPDU format, refer to the receive procedure and state machine in Clause 19 (High Throughput (HT) PHY specification). If the detected format indicates a VHT PPDU format, refer to the receive procedure and state machine in Clause 21 (Very High Throughput (VHT) PHY specification). If the detected format indicates an HE PPDU format, refer to the receive procedure and state machine in Clause 27 (High Efficiency (HE) PHY specification). If the detected format indicates an EHT PPDU format, refer to the receive procedure and state machine in Clause 36 (Extremely high throughput (EHT) PHY specification. While a particular format has not been excluded, the corresponding receive procedure may operate such that multiple receive procedures operate in parallel until a single format is indicated and a single receive procedure is operating.

If the UHR STA is ELR capable, the following processing may be used in addition to the aforementioned receive procedure:

* If the L-SIG, HT-SIG, VHT-SIGA, HE-SIG-A and U-SIG in the corresponding PPDU is identified as invalid, the UHR STA may continue processing the PPDU and searching for the ELR-MARK. Futher details are described in this subclause.
* Note: A valid SIG field refers to a valid CRC or parity check, and the PPDU is not filtered out by checking the contents of this SIG field. An invalid SIG field refers to a failed CRC or parity check, or the PPDU is filtered out by checking the contents of this SIG field.

Through station management (via the PLME), the PHY is set to the appropriate frequency as specified in

[38.4 (UHR PLME)](#_bookmark329). The PHY has also been configured with BSS identification information and STA identification information (i.e., BSS color value and STA-ID) so that it can receive data intended for the STA in the specific BSS. Other receive parameters, such as RSSI and indicated DATARATE, may be accessed via the PHY SAP.

Upon receiving the transmitted PHY preamble in a greater than or equal to 20 MHz BSS, the PHY measures a receive signal strength. This activity is indicated by the PHY to the MAC via a PHY-CCA.indication primitive. A PHY-CCA.indication(BUSY, channel-list) primitive is also issued as an initial indication of reception of a signal as specified in [36.3.21.6 (CCA sensitivity)](#_bookmark316). The channel-list parameter of the PHY-CCA.indication primitive is absent when the operating channel width is 20 MHz. The channel-list parameter is present when the operating channel width is 40 MHz, 80 MHz, 160 MHz, or 320 MHz.

The PHY shall not issue a PHY-RXEARLYSIG.indication nor a PHY-RXSTART.indication primitive in response to a PPDU that does not overlap the primary channel unless the PHY at an AP receives the UHR TB PPDU solicited by the AP. The PHY shall issue both a PHY-RXEARLYSIG.indication primitive and a PHY-RXSTART.indication primitive for the UHR TB PPDU solicited by the AP.

The PHY includes the measured RSSI and RSSI\_LEGACY values in the PHY-RXSTART.indication(RXVECTOR) primitive issued to the MAC.

After the PHY-CCA.indication(BUSY, channel-list) primitive is issued, the PHY entity shall begin receiving the training symbols and searching for L-SIG in order to set the maximum duration of the data stream. Then the PHY will search for the preambles for non-HT, HT-MF, VHT, HE, EHT andUHR PPDU.. If the constellation used in the first symbol after the first long training field is QBPSK, the PHY entity shall continue to detect the received signal using the receive procedure for HT-GF depicted in Clause 19 (High Throughput (HT) PHY specification). For detecting the UHR preamble, the PHY entity shall search for RL-SIG and evaluate the LENGTH field. If RL-SIG is detected, the PHY entity should check the parity bit and RATE fields in L- SIG and RL-SIG. If either the check of the parity bit is invalid or the RATE field is not set to 6 Mb/s, neither a PHY-RXEARLYSIG.indication nor a PHY-RXSTART.indication primitive is issued. If the check of the parity bit is valid and the RATE field indicates 6 Mb/s but the LENGTH field value in L-SIG is a not a multiple of three, neither a PHY-RXEARLYSIG.indication nor a PHY-RXSTART.indication primitive is issued. A PHY entity may determine from L-SIG that UHR PPDU format are excluded via other means, in which case neither a PHY-RXEARLYSIG.indication nor a PHY-RXSTART.indication primitive is issued. If the UHR preamble are not detected, the PHY should continue to detect the received signal using non-HT, HT, VHT, and HE receive procedure in Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification), Clause 19 (High Throughput (HT) PHY specification), Clause 21 (Very High Throughput (VHT) PHY specification), Clause 27 (High Efficiency (HE) PHY specification) and Clause 36 (Extremely high throughput (EHT) PHY specification) respectively.

If a valid parity bit and the RATE with 6 Mb/s are indicated in L-SIG and RL-SIG and the LENGTH field value in L-SIG and RL-SIG is a multiple of three, U-SIG field is present after RL-SIG. PHY entity shall issue a PHY-RXEARLYSIG.indication primitive and shall begin receiving the U-SIG field and identify the PPDU version based on the PHY Version Identifier field in the U-SIG field. ~~The PHY entity shall check the constellation of the second symbol of the U-SIG field. If the constellation is QBPSK, the PHY entity shall receive the U-SIG field and the repeated U-SIG field (four symbols in total following the RL-SIG). If the constellation is BPSK,~~ the PHY entity shall receive the U-SIG field. Then the PHY entity shall check the CRC of the U-SIG field ~~(and the repeated U-SIG field if present)~~.

* If the U-SIG field indicates a valid CRC, the PHY entity shall report the version independent fields in the U-SIG field (e.g., TXOP, BSS color, and Bandwidth) to the MAC entity.
* If the U-SIG field indicates a valid CRC, and the PHY version identifier or the BSS color(s) or the UL/DL does not contain an intended value, ~~or the constellation of the second symbol of the U-SIG~~

~~field is QBPSK,~~ the PHY entity shall issue a PHY-RXSTART.indication(RXVECTOR) then issue a PHY-RXEND.indication(Filtered) if the PHY entity is not ELR capble. Otherwise, the PHY entity should continue searching for the ELR-MARK.

* If the U-SIG field indicates a valid CRC and the U-SIG field indicates a Validate U-SIG indication, the PHY shall issue the error condition PHY-RXEND.indication(FormatViolation) primitive and maintain PHY-CCA.indication(BUSY, channellist) primitive for the predicted duration of the transmitted PPDU derived from the LENGTH field in L-SIG as defined in [Equation (36-108)](#_bookmark326) unless it receives a PHY-CCARESET.request primitive before the end of the PPDU for instance during spatial reuse operation as described in 37.10 (UHR Spatial reuse operation) if the PHY entity is not ELR capable. Otherwise, the PHY entity should continue searching for the ELR-MARK. A Validate U-SIG indication is defined as a Validate field in the U-SIG field being set to 0 or a field value of a field in the U-SIG field being set to a Validate state.
* If the U-SIG field indicates a valid CRC and the U-SIG field indicates a Disregard U-SIG indication, the PHY entity shall continue processing the U-SIG. A Disregard U-SIG indication is defined as a Disregard field in the U-SIG field being set to any value or a field value of a field in the U-SIG field being set to a Disregard state. The PHY entity shall not process the Disregard field.
* If the U-SIG field indicates an invalid CRC: the PHY shall issue the error condition PHY-RXEND.indication(FormatViolation) primitive and maintain PHY-CCA.indication(BUSY, channellist) primitive for the predicted duration of the transmitted PPDU derived from the LENGTH field in L-SIG as defined in [Equation (36-108)](#_bookmark326) unless it receives a PHY-CCARESET.request primitive before the end of the PPDU for instance during spatial reuse operation as described in

37.10 (UHR Spatial reuse operation) if the PHY entity is not ELR capable. Otherwise, the PHY entity should continue searching for the ELR-MARK.

RXTIMEs =

-L---E----N---G-----T---H------+ 3  4 + 20 + *SignalExtension*

3

(36-108)

where

LENGTH is the value of the LENGTH field in L-SIG.

*SignalExtension* is defined in Table 27-61 (HE PHY characteristics).

If U-SIG field is valid, and PHY version identifier, the BSS color(s), the UL/DL, the PPDU Type and compression mode, and the CoBF/CoSR indication all indicates an intended value, then the PHY entity will parse the PPDU Type And Compression Mode subfield, the DL/UL subfield, ELR validation bits, ELR-detection, and the CoBF/CoSR indication subfield in the U-SIG field and identify the UHR PPDU type.

If the received PPDU is UHR MU PPDU, the PHY entity shall begin receiving the UHR-SIG, UHR-STF, and UHR-LTF fields for UHR MU PPDU as shown in [Figure 38-78 (PHY receive procedure for an UHR MU](#_bookmark323) [PPDU)](#_bookmark323). The PHY entity shall check the CRC of the Common field of UHR-SIG.

* If the CRCs protecting the Common field of UHR-SIG field are valid, for all supported modes, unsupported modes and Validate indication, the PHY entity shall maintain PHY- CCA.indication(BUSY, channellist) primitive for the predicted duration of the transmitted PPDU, as defined by RXTIME in [Equation (36-108)](#_bookmark327), unless it receives a PHY-CCARESET.request primitive before the end of the PPDU for instance during spatial reuse operation as described in 37.10 (UHR Spatial reuse operation). A Validate UHR-SIG indication is defined as a field value of a subfield either in the EHT-SIG common field or in the receiver’s own user field being set to a Validate state.
* If the UL/DL subfield of the U-SIG field is set to 0 and the CRCs protecting the Common field of the UHR-SIG field are valid, the PHY entity shall search for intended STA-ID in each User field. If an intended STA-ID are detected in a user encoding block or an intended STA-ID is detected in the common encoding block of UHR-SIG (STA-ID can be present in the common encoding block of UHR-SIG only if the PPDU type and compression mode and UL/DL indicate a DL non-OFDMA transmission) with valid CRC, and an unsupported mode or a Validate UHR-SIG indication is not indicated, the PHY entity shall continue receiving the UHR-STF after the UHR-SIG field.
* If the receiving PHY entity is contained in an AP, the UL/DL subfield of the U-SIG field is set to 1, the value of the BSS Color subfield matches a value in the PHYCONFIG VECTOR parameter BSS\_COLOR\_LIST, the CRC protecting the common encoding block of the UHR-SIG field is valid and an unsupported mode or a Validate UHR-SIG indication is not indicated, the PHY entity may check the STA-ID in the User field.
  + If the PHY entity checks the STA-ID in the User field and the STA-ID value matches the 11 LSBs of the AID of a STA in the AP’s BSS, then the PHY shall continue receiving the UHR-STF after the UHR-SIG field.
  + If the PHY entity does not check the STA-ID in the User field, then the PHY shall continue receiving the UHR-STF after the UHR-SIG field.
* If the UL/DL subfield of the U-SIG field is set to 0 and the CRCs protecting the Common field of the UHR-SIG field are valid and no intended STA-ID is detected in all the User fields, the PHY entity shall issue a PHY-RXSTART.indication(RXVECTOR) then issue a PHY- RXEND.indication(Filtered).
* If the UL/DL subfield of the U-SIG field is set to 0 and the CRCs protecting the Common field of the UHR-SIG field are valid and an intended STA-ID is detected, but an unsupported mode or a Validate UHR-SIG indication is indicated in UHR-SIG field, the PHY shall issue a PHY- RXSTART.indication(RXVECTOR) then issue a PHY-RXEND.indication(UnsupportedRate) primitive.
* If the UL/DL subfield of the U-SIG field is set to 1 and the CRC protecting the common encoding block of the UHR-SIG field is valid, but an unsupported mode or a Validate UHR-SIG indication is indicated in UHR-SIG field, the PHY shall issue a PHY-RXSTART.indication(RXVECTOR) then issue a PHY-RXEND.indication(UnsupportedRate) primitive.
* If the CRCs protecting the Common field of the UHR-SIG field are not valid, the PHY shall issue the error condition PHY-RXEND.indication(FormatViolation) primitive and maintain PHY- CCA.indication(BUSY, channellist) primitive for the predicted duration of the transmitted PPDU derived from the LENGTH field in L-SIG as defined in [Equation (36-108)](#_bookmark326) unless it receives a PHY- CCARESET.request primitive before the end of the PPDU for instance during spatial reuse operation as described in 37.10 (UHR Spatial reuse operation).

If the received PPDU is UHR TB PPDU, the PHY entity shall continue receiving the UHR-STF and UHR- LTF for an UHR TB PPDU shown in [Figure 38-79 (PHY receive procedure for an UHR TB PPDU)](#_bookmark324). If a STA receives an UHR TB PPDU and the TRIGVECTOR parameters are not present in its PHY entity, the STA shall use [Equation (36-108)](#_bookmark326) to calculate the predicted duration of the UHR TB PPDU.

If U-SIG indicates the received PPDU is UHR ELR PPDU and the three ELR validate bits are all ones and STA-ID value matches the 11 LSBs of the AID of the receive STA, the PHY entity may skip the ELR-MARK detection and continue receiving the UHR-STF and UHR- LTF and ELR-SIG shown in Figure 38-80 (PHY receive procedure for an UHR ELR PPDU).

If L-SIG, HT-SIG, VHT-SIG-A, HE-SIG-A, or U-SIG is not valid which refers to either an invalid CRC, parity check or PPDU is filtered out by checking the contents in the corresponding SIG field , the ELR capable PHY entity should begin detecting ELR-MARK for UHR ELR PPDU as shown in [Figure 38-80 (PHY receive procedure for an UHR ELR](#_bookmark323) [PPDU)](#_bookmark323). The PHY entity shall detect the ELR-MARK using the known MARK sequence corresponding to its current BSS color.

If the PHY entity is in parallel receive procedures and ELR-MARK is not detected, the PHY entity should continue with other non-ELR PPDU receive procedures.

