IEEE P802.11  
Wireless LANs

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| PDT MAC NPCA | | | | |
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Abstract

This document contains Proposed Draft Text (PDT) for the Non Primary Channel Access (NPCA) feature of the proposed TGbn (UHR, Ultra High Reliability) amendment to the 802.11 standard.

# Revision information

The following is a summary of the important changes that occurred within each revision of this document:

|  |  |
| --- | --- |
| **Revision** | **Major changes** |
| 0 | Initial revision |
| 1 | Author list adjustments |
| 2 | Text offered by TTT members to address motions that were passed during the NOV 2024 802.11 meeting session, with accompanying new motion text added to the motion section |
| 3 | Fix a few editorial issues in the motions  The r2 version of this document was mostly a consolidation of various text suggestions without a thorough editorial review. The r3 version includes a much more careful examination of the text with the aim of correcting editorial issues. The summary of those corrections is listed here, NOTE THAT a few TECHINCAL CHANGES occurred in the update to r3:  Make figure numbers 9-XX different from each other  Remove duplicate reference to Figure NPCA Op Info field format  9.4.2.x UHR Operation element  - NPCA Primary Channel subfield, editorial clarifications  - NPCA Minimum Duration Threshold subfield, editorial clarifications  - NPCA Operation Information Present subfield, editorial clarifications  - NPCA Switching Delay subfield, editorial clarifications – TECHNICAL change = max value is 252 usec, not 256 usec  - NPCA Switch Back Delay subfield, editorial clarifications – TECHNICAL change = max value is 252 usec, not 256 usec, make format diagram subfield name match description name  37.x Non-primary channel access (NPCA)  - added editorial clarification, more precise text regarding enabling NPCA operation within a BSS  - various minor editorial changes, e.g. add missing articles, NPCA mode vs NPCA operation, capitalization consistency  - added a paragraph to restrict NPCA operation by an NPCA STA to the times when the AP has indicated that NPCA operation is enabled in the BSS  - Added terms NPCA HE switch time and NPCA NHT switch time to better differentiate the two distinct parameters identified in the NPCA STA switching rules section |
| 4 | 9.4.2.x UHR Operation element – EDITORIAL CHANGE  - removed a phrase from within the description for the NPCA Primary Channel subfield that unnecessarily described a condition for entering NPCA operation – that condition is not needed here and did conflict with the more expansive conditions listed elsewhere  37.x Non-primary channel access (NPCA) – TECHNICAL CHANGE  - changed the BSS BW limitation on when NPCA may be used from >40 MHz to > 40 or 80 MHz as per motion 134.  - NOTE that this TECHNICAL CHANGE is made to conform to the language of motion 134, which is confusing, as that motion language includes: TBD MHz, where TBD = 40 MHz or 80 MHz |
| 5 | Everywhere, per editor’s recommendations:   * Changed subfield to field (note that there are uses of subfield within the quoted passing motions, since these are quoted motions, the term subfield remains in the quoted motions) * Changed “is set to 0” and “is set to 1” in NPCA Operation Information Present field description to “A value of 1 …. indicates ….” |
| 6 | Changes made after presentation of document during 802.11 TGbn MAC adhoc conference call on 2024-12-05, some of the suggested changes were mentioned during the call, and others were sent on the reflector during and after the call:   * Editorial: Added a new DISCUSSION section * Editorial: 37.x Differentiation of AP vs non-AP STA terms * Technical: Added TBD near instances of “40 or 80” * Technical: 37.x Modified language of “received PPDU” for the non Control frame case (i.e. case a)) because the PPDU is not necessarily actually “received”, this required removal of the adjective “received” in several places and the inclusion of the use of PHY-RXSTART.indication() and RXVECTOR * Editorial: 37.x added space before MHz where needed, change NPCA Primary to NPCA primary, except for the field name, control frame capitalization, consistent use of NPCA Switch Delay and NPCA switch delay |
| 7 | More editorial changes, all the result of comments from Mark Rison:   * 9.3.3.10 Probe REP format, extra “–“ and space removed * 9.4.2.x UHR CAP IE – “supported by the STA transmitting this field” changed to “supported by the STA”, as such language is typical of the baseline. * 9.4.2.x UHR OP IE – several editorial cleanup changes * 37.x a lot of editorial changes, but no real technical changes * Quite a few of Mark’s comments were questions about clarifying existing requirements or requests for additional behavioural specification, which are probably better resolved in a forum that includes more participants |
| 8 | Editorial changes:   * 37.x “addressed to it” removed, as this is implicit in the definition of “receive” * Six instances of OBSS changed to “inter-BSS” as this is the more accurate adjective |
| 9 | Technical changes:   * 37.x – in the behavioural language, there is text which describes the two major conditions that must be met to invoke an NPCA channel change, i.e. conditions a) and b) – it has been pointed out that a third condition actually exists in the adopted motion, which is “TBD” – it seems, despite potentially ambiguous syntax, that the TBD in the motion (#11) is subject to the preceding condition of “primary channel is known to be busy”, therefore, the TBD condition is added as item c), with the qualifier “the primary channel is known to be busy” * Removed text that limited choice of NPCA primary channel, as this language is not based on any passed motion   Editorial changes:   * None |
