IEEE P802.11  
Wireless LANs

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| --- | --- | --- | --- | --- |
| Proposed Text Changes for NDP feedback report | | | | |
| Date: 2017-03-13 | | | | |
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Abstract

This document provides proposals for spec changes for NDP feedback report.

CIDs 7387, 6144, 7386, 8304, 9101, 9573, 8571.

Rev 1:

* Color coding for groupID section

Rev 2:

* The trigger type design proposed reflects the SPs that were done in the MAC ad hoc meeting and to reflect the will of the group: information in per-STA info field

SP1:

* Which option do you prefer?
  + STAs scheduled by a NDP feedback report trigger frame variant with a feedback type set to “resource request” are identified by:
    - Option 1: a single mode: a range of AIDs
    - Option 2: 2 modes: a mode with a range of AIDs and a mode with groupID

Option 1: 21, Option 2: 12

SP2:

* Do you agree to define a new NDP feedback report trigger frame variant?
  + Y:28, N:1, A: 16

SP3:

* Do you agree to define that the STAs scheduled by a NDP feedback report trigger frame variant with a feedback type set to “resource request” are identified by one range of AIDs

Note: A range of AIDs is defined to be between AID start and AID start + NAIDs - 1. The trigger frame includes the AID start parameter and the needed parameters to calculate NAIDs

* One range of AIDs: 14Y / 2N / 17A
* One of multiple ranges of AIDs: 13Y / 5N / 14A

Rev 3:

* Modification of PHY section to describe NDP feedback report PPDU

Rev 4:

* Cleaning based on feedbacks during presentation

1. **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 TGax Draft. The introduction and the explanation of the proposed changes are not part of the adopted material.

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

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CID** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 7387 | 174.24 | NDP feedback report are sent in response to a trigger frame. The specification must define a new trigger type soliciting NDP feedback report from multiple STAs. | Define a new trigger type soliciting NDP feedback report | Revised = agree in principle with the comment.  Modify the spec to propose a new trigger type as defined in document 0073r4. |
| 6144 | 174.24 | Clarify more details about NDP feedback report procedure such as which kind of trigger frame and how to solicit NDP feedback report. | as the comment | Revised = agree in principle with the comment.  Modify the spec to propose a new trigger type as defined in document 0073r4. |
| 7386 | 174.24 | NDP feedback report procedure must be detailed | Provide a description of NDP feedback report procedure for the AP side and the STA side | Revised = agree in principle with the comment.  Modify the spec with the proposed changes in document 0073r4. |
| 8304 | 174.24 | "The NDP feedback report is a mechanism for an HE AP to collect short feedbacks from a very high number of HE STAs, in an efficient manner. The feedbacks (e.g. resource requests) are sent without data payloads in response to a Trigger frame. The feedbacks are not for channel sounding. This mechanism is optional for non-AP STA." No type of Trigger frame is defined for NDP feedback report generation. | Precise the NDP feedback procedure | Revised = agree in principle with the comment.  Modify the spec with the proposed changes in document 0073r4. |
| 9101 | 174.24 | The NDP feedback mechanism is not defined | create a new type of trigger frame to indicate to the STA the time/frequency/space dimensions. | Revised = agree in principle with the comment.  Modify the spec with the proposed changes in document 0073r4. |
| 9573 | 174.24 | It is not clear how to trigger the NDP feedback report as there is no trigger variant for triggering this NDP type of feedback frame. | Need to clarify this or define a new trigger variant for the NDP type of feedback. | Revised = agree in principle with the comment.  Modify the spec with the proposed changes in document 0073r4. |
| 8571 | 174.24 | PHY design for NDP feedback report procedure is missing | Please provide PHY design details for this feature | Revised – agree in principle with the comment. Modify the spec with the proposed changes in document 0073r4. |

1. **Proposed changes**

**Green text is part of the proposed changes and reflects the proposed PHY design.**

**9.3.1.23 Trigger frame format (#6144, #7387, #9101, #9573)**

***TGax editor: Modify Table 9-27a—Trigger Type subfield encoding as the following:***

|  |  |
| --- | --- |
| * Trigger Type subfield encoding | |
| Trigger Type field value | Description |
| 0 | Basic Trigger |
| 1 | Beamforming Report Poll |
| 2 | MU-BAR |
| 3 | MU-RTS |
| 4 | Buffