IEEE P802.11  
Wireless LANs

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| MAC-PDT-CR for ICF/ICR rules with multiple modes | | | | |
| Date: 2025-07-03 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
|  |  |  |  |  |
| Alfred Asterjadhi | Qualcomm Inc. |  |  | aasterja@qti.qualcomm.com |
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Abstract

This document contains proposed draft text and some comment resolutions for the following CIDs related to ICF/ICR rules.

* 101, 3252, 3645, 3868, 3869.

Rev 0: Initial version of the document. Contains also suggested changes for the acknowledgment subclause that may need to be transferred to [11-25/910r1](https://mentor.ieee.org/802.11/dcn/25/11-25-0910-01-00bn-cc50-cr-for-clause-37-4.docx)

Rev 1: Incorporates feedback/suggestions received from Mark, Michail, Po-Kai, and Gaius. Most changes highlighted in green (deletions are not tracked).

Rev 2-3: Incorporates feedback/suggestions from Kaying, Zhenpeng, Shawn, Morteza, Sindhu, Po-Kai, Laurent, et. Al. Changes are still highlighted in green.

Rev 4: Incoporated suggestions received from Yongho and Mark.

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| **CID** | **Commenter** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 101 | Xiangxin Gu | 37.11.2 | 82.06 | how to set "UL Length subfield" in the BSRP frame? | Please clarify it. | Revised –  Agree in principle. Proposed resolution adds rules to clarify the setting of the UL Length for BSRP NTB Trigger frame and BSRP Trigger frames for the different modes.  TGbn editor to make the changes shown in 11-25/1071r4 under all headings that include CID 101. |
| 3252 | GEORGE CHERIAN | 37.3.1 | 67.59 | Remove TBD | As in the comment | Revised –  Agree in principle. Proposed resolution is to add a reference to the response rules for ELR PPDUs.  TGbn editor to make the changes shown in 11-25/1071r4 under all headings that include CID 3252. |
| 3645 | Alfred Asterjadhi | 37.3.1 | 67.45 | Need to also call out explicitly the rules for the case of ICF/ICR combinaitons. Also the ELR procedure for ack is not really TBD but rather the PPDU selection procedure is to be defined. Hence need to add the rules for ELR to PPDU selection procedure | As in comment. | Revised –  Agree in principle. Proposed resolution adds rules to clarify the uses of ICF/ICRs for the different enabled modes, additional requirements. Finally, it points to the subcauses for acknowledgment procedures when using ELR PPDUs.  TGbn editor to make the changes shown in 11-25/1071r4 under all headings that include CID 3645. |
| 3868 | Abhishek Patil | 37.3.1 | 67.45 | There will be other features/use cases where the MBA carries feedback information (potentially in addition to carrying a BA bitmap). Therefore, providing a reference only to DUO is incorrect. Instead, create a new section - perhaps in clause 9 (under MBA subclause) that lists all the possible feedback scenarios for various combinations of AckType/TID fields and provide a reference to that section here. In the new section (in clause 9), provide references to the normative clauses describing the behavior for each of the feedback types. | As in comment | Revised –  Agree in principle. Proposed resolution adds a subclause for this purpose.  TGbn editor to make the changes shown in 11-25/1071r4 under all headings that include CID 3868. |
| 3869 | Abhishek Patil | 37.3.1 | 67.48 | It is possible that not all type feedback is allowed to be carried along with Per AID TID Info field carrying a BA Bitmap. Furthermore, not all feedback type combinations may be allowed. It will be helpful to have a table or some other way to represent which combinations are allowed (or disallowed). | As in comment | Revised –  Agree in principle. Proposed resolution adds a subclause for this purpose.  TGbn editor to make the changes shown in 11-25/1071r4 under all headings that include CID 3869. |
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**Discussions***.*

***TGbn editor: Please insert the following subclause:***

## 37.6a Rules for initial Control and initial Control response frames*[#3645, 3868, 3869]*

### 37.6a.1 General

UHR defines four initial Control frames (ICFs) that are used for different modes of operation (i.e., DPS, NPCA, EMLSR, DUO and DSO), namely RTS, MU-RTS Trigger, BSRP Trigger, and BSRP NTB Trigger frames. An ICF can be used for more than one mode and a mode can use more than one ICF subject to the rules in this subclause.

A UHR non-AP STA that is required to send an ICF to an AP for mobile AP DPS or NPCA shall use an RTS, or BSRP NTB Trigger frame as the ICF subject to the following:

* The ICF shall satisfy the requirements defined in 37.15.1 (Dynamic power save (DPS) operation) if the mobile AP has enabled DPS.
* If the ICF is sent on the NPCA primary channel, then the ICF shall additionally satisfy the requirements defined in 37.16 (Non-primary channel access (NPCA).
  + RTS is not allowed in the NPCA primary channel
* If Control frame protection has been negotiated with the AP, then the ICF shall be a protected BSRP NTB Trigger frame that additionally satisfies the requirements defined in 12.6.22 (Protection of Control frames).
* If the UHR non-AP STA has enabled DUO, then the STA shall additionally follow the requirements defined in 37.17.2 (Dynamic Unavailability Operation (DUO) mode) if the ICF carries unsolicited unavailability feedback.

NOTE 2—A UHR non-AP STA might send a BSRP NTB Trigger frame as an ICF to carry unsolicited unavailability feedback subject to the requirements defined in 37.17.2 (Dynamic Unavailability Operation (DUO) mode).

A UHR AP that is required to send an ICF to a non-AP STA, for non-AP STA DPS, NPCA, EMLSR, DUO, or DSO, shall use an RTS, MU-RTS Trigger, BSRP Trigger, or BSRP NTB Trigger frame as the ICF subject to the following:

* The ICF shall satisfy the requirements defined in 37.15.1 (Dynamic power save (DPS) operation) if the STA has enabled DPS, the requirements defined in 37.19 (Enhanced multi-link single-radio (EMLSR) operation for a UHR non-AP MLD) if the STA is affiliated with a non-AP MLD and is operating on an EMLSR link, and the requirements defined in 37.17.2 (Dynamic Unavailability Operation (DUO) mode) if the STA has enabled DUO.
  + RTS frame is not allowed unless the STA has only enabled DPS with zero length DPS padding
  + MU-RTS Trigger frame is not allowed if DUO is enabled
  + BSRP NTB Trigger frame is allowed but only if DUO is enabled or Control frame protection has been negotiated; otherwise, is not allowed
* If the ICF is sent on the NPCA primary channel, then the ICF shall additionally satisfy the requirements defined in 37.16 (Non-primary channel access (NPCA).
  + RTS is not allowed on the NPCA primary channel,
  + BSRP NTB Trigger is allowed but only if DUO is enabled or Control frame protection has been negotiated; otherwise, is not allowed
* If the ICF is intended to cause the STA to switch to a DSO subband then the ICF shall additionally satisfy the requirements defined in 37.24 (Dynamic Subband Operation).
  + RTS, MU-RTS Trigger and BSRP NTB Trigger frames are not allowed
* If Control frame protection has been negotiated with the non-AP STA, then the ICF shall be a protected BSRP Trigger or a protected BSRP NTB Trigger frame that additionally satisfies the requirements defined in 12.6.22 (Protection of Control frames).
  + RTS and MU-RTS Trigger are not allowed

A UHR non-AP STA that has enabled any of the operation modes that requires an ICF from the associated UHR AP (i.e., EMLSR, DPS with non-zero padding, DSO, NPCA, or DUO), is not expected to set the UL MU Disable subfield to 1 in transmitted OM Control subfields because any UL MU Disable field set to 1 sent by the non-AP STA is ignored by the AP if the non-AP STA has enabled any of these modes since the AP is required to send ICFs to the non-AP STA in order to operate in any of these modes.

A UHR non-AP STA that has enabled either DSO or NPCA, is not expected to set the UL MU Data Disable subfield to 1 in transmitted OM Control subfields because any UL MU Data Disable field set to 1 sent by the non-AP STA is ignored by the AP if the non-AP STA has enabled any of these modes since the AP is required to make trigger-based allocations for the STA in order to operate in any of these modes.

A UHR STA that transmits an ICF that is an MU-RTS Trigger, BSRP Trigger, or BSRP NTB Trigger frame, in addition to satisfying the requirements defined in 35.5.2.2.3 (Padding for a Trigger frame), shall also satisfy any applicable requirements that are defined in 37.20 (Padding for an ICF), and in the subclauses below.

A UHR STA shall carry an ICF in a non-HT PPDU or a non-HT duplicate PPDU.

A UHR STA responds to an RTS frame and to an MU-RTS Trigger frame as defined in 10.3.2.9 (CTS and DMG CTS procedure) and in 35.2.2 (MU-RTS Trigger/CTS frame exchange procedure for EHT STAs), respectively, and responds to a BSRP Trigger and BSRP NTB Trigger frames as defined in the subclauses below while satisfying the requirements defined in 37.2.1 (Setting and resetting the NAV with BSRP Trigger frame).

### 37.6a.2 BSRP Trigger frame soliciting a TB PPDU

A UHR AP that transmits a BSRP Trigger frame to a UHR non-AP STA shall allocate, within the BSRP Trigger frame, sufficient resources for the STA to generate a TB PPDU response that:

* Contains one or more QoS Null frames as required by 26.5.2.4 (A-MPDU contents in an HE TB PPDU) if the UHR non-AP STA has not enabled DUO, has not enabled LLI and has not negotiated Control frame protection or
* Contains one Multi-STA BlockAck frame, in addition to the one or more QoS Null frames required by 26.5.2.4 (A-MPDU contents in an HE TB PPDU), if the non-AP STA has enabled DUO or has enabled LLI or has negotiated Control frame protection, wherein the Multi-STA BlockAck frame is expected to contain all the following Per AID TID Info fields:
  + One Per AID TID Info field with Ack Type field equal to 1 and TID field equal to 13 *[2 octets]*
  + One Per AID TID Info field that carries unavailability feedback if the non-AP STA has enabled DUO (see 37.12.2 (Dynamic Unavailability Operation (DUO) mode)) *[8 octets]*
  + One Per AID TID Info field that carries low latency feedback if the non-AP STA has enabled LLI (see 37.22 (Low Latency Indication)) *[8 octets]*
  + One Per AID TID Info field that carries PN And MIC if the AP and the non-AP STA have negotiated Control frame protection (see 12.6.22 (Protection of Control frames)) *[36 octets]*
  + Zero or more Per AID TID Info fields that carry padding, wherein the padding shall be sufficient to at least satisfy the MIC padding delay (see 12.5.5.7 (Padding)) *[variable octets].*

A UHR non-AP STA that receives a BSRP Trigger frame from its associated UHR AP, which addresses the STA in a User Info field of the BSRP Trigger frame, shall respond, subject to the rules defined in 26.5.2 (UL MU operation), with a TB PPDU that:

* Contains one or more QoS Null frames as required by 26.5.2.4 (A-MPDU contents in HE TB PPDU) if the non-AP STA has not enabled DUO, has not enabled LLI, and has not negotiated Control frame protection or
* Contains one Multi-STA BlockAck frame, in addition to the one or more QoS Null frames required by 26.5.2.4 (A-MPDU contents in an HE TB PPDU), if the non-AP STA has enabled DUO or has enabled LLI or has negotiated Control frame protection, wherein the Multi-STA BlockAck frame shall be the first MPDU of the A-MPDU and shall contain the following Per AID TID Info fields:
  + Zero or one Per AID TID Info field with Ack Type field equal to 1 and TID field equal to 13 *[2 octets]*
  + Zero or one Per AID TID Info field that carries unavailability feedback if non-AP STA has enabled DUO (see 37.12.2 (Dynamic Unavailability Operation (DUO) mode)) *[8 octets]*
  + Zero or one Per AID TID Info field that carries low latency feedback if the non-AP STA has enabled LLI (see 37.22 (Low Latency Indication)) *[8 octets]*
  + One Per AID TID Info field that carries PN And MIC if the AP and the non-AP STA have negotiated Control frame protection (see 12.6.22 (Protection of Control frames) *[36 octets]*
  + Zero or more Per AID TID Info fields that carry padding, wherein the padding is sufficient to at least satisfy the MIC padding delay (see 12.5.5.7 (Padding)) and may also be used to ensure that the length of the response TB PPDU is equal to the length of the TB PPDU that is solicited by the BSRP Trigger frame *[variable octets].* The non-AP STA may also use A-MPDU padding, instead of Per AID TID Info fields that carry padding, to satisfy any of these requirements.

The total number of Per AID TID Info fields in the BA Information field of the Multi-STA BlockAck frame shall be greater than zero, and there shall be at least one Per AID TID Info field that is either

* a Per AID TID Info field with Ack Type equal to 1 and TID equal to 13 (ICR context) or
* a Per AID TID Info field that carries unavailability feedback or
* a Per AID TID Info field that carries low latency feedback

The Per AID TID Info fields shall appear in the BA Information field in the same order of appearance as in the above list except that low latency feedback may appear before unavailability feedback, and no Per AID TID Info fields shall appear after the last Per AID TID Info field that carries padding, if such a Per AID TID Info field is present.

### 37.6a.3 BSRP NTB Trigger frame soliciting a non-HT (duplicate) PPDU

A UHR STA that transmits a BSRP NTB Trigger frame to a peer UHR STA shall set the UL length field of the BSRP NTB Trigger frame to the value of the L-SIG LENGTH field of the response non-HT (duplicate) PPDU, and shall ensure that the value is calculated assuming that the response PPDU is sent using a rate that is equal to the primary rate, which is defined below, and that the PPDU includes a Multi-STA BlockAck frame that contains all the following Per AID TID Info fields:

* One Per AID TID Info field with Ack Type field equal to 1 and TID field equal to 13 *[2 octets]*
* One Per AID TID Info field that carries unavailability feedback if the peer STA is a non-AP STA that has enabled DUO (see 37.12.2 (Dynamic Unavailability Operation (DUO) mode)) *[8 octets]*
* One Per AID TID Info field that carries low latency feedback if the peer STA is a non-AP STA that has enabled LLI (see 37.22 (Low Latency Indication)) *[8 octets]*
* One Per AID TID Info field that carries PN And MIC if the STA and the peer STA have negotiated Control frame protection (see 12.6.22 (Protection of Control frames)) *[36 octets]*
* Zero or more Per AID TID Info fields that carry padding wherein the padding is sufficient to at least satisfy the MIC padding delay (see 12.5.5.7 (Padding)) *[variable octets].[#101]*

A UHR STA that receives a BSRP NTB Trigger frame from its peer UHR STA, which addresses the STA in a User Info field of the BSRP NTB Trigger frame, shall respond, subject to the rules defined in 26.5.2.5 (UL MU CS mechanism), with a non-HT (duplicate) PPDU that:

* Has the L-SIG LENGTH equal to the value of the UL Length field of the soliciting BSRP NTB Trigger frame
* Has a rate that is equal to either the primary rate or the alternate rate, if one exists, wherein:
  + The primary rate is defined as the highest rate in the BSSBasicRateSet parameter that is less than or equal to the rate (or non-HT reference rate; see 10.6.11 (Non-HT basic rate calculation)) of the BSRP NTB Trigger frame. If no rate in the BSSBasicRateSet parameter meets these conditions, the primary rate is defined to be the highest mandatory rate of the attached PHY that is less than or equal to the rate (or non-HT reference rate; see 10.6.11 (Non-HT basic rate calculation)) of the BSRP NTB Trigger frame.
  + The alternate rate is defined as the rate that is selected following the rules in 10.6.6.5.4 (Selection of an alternate rate or MCS for a control response frame).
* Carries an individually addressed Multi-STA BlockAck frame that contains:
  + Zero or one Per AID TID Info field with Ack Type field equal to 1 and TID field equal to 13 *[2 octets]*
  + Zero or one Per AID TID Info field that carries unavailability feedback if the peer STA is a non-AP STA that has enabled DUO (see 37.12.2 (Dynamic Unavailability Operation (DUO) mode) *[8 octets]*
  + Zero or one Per AID TID Info field that carries low latency feedback if the peer STA is a non-AP STA that has enabled LLI (see 37.22 (Low Latency Indication) *[8 octets]*
  + One Per AID TID Info field that carries PN And MIC if the STA and the peer STA have negotiated Control frame protection (see 12.6.22 (Protection of Control frames) *[36 octets]*
  + Zero or more Per AID TID Info fields that carry padding, wherein the padding is sufficient to at least satisfy the MIC padding delay (see 12.5.5.7 (Padding) and shall also be used to ensure that the length of the response PSDU is equal to the UL Length field of the BSRP NTB Trigger frame *[variable octets]*.*[#101]*