If ELR-MARK is detected, or the received PPDU is UHR ELR PPDU intended for the STA that is detected from U-SIG such that the ELR-MARK detection is bypassed, the PHY entity shall continue receiving the UHR-STF and UHR- LTF and ELR-SIG for a UHR ELR PPDU shown in Figure 38-80 (PHY receive procedure for an UHR ELR PPDU). The PHY entity shall check the CRCs of ELR-SIG1 and ELR-SIG2.

* If the CRC protecting ELR-SIG1 is not valid, the PHY shall issue the error condition PHY-RXEND.indication(FormatViolation) primitive and maintain PHY- CCA.indication(BUSY, channellist) primitive for the predicted duration of the transmitted PPDU derived from the LENGTH field in L-SIG as defined in Equation (36-108) if L-SIG is valid, unless it receives a PHY- CCARESET.request primitive before the end of the PPDU for instance during spatial reuse operation as described in 37.10 (UHR Spatial reuse operation).If L-SIG is not valid, neither a PHY-RXEARLYSIG.indication nor a PHY-RXSTART.indication primitive is issued.
* If the CRC protecting ELR-SIG1 is valid, the UL/DL does not contain an intended value, the PHY entity shall issue a PHY-RXSTART.indication(RXVECTOR) then issue a PHY-RXEND.indication(Filtered). The PHY shall maintain PHY- CCA.indication(BUSY, channellist) primitive for the predicted duration of the transmitted PPDU derived from the LENGTH field in ELR-SIG1 as defined in Equation (38-110) unless it receives a PHY- CCARESET.request primitive before the end of the PPDU for instance during spatial reuse operation as described in 37.10 (UHR Spatial reuse operation).
* If the CRC protecting ELR-SIG1 is valid and the UL/DL contains an intended value, the PHY shall continue to check CRC of ELR-SIG2
  + If the CRC protecting ELR-SIG2 is not valid, the PHY shall issue the error condition PHY-RXEND.indication(FormatViolation) primitive and maintain PHY- CCA.indication(BUSY, channellist) primitive for the predicted duration of the transmitted PPDU derived from the LENGTH field in ELR-SIG1 as defined in Equation (38-110) unless it receives a PHY- CCARESET.request primitive before the end of the PPDU for instance during spatial reuse operation as described in 37.10 (UHR Spatial reuse operation).
  + If the CRC protecting ELR-SIG2 is valid, the STA-ID in ELR-SIG2 does not match the 11 LSBs of the AID of a STA in the AP’s BSS, then the PHY entity shall issue a PHY-RXSTART.indication(RXVECTOR) then issue a PHY-RXEND.indication(Filtered). The PHY shall maintain PHY- CCA.indication(BUSY, channellist) primitive for the predicted duration of the transmitted PPDU derived from the LENGTH field in ELR-SIG1 as defined in Equation (38-110) unless it receives a PHY- CCARESET.request primitive before the end of the PPDU for instance during spatial reuse operation as described in 37.10 (UHR Spatial reuse operation).
  + If the CRC protecting ELR-SIG2 is valid, the STA-ID in ELR-SIG2 matches the 11 LSBs of the AID of a STA in the AP’s BSS, then the PHY entity shall continue receiving the Data field of the PSDU.

If signal loss occurs during reception prior to completion of the PSDU reception, the error condition PHY-RXEND.indication(CarrierLost) shall be reported to the MAC. After waiting for the end of the PPDU as determined by [Equation (38-110)](#_bookmark327), the PHY shall set the PHY-CCA.indication(IDLE) primitive and return to the RX IDLE state.

RXTIMEs

= 20 + *TUHR*\_*PREAMBLE* + *NSYMTSYM* + *TPE* + *SignalExtension*

(38-110)

where

*TUHR*\_*PREAMBLE* is defined in [Equation (38-97)](#_bookmark263).

*NSYM* is defined in Equation (38-aa), Equation (38-bb) and [Equation (38-cc)](#_bookmark262), respectively for UHR MU PPDU, UHR TB PPDU and UHR ELR PPDU.

The received PSDU bits are assembled into octetsand present to the MAC using a series of PHY-DATA.indication(DATA) primitive exchanges. Any final bits that cannot be assembled into a complete octet are considered pad bits and discarded. After the reception of the final bit of the last PSDU octet, andpossible padding and tail bits, the PHY entity shall check whether packet extension and/or signal extension is applied. If packet extension and/or signal extension is applied, the PHY entity shall wait until the packet extension and/or signal extension expires before issuing a PHY-RXEND.indication (NoError, RXVECTOR) returning to the RX IDLE state, as shown in [Figure 38-80 (PHY receive state machine)](#_bookmark325).