| 10 | Technical changes:   * 37.x – following a suggestion, in the non-control frame case, moved the use of the TXOP\_DURATION parameter in determining whether the duration of the OBSS activity exceeds the NPCA MinDurThreshold to be TBD (modified and moved to further sublevel of bullet) – based on comments from Kaiying Lu * 37.x – added a new paragraph describing untriggered UL transmission persmissions and determination and deleted a line from the bulleted section that had similar language as the newly inserted text – based on comments from Chaoming Luo   Editorial changes:   * None |
| 11 | Technical changes:   * 37.x added statement on multiple BSS NPCA operation re channel per M131 * NPCA op info field changed to indicate not just AP switching delays but also non-AP STA   Editorial changes:   * Author list changes * ADDED a New **OPEN ISSUES** section * Add some MOTION references to some text using hyperlinks and bookmarks – not part of standard draft text, so these will probably disappear once the text is adopted * Management frame formats – removed some yellow highlighting * Management frame formats – removed several hard hyphens * Probe Resp frame format – removed TBD in the heading * UHR Capabilities – minor wording changes * NPCA Op Info field description, slight wording changes * Some capitalization changes * Figure numbering, “A value 0 indicates” vs “0 indicates” * “its BSS” – “the BSS of which it is a member” * “XXXX parameter of the VECTOR” vs “VECTOR parameter XXXX” |
| 12 | Technical changes:   * 37.x item b), OBSS control frame exchange initiation of NPCA Op, removed “/or”   Editorial changes:   * 9.4.2.x UHR OP IE field: NPCA Minimum Duration Threshold field description wording change, along the lines of a comment from John Wullert * 37.x NPCA Operation description: removed the word “remaining” as John Wullert indicates, there is no reason that the previously received portion of an OBSS PPDU could not be simply included in the NPCA Min Dur Thresh field * Changed MBSS to multiple BSS * Added more motion tags |
| 13 | Technical changes:   * 37.x item b) c., removed redundant phrase: “and the channel occupied by the received PPDU(s)”   Editorial changes:   * None |
| 14 | Technical changes:   * None   Editorial changes:   * Fixed Table numbering for some management frames * Changed headers for UHR OP IE and UHR CAP IE per 11-24-1993, also changed order of OP and CAP to match spec skeleton (CAP first) * Changed header numbering for main NPCA behavioural subclause from 37.x to 37.10 per doc 11-24-1993 (spec skeleton) * Fixed some management table heading names * Changed a motion hyperlink from M129 to M124 * Changed a motion hyperlink from M129 to M11 * 37.10, added a missing pronoun “it” within item a) b. * 37.10 Within the second set of behaviors, changed phrasing that included the troublesome “reception” to “meeting condition a) above” to avoid duplicating complex technical text * 37.10 Within the second set of behaviors, changed phrasing that included the troublesome “reception” to “meeting condition b) above” to avoid duplicating complex technical text |
| 15 | Technical changes:   * 37.10 for untriggered UL mode enable/disable, remove “by transmitting TBD frames”   Editorial changes:   * 37.10 item c) only says TBD, so it does not add to the document by its presence and does not subtract from the document by its absence |
| 16 | Technical changes:   * None   Editorial changes:   * 37.10 untriggered UL sentence modified to use language that is more formal standards language * 37.10 removed leftover reference to previously deleted item c) |
| 17 | Technical changes:   * None   Editorial changes:   * 9.4.2.aaa UHR Op IE – slight modification to the NPCA Op Info field definition * 9.4.2.aaa UHR Op IE – added “in order” between the adjacent instances of the word “to” to create a clearer wording * 37.10 changed multiple BSS to multiple BSSID set and modified the language of the sentence that describes multiple BSSID set behaviour to clarify that NPCA operation is enabled per AP within a BSSID set and not for the entire BSSID set or none of the BSSID set * 37.10 slight modifications to conditions to determine when to switch to NPCA, specifically regarding “any of conditions” vs “either condition” due to the dropping of condition c) in an earlier revision |
| 18 | Technical changes:   * Removed statement “AP may enable” NPCA operation – no motion has yet passed to indicate the mechanism for enabling the mode, (M11 does not actually say how the mode is enabled, just that it exsits) so this language is speculative and is removed until more explicit agreement is reached   Editorial changes:   * None |
| 19 | Technical changes:   * None   Editorial changes:   * Add an author |
| 20 | Technical changes:   * 37.10 NPCA Operation - Possibly a technical change, modified the untriggered UL paragraph’s last sentence. The previous version had attempted to interpret the ambiguous language of the MU EDCA portion of the relevant motion M129 by using editorial license to create a sentence that is *based on* the motion sentence. Due to the existence of at least two possible interpretations of the motion language, the last sentence is now changed to use EXACTLY the language that is found in the motion, thereby incorporating the ambiguity into the draft text.   Editorial changes:   * 9.4.2.aaa UHR OP IE – changed reference motion from 129 to 124 |
| 21 | Technical changes:   * 37.10 NPCA Operation – restored TXOP\_DURATION into the time to perform NPCA for case a) [PPDU reception case] conditional on the AP selecting whether to use the value or not.   Editorial changes:   * None |
| 22 | Technical changes:   * 37.10 NPCA Operation – add a restriction that a non-AP STA can only enable NPCA mode if it is associated with an NPCA AP.   Editorial changes:   * Fixed revision number in document header |
| 23 | Technical changes:   * 37.10 NPCA Operation – add TBD to the TXOP\_DURATION subbullet.   Editorial changes:   * None |
|  |  |