The total number of Per AID TID Info fields in the BA Information field of the Multi-STA BlockAck frame shall be greater than zero, the Per AID TID Info fields shall appear in the BA Information field in the same order of appearance as in the above list except that low latency feedback may appear before unavailability feedback, and no Per AID TID Info fields shall appear after the last Per AID TID Info field that carries padding, if such a Per AID TID Info field is present.

***TGbn editor: Please change the following subclause:***

**37.6 UHR Acknowledgement Procedure**

The UHR acknowledgment procedure builds on the features defined for HT-immediate block ack (see 10.25.6 (HT-immediate block ack extensions)), HE acknowledgement (see 26.4 (HE acknowledgment procedure)) and EHT acknowledgement (see 35.4 (EHT acknowledgment procedure)).

A UHR AP that sends a PPDU that solicits an acknowledgment or block acknowledgment from a UHR STA, which has enabled DUO or has enabled LLI or has negotiated Control frame protection with the UHR AP, shall ensure that 1) the value of the Duration/ID field of MPDU(s) carried in the PPDU, and 2) the resources that are allocated in any triggering frames carried in the PPDU, are calculated to account for an immediate response that is a Multi-STA BlockAck frame that, in addition to Per AID TID Info field(s) that contain the solicited (block) acknowledgment context(s), also contains

* One Per AID TID Info field that carries unavailability feedback if the non-AP STA has enabled DUO (see 37.12.2 (Dynamic Unavailability Operation (DUO) mode)) *[8 octets]*
* One Per AID TID Info field that carries low latency feedback if the non-AP STA has enabled LLI (see 37.22 (Low Latency Indication)) *[8 octets]*
* One Per AID TID Info field that carries PN And MIC if the AP and the non-AP STA have negotiated Control frame protection (see 12.6.22 (Protection of Control frames)) *[36 octets]*
* Zero or more Per AID TID Info fields that carry padding, wherein the padding shall be sufficient to at least satisfy the MIC padding delay (see 12.5.5.7 (Padding)) *[variable octets].*

A UHR non-AP STA that sends a PPDU that solicits an acknowledgment or block acknowledgment from a peer UHR STA and that has negotiated Control frame protection with that peer UHR STA, shall ensure that the value of the Duration/ID field of the MPDU(s) carried in the PPDU are calculated to account for an immediate response that is a Multi-STA BlockAck frame that, in addition to the Per AID TID Info field(s) that contain the solicited (block) acknowledgment context(s), also contain:

* One Per AID TID Info field that carries PN And MIC *[36 octets]*
* Zero or more Per AID TID Info fields that carry padding, wherein the padding shall be sufficient to at least satisfy the MIC padding delay (see 12.5.5.7 (Padding)) *[variable octets].*

A UHR STA, which has enabled DUO or has enabled LLI or has negotiated Control frame protection, that receives a PPDU that contains frames requiring an acknowledgment or block acknowledgment shall respond with a Multi-STA BlockAck frame that, in addition to the acknowledgment context(s) defined in 26.4.2 (Acknowledgment context in a Multi-STA BlockAck frame, shall contain after the Per AID TID Info fields with acknowledgment context(s):

* Zero or one Per AID TID Info field that carries unavailability feedback if the STA is a non-AP STA that has enabled DUO (see 37.12.2 (Dynamic Unavailability Operation (DUO) mode) *[8 octets]*
* Zero or one Per AID TID Info field that carries low latency feedback if the STA is a non-AP STA that has enabled LLI (see 37.22 (Low Latency Indication) *[8 octets]*
* One Per AID TID Info field that carries PN And MIC if the STA and the peer STA have negotiated Control frame protection (see 12.6.22 (Protection of Control frames) *[36 octets]*
* Zero or more Per AID TID Info fields that carry padding, wherein the padding is sufficient to at least satisfy the MIC padding delay (see 12.5.5.7 (Padding) *[variable octets]*

The total number of Per AID TID Info fields in the BA Information field of the Multi-STA BlockAck frame shall be greater than zero, the Per AID TID Info fields shall appear in the BA Information field in the same order of appearance as in the above list except that low latency feedback may appear before unavailability feedback, and no Per AID TID Info fields shall appear after the last Per AID TID Info field that carries padding, if such a Per AID TID Info field is present.*[#3645]*

A UHR STA that receives a Multi-STA BlockAck frame that is a response to frames requiring acknowledgment shall examine Per AID TID Info field received in the Multi-STA BlockAck frame, and shall process each Per AID TID Info field using the procedure defined in 26.4.2 (Acknowledgment context in a Multi-STA BlockAck frame) and Clause 37.17.2 (Dynamic Unavailability Operation (DUO) mode) when non-acknowledgement context is carried in the same Multi-STA BlockAck frame.

A UHR STA that responds to a UHR MU PPDU with a UHR TB PPDU follows the same rules as an HE STA that responds to an HE SU PPDU or HE ER SU PPDU with a TB PPDU as defined in 26.4.4.4 (Responding to an HE MU PPDU, HE SU PPDU, or HE ER SU PPDU with an HE TB PPDU) with the following changes:

— Replacing HE MU PPDU, HE SU PPDU or HE ER SU PPDU by UHR MU PPDU

— Replacing HE TB PPDU by UHR TB PPDU

— Replacing HE STA by UHR STA.

…

A UHR STA that transmits an UHR ELR PPDU follows the rules defined in 37.4.2 (Enhanced long range (ELR) operation)). .*[#3252, 3645]*

***TGbn editor: Please change the following subclause:*** ***[#3645, 3868, 3869]***

**10.6.11 Non-HT basic rate calculation**

This subclause defines how to convert an HT-MCS, a VHT-MCS, an HE-MCS, an EHT-MCS, or an UHR-MCS to a non- HT basic rate for the purpose of determining the rate of the response frame. It consists of two steps as follows:

1. Use the modulation and coding rate determined from the HT-MCS (defined in 19.5 (Parameters for HT-MCSs)), VHT-MCS (defined in 21.5 (Parameters for VHT-MCSs)), HE-MCS (defined in

27.5 (Parameters for HE-MCSs), EHT-MCS (defined in 36.5 (Parameters for EHT-MCSs)) or UHR-MCS (defined in 38.5 (Parameters for UHR-MCSs)) to locate a non-HT reference rate by lookup into [Table 10-10 (Non-HT reference rate)](#_bookmark9).1 In the case of an MCS with UEQM, the modulation of stream 1 is used.

1. The non-HT basic rate is the highest rate in the BSSBasicRateSet parameter that is less than or equal to this non-HT reference rate.

**Table 10-10—Non-HT reference rate**

|  |  |  |
| --- | --- | --- |
| **Modulation** | **Coding rate (R)** | **Non-HT reference rate (Mb/s)** |
| BPSK | 1/2 | 6 |
| BPSK | 3/4 | 9 |
| QPSK | 1/2 | 12 |
| QPSK | 2/3 | 12 |
| QPSK | 3/4 | 18 |
| 16-QAM | 1/2 | 24 |
| 16-QAM | 2/3 | 24 |
| 16-QAM | 3/4 | 36 |
| 16-QAM | 5/6 | 36 |
| 64-QAM | 1/2 | 48 |
| 64-QAM | 2/3 | 48 |
| 64-QAM | 3/4 | 54 |
| 64-QAM | 5/6 | 54 |
| 256-QAM | 2/3 | 54 |
| 256-QAM | 3/4 | 54 |
| 256-QAM | 5/6 | 54 |
| 1024-QAM | 3/4 | 54 |
| 1024-QAM | 5/6 | 54 |
| 4096-QAM | 3/4 | 54 |
| 4096-QAM | 5/6 | 54 |

NOTE 1—The selection of a non-HT basic rate for the frame sent in response to an HE or EHT PPDU is not influenced by DCM encoding in the HE, EHT, or UHR PPDU.