# Introduction

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGbe Draft. The abstract, revision information, introduction, explanation of the proposed changes, discussion and references sections are not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGbe Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

## Explanation of the proposed changes:

The proposed changes to the 802.11 TGbn draft within this document are based on the following motions adopted by the TGbn task group:

### Relevant passing motions:

* TGbn defines a mode of operation that enables a STA to access the secondary channel while the primary channel is known to be busy due to OBSS traffic or other TBD conditions.
  + The mode of operation shall not assume that the STA is capable to detect or decode a frame and obtain NAV information of the secondary channel concurrently with the primary channel.
  + A BSS shall only have a single NPCA primary channel (name TBD) on which the STA contends while the primary channel of the BSS is known to be busy due to OBSS traffic or other TBD conditions.
* [Motion #11, [1]]
* TGbn defines a mode of operation in NPCA where the NPCA non-AP does not use untriggered UL transmissions on the NPCA primary channel
  + This mode can be enabled/disabled by the AP
  + Whether the mode is for all associated non-APs or per non-AP is TBD
  + TBD whether MU EDCA parameters mechanism is used for this or not

[Motion #129, [1]]

* An NPCA STA shall indicate the following to its peer NPCA STA
  + NPCA switching delay
    - time it needs to switch from the BSS Primary channel to the NPCA Primary channel
  + NPCA switch back delay
    - time it needs to switch from the NPCA Primary channel to the BSS Primary channel
  + Delay values range between 0 and 256 us with a 4 us resolution

[Motion #124, [1]]

* An AP that is capable of Non-Primary Channel Access (NPCA) announces at most one NPCA Primary channel
  + NPCA Primary channel is in AP's BSS operating channel width
  + NPCA Primary channel is not a punctured 20 MHz subchannel (as indicated in EHT Operation element)
  + Details on signaling is TBD

[Motion #130, [1]]

* All the APs in a multiple BSSID set that enable NPCA announce the same NPCA primary channel

[Motion #131, [1] and [205]]

* An NPCA STA shall initiate frame exchange on the NPCA Primary channel with an NPCA Initial Control Frame in the non-HT PPDU or non-HT duplicate PPDU format using a rate of 6 Mb/s, 12 Mb/s, or 24 Mb/s
  + Details on NPCA ICF are TBD

[Motion #125, [1]]

* The event that triggers switching to the NPCA primary channel shall be
  + OBSS Control frame exchange (e.g., (MU-)RTS/CTS) or
  + OBSS HE/EHT/UHR PPDU
  + Note: Other conditions TBD

[Motion #144, [1]]

* The NPCA operation shall use the same EDCA parameters ((MU) EDCA Parameter Set, EPCS EDCA Parameters), on both the BSS primary channel and the NPCA primary channel.

[Motion #145, [1]]

* An NPCA STA shall initiate a TXOP on the NPCA Primary channel following the rules defined in 10.23.2.2 (EDCA backoff procedure) and 10.23.2.4 (Obtaining an EDCA TXOP) with the following exception:
  + Every time the STA switches to the NPCA Primary channel, it shall initialize CW\_NPCA[AC] to TBD value and pick a new backoff counter (BO\_NPCA) randomly between 0 and CW\_NPCA[AC]. QSRC\_NPCA[AC] shall be set to 0.
  + NOTE – Baseline EDCA procedure is followed on the BSS Primary channel. The values of CW\_NPCA and BO\_NPCA are discarded by the NPCA STA when it switches back to the BSS Primary channel.

[Motion #126, [1]]

* After an NPCA STA has gained the right to initiate a TXOP on the NPCA Primary channel, it can transmit on a set of channels that:
  + Includes the NPCA Primary channel, and
  + are within the AP’s BSS bandwidth, and
  + do not include the channels in the bandwidth occupied by the OBSS traffic that caused the NPCA STA to switch from the BSS primary channel to the NPCA primary channel, and
  + do not include the channels that are indicated as punctured in the Disabled Subchannel Bitmap subfield in the EHT Operation element,
  + It is TBD whether a frame that does not solicit TB PPDUs can puncture 20 MHz subchannels not indicated as punctured in the Disabled Subchannel Bitmap subfield of the EHT Operation element

[Motion #127, [1]]

* When transmitting a Trigger frame on the NPCA Primary channel, the NPCA AP shall signal the RU index considering the NPCA Primary channel as the reference primary channel
  + The Trigger frame shall explicitly indicate that it is transmitted via the NPCA Primary channel (details TBD)

[Motion #128, [1]]

* When an NPCA STA switches to the NPCA Primary channel, it shall not initiate a transmission to its peer NPCA STA until the peer STA’s switching delay has elapsed since TBD switch start time

[Motion #132, [1]]

* An AP that enables NPCA announces the minimum duration threshold of the BSS primary channel busyness because of OBSS activity for switching to NPCA primary channel
  + If the duration of the OBSS activity that makes the primary channel busy is smaller than the duration threshold, the NPCA STAs (AP and non-AP) do not switch to the NPCA primary channel.

[Motion #133, [1]]

* An AP shall not allow the use of NPCA within its BSS if the BSS operating bandwidth is less than or equal to TBD MHz, where TBD = 40 MHz or 80 MHz

[Motion #134, [1]]

* If an NPCA STA receives an OBSS RTS frame in a non-HT duplicate PPDU that does not include the bandwidth signaling TA, the NPCA STA shall not switch to the NPCA Primary channel,
* If an NPCA STA receives an OBSS RTS frame in a non-HT duplicate PPDU that includes the bandwidth signaling TA and the signaled PPDU bandwidth is 320 MHz, the NPCA STA shall not switch to the NPCA Primary channel,
* If an NPCA STA receives a CTS frame in a non-HT duplicate PPDU without receiving the soliciting OBSS RTS or MU-RTS frame, the NPCA STA shall not switch to the NPCA Primary channel
* [Motion #164, [1]]

## DISCUSSION:

The use of the term “received PPDU” in the descriptive behavioural subclauses (e.g. 37.x NPCA) is problematic because the OBSS PPDU that is used to trigger a switch to an NPCA operation on a subchannel of the BSS is not always actually “received”. For the Control frame cases, the PPDU(s) are received, but for the PPDU without a preceding Control frame, only the PHY header of the OBSS PPDU is received before the switch occurs. So for that case, we cannot use “received”. The MAC does receive information from the PHY after a valid PHY header reception, in the PHY-RXSTART.indication() primitive and this does contain an RXVECTOR.

## Open Issues:

1. NPCA Op Information – this field is inside of the UHR OP IE, which is only transmitted by an AP, yet it contains NPCA operational parameters that are also applicable to STAs, e.g. switch delay. Therefore, this field should appear somewhere else where a STA can indicate its values to the AP
2. Need to define appropriate MIB variables and maybe some MAC variables
3. EDITOR GUIDANCE REQUIRED – “supported by the STA”
4. EDITOR GUIDANCE REQUIRED – “a the STA transmitting this field/frame”
5. Need to define behaviour/use for switch back delay
6. Need text on what happens if AP dynamically lowers BSS BW below 160 MHz – is NPCA disabled implicitly?
7. Mismatch between location of NPCA parameters and non-AP STA – the parameters are currently in the UHR OP IE, but non-AP STA does not transmit this IE
8. STA vs MAC entity performing some operations
9. More detail on NPCA STA determination that a received PPDU is response to an ICF
10. More detail on determining OBSS duration
11. Need definitions for BO\_NPCA and CW\_NPCA, further behaviour for QSRC\_NPCA
12. Need definition for NPCA initial control frame and behaviour
13. Description of NPCA ICF use for multiple exchanges within a single NPCA operation/excursion
14. Untriggered UL operation enable/disable frame and behaviour missing
15. Condition c) primary channel is known to be busy and TBD conditions is unspecified

# Text to be adopted begins here:

***TGbn editor: Please make the following changes to the 802.11bn draft D0.1:***

**9.3.3.5. Association Request frame format**

***TGbn editor: Please insert a new row as follows:***

**Table 9-64—Association Request frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImplemented is true; otherwise, it is not present. |

**9.3.3.6. Association Response frame format**

***TGbn editor: Please insert a new row as follows:***

**Table 9-65—Association Response frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImplemented is true; otherwise, it is not present. |
| <Last assigned + 2> | UHR Operation | The UHR Operation element is present if dot11UHROptionImplemented is true; otherwise, it is not present. |

**9.3.3.7. Reassociation Request frame format**

***TGbn editor: Please insert a new row as follows:***

**Table 9-66—Reassociation Request frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImplemented is true; otherwise, it is not present. |

* + - 1. **Reassociation Response frame format**

***TGbn editor: Please insert a new row as follows:***

**Table 9-67—Reassociation Response frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImplemented is true; otherwise, it is not present. |
| <Last assigned + 2> | UHR Operation | The UHR Operation element is present if dot11UHROptionImplemented is true; otherwise, it is not present. |

* + - 1. **Probe Request frame format**

***TGbn editor: Please insert a new row as follows:***

**Table 9-68—Probe Request frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImplemented is true; otherwise, it is not present. |

* + - 1. **Probe Response frame format**

***TGbn editor: Please insert a new row as follows:***

**Table 9-69—Probe Response frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImplemented is true; otherwise, it is not present. |
| <Last assigned + 2> | UHR Operation | The UHR Operation element is present if dot11UHROptionImplemented is true; otherwise, it is not present. |

* + 1. **Elements**
       1. **General**

***TGbn editor: Please insert a new row as follows:***

**Table 9-130—Element IDs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Element ID** | **Element ID Extension** | **Extensible** | **Fragmentable** |
| … |  |  |  |  |
| UHR Capabilities (see [9.4.2.x (UHR](#_bookmark180)  [Capabilities element)](#_bookmark180)) | 255 | <ANA> | Yes | No |
| UHR Operation (see [9.4.2.x (UHR](#_bookmark180)  [Capabilities element)](#_bookmark180)) | 255 | <ANA> | Yes | No |

***TGbn editor: Please insert a new subclause as follows:***

**9.4.2.aaa UHR Operation element**

The format of the UHR Operation element is shown in [Figure 9-X3 (UHR Operation element format)](#_bookmark181).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Element ID | Length | Element ID Extension | UHR Operation Parameters | Basic UHR MCS And Nss Set | UHR Operation Information |

Octets: 1 1 1 TBD TBD TBD

**Figure 9-X3—UHR Operation element format**

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

The format of the UHR Operation Parameters field is defined in Figure 9-X4 (UHR Operation Parameters field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 | B1 - TBD |  |  |
|  | NPCA Operation Information Present | Reserved |  |  |
| Bits: | 1 | TBD |  |  |

**Figure 9-X4—** **UHR Operation Parameters field format**

The NPCA Operation Information Present field indicates whether NPCA operation is enabled at the AP transmitting this field and whether the NPCA Operation Information field is present in the UHR Operation Information field. The NPCA Operation Information Present field is set to 1 to indicate that NPCA operation is enabled and that the NPCA Operation Information field is present in the UHR Operation Information field. The NPCA Operation Present field is set to 0 to indicate that NPCA operation is not enabled and that the NPCA Operation Information field is not present in the UHR Operation Information field. [M124](#M124)

The format of the NPCA Operation Information field is defined in Figure 9-X5 (NPCA Operation Information field format). [M124](#M124)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 - B7 | B8 - TBD | TBD - TBD | TBD |
|  | NPCA Primary Channel | NPCA Minimum Duration Threshold | NPCA Switching Delay | NPCA Switch Back Delay |
| Bits: | 8 | TBD | 6 | 6 |

**Figure 9-X5—** **NPCA Operation Information field format**

The NPCA Primary Channel field indicates the channel number of a channel within the BSS bandwidth that corresponds to the channel that the NPCA AP and its associated NPCA non-AP STAs switch to in order to perform NPCA operation, as described in 37.x (Non-primary channel access (NPCA)). [M11](#M11) [M130](#M130)

The NPCA Minimum Duration Threshold field indicates the minimum duration of inter-BSS activity (inter-BSS PPDU or inter-BSS TXOP) that is required to have been indicated on the primary channel of the BSS as a necessary condition to permit an NPCA STA to switch to the NPCA primary channel to perform NPCA operation. The encoding and the maximum value of this field are TBD. [M133](#M133)

The NPCA Switching Delay field indicates the time needed by an NPCA STA to switch from the BSS primary channel to the NPCA primary channel in units of 4 usec. [M124](#M124)

The NPCA Switch Back Delay field indicates the time needed by an NPCA STA to switch from the NPCA primary channel to the BSS primary channel in units of 4 usec. [M124](#M124)

***TGbn editor: Please insert a new subclause as follows:***

**9.4.2.aab UHR Capabilities element**

The format of the UHR Capabilities element is shown in [Figure 9-X1 (UHR Capabilities element format)](#_bookmark181).

|  |  |  |  |
| --- | --- | --- | --- |
| Element ID | Length | Element ID Extension | UHR MAC Capabilities Information |

Octets: 1 1 1 TBD

**Figure 9-X1—UHR Capabilities element format**

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

The format of the UHR MAC Capabilities Information field is defined in Figure 9-X2 (UHR MAC

Capabilities Information field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 | B1 – TBD |  |  |
|  | NPCA Supported | Reserved |  |  |
| Bits: | 1 | TBD |  |  |

**Figure 9-X2—** **UHR MAC Capabilities Information field format**

The NPCA Supported field indicates whether NPCA operation is supported by the STA. 1 indicates that NPCA operation is supported. 0 indicates that NPCA operation is not supported.

***TGbn editor: Please add the following subclause 37.10 Non-primary channel access (NPCA) in 802.11bn D0.1:***

37.10 Non-primary channel access (NPCA)

A STA that supports NPCA operation is called an NPCA STA. An AP that supports NPCA operation is called an NPCA AP. A non-AP NPCA STA shall set the NPCA Supported field of the UHR MAC Capabilities Information field of the UHR Capabilities element to 1. A non-AP NPCA STA may enable the NPCA mode only if it is associated with an NPCA AP. It is TBD how the non-AP STA enables NPCA mode.

An NPCA AP that has an operating bandwidth less than TBD (but either 80 or 160 MHz) shall not enable NPCA operation. An AP of a multiple BSSID set which enables NPCA operation shall indicate the same NPCA primary channel as all of the other APs of the same multiple BSSID set which have enabled NPCA operation. [M131](#M131) [M134](#M134)

An NPCA AP that has enabled NPCA operation shall include the NPCA Operation Information field in its UHR Operation element and indicate its NPCA switching delay and NPCA switch back delay respectively in the NPCA Switching Delay field and NPCA Switch Back Delay field of the TBD frames. [M124](#M124)

A non-AP STA that supports NPCA operation shall announce its NPCA switching delay and NPCA switch back delay respectively in the NPCA Switching Delay field and NPCA Switch Back Delay fields of the TBD frames.

An NPCA AP may enable a mode of operation in which untriggered UL transmissions on the NPCA primary channel by NPCA non-AP STAs is not permitted. Whether the mode is for all associated non-APs or per non-AP is TBD. Whether MU EDCA parameters mechanism is used for this or not is TBD. [M129](#M129)

A non-AP NPCA STA shall not switch to the NPCA primary channel for NPCA operation if the value of the most recently received NPCA Operation Information Present field from its associated AP is equal to 0.An NPCA AP shall not switch to the NPCA primary channel for NPCA operation if the value of its most recently transmitted NPCA Operation Information Present field is equal to 0. [M11](#M11)

An NPCA STA may switch to the NPCA primary channel for NPCA operation if the value of the most recently received or transmitted NPCA Operation Information Present field corresponding to the BSS of which it is a member is equal to 1 and either condition a) or b) is met: [M11](#M11)

1. the STA received a PPDU and/or received a PHY-RXSTART.indication primitive for an HE/EHT/UHR PPDU on the BSS primary channel and all of the following conditions are true: [M144](#M144)
   1. the PPDU is classified by the STA as an inter-BSS PPDU following the procedure defined in 26.2.2 (Intra-BSS and inter-BSS PPDU classification). [M11](#M11)
   2. the duration of the PPDU, (determined by the MAC in a manner TBD, but necessarily involving some of the parameters of the RXVECTOR associated with the received PPDU) or the duration of the PPDU plus the value of the RXVECTOR parameter TXOP\_DURATION of the PPDU, is greater than the value indicated in the most recently received or transmitted NPCA Minimum Duration Threshold field corresponding to the BSS of which it is a member [M133](#M133)
      1. whether the RXVECTOR parameter TXOP\_DURATION of the PPDU is considered for this comparison and whether it is indicated by the AP is TBD
   3. the 20/40/80/160 MHz channel occupied by the PPDU is identified by the STA, based on the Bandwidth field in the PHY preamble of the PPDU and the channel allocations in the corresponding band, and the channel occupied by the PPDU does not overlap with the NPCA primary channel [M127](#M127)
   4. TBD conditions
2. the STA received a PPDU containing a Control frame and a PPDU containing an initial response frame of a Control frame exchange on the BSS primary channel and all of the following conditions apply: [M144](#M144) [M164](#M164)
   1. the received PPDU(s) are classified by the STA as inter-BSS PPDU(s) following the procedure defined in 26.2.2 (Intra-BSS and inter-BSS PPDU classification)
   2. the TXOP duration, determined from the Duration field of the received frame(s), is greater than the value indicated in the most recently received or transmitted NPCA Minimum Duration Threshold field corresponding to its BSS [M133](#M133)
      1. Whether the RXVECTOR parameter TXOP\_DURATION of the received PPDU(s) are considered for this comparison is TBD
   3. the 20/40/80/160 MHz channel occupied by the received PPDU(s), identified by the STA based on the channel allocations in the corresponding band and the PPDU bandwidth that is signaled in the received PPDU(s) or obtained from the RXVECTOR parameter CH\_BANDWIDTH\_IN\_NON\_HT of the received PPDU(s), does not overlap with the NPCA primary channel [M127](#M127)
      1. if the Control frame is an RTS frame in a non-HT (duplicate) PPDU, then it includes a bandwidth signaling TA and the signaled PPDU bandwidth is 20 MHz, 40 MHz, 80 MHz, or 160 MHz [M164](#M164)
      2. identification of the channel occupied by a received CTS frame in a non-HT (duplicate) PPDU is determined by examining the RTS frame or the MU-RTS frame that elicited the CTS response
   4. TBD conditions

When an NPCA STA switches to the NPCA primary channel for NPCA operation, then the following rules apply:

1. If the STA switches from the BSS primary channel to the NPCA primary channel based on an meeting condition a) above, the STA shall initiate the switch at the NPCA HE switch time and it shall be ready to transmit and receive frames (subject to its capabilities and operating mode) on the NPCA primary channel no later than the value of its most recently indicated NPCA switching delay after the NPCA HE switch time, where NPCA HE switch time is defined as follows: [M124](#M124)
   1. TBD
2. If the STA switches from the BSS primary channel to the NPCA primary channel based on meeting condition b) above, the STA shall initiate the switch at the NPCA NHT switch time and it shall be ready to transmit and receive frames addressed to it (subject to its capabilities and operating mode) on the NPCA primary channel no later than the value of its most recently indicated NPCA switching delay after the NPCA NHT switch time, where NPCA NHT switch time is defined as follows: [M124](#M124)
   1. TBD
3. The STA shall use the same EDCA parameter set, MU EDCA parameter set, and EPCS EDCA parameter set values for operation on the NPCA primary channel as it uses on the BSS primary channel. [M145](#M145)
4. Once the STA becomes ready to transmit on the NPCA primary channel, the STA may initiate a TXOP on the NPCA primary channel by following the rules defined in 10.23.2.2 (EDCA backoff procedure) and 10.23.2.4 (Obtaining an EDCA TXOP) with the following exceptions: [M126](#M126)
   1. Each time that the STA switches to the NPCA primary channel, it shall initialize CW\_NPCA[AC] to TBD value and randomly choose a new initial value between 0 and CW\_NPCA[AC] for the backoff counter (BO\_NPCA[AC]). [M126](#M126)
   2. QSRC\_NPCA[AC] shall be set to 0.
   3. If the STA is a non-AP STA and the associated AP has disabled the use of untriggered UL transmissions on the NPCA primary channel for that STA, then the STA shall not initiate a TXOP on the NPCA primary channel.

NOTE – The baseline EDCA procedure is followed on the BSS primary channel. The values of CW\_NPCA[AC] and BO\_NPCA[AC] are discarded by the NPCA STA when it switches back to the BSS primary channel. [M126](#M126)

1. The STA shall not initiate a transmission on the NPCA primary channel to another STA until that STA’s NPCA switching delay time has elapsed since the NPCA HE switch time if switching due to condition a) above or NPCA NHT switch time if switching due to condition b) above [M132](#M132)
2. The STA shall begin all frame exchanges on the NPCA primary channel with an NPCA initial Control frame using non-HT PPDU or non-HT duplicate PPDU format using a rate of 6 Mb/s, 12 Mb/s, or 24 Mb/s.
   1. Details on the NPCA ICF are TBD [M125](#M125)
3. An NPCA AP that transmits a Trigger frame on the NPCA primary channel shall indicate RU index values that use the NPCA primary channel as the reference primary channel. The Trigger frame shall include an explicit indication that it is being transmitted on the NPCA primary channel. Signaling details TBD. [M128](#M128)
4. The 20 MHz channels occupied by PPDUs transmitted by the STA shall meet all of the following conditions: [M127](#M127)
   1. include at least the NPCA primary channel
   2. all be within the BSS bandwidth
   3. not include any of the channels occupied by the inter-BSS traffic that caused the STA to switch from the BSS primary channel to the NPCA primary channel
   4. not include channels that are indicated as punctured in the Disabled Subchannel Bitmap field in the EHT Operation element
   5. It is TBD whether a frame that solicits a response other than TB PPDUs can puncture 20 MHz subchannels not indicated as punctured in the Disabled Subchannel Bitmap field of the EHT Operation element.

# Text to be adopted ends here.

# Notes

Regarding NPCA Minimum Duration Threshold

and the duration of the PPDU is greater than or equal to the threshold plus the NPCA HE switch time

Possible definition of NPCA HE switch time:

equal to the amount of time, measured from the start of the received PPDU, that has elapsed, when the receiving STA is ready to switch to the NPCA channel

and the DUR value in the ICF or ICR is greater than or equal to the threshold plus the NPCA NHT switch time

and NPCA NHT switch time:

equal to the amount of time, measured from the start of the received control frame, that has elapsed, when the receiving STA is ready to switch to the NPCA channel

The switch time is different for every implementation and perhaps for different frames with different formats and encodings. So the AP has to choose the longest time of all of the possibilities of all associated STAs and then advertise that.

**References:**

1. [11-24-0171r21](https://mentor.ieee.org/802.11/dcn/24/11-24-0171-21-00bn-tgbn-motions-list-part-1.pptx): 11-24-0171-21-00bn-tgbn-motions-list-part-1, Alfred Asterjadhi (Qualcomm Inc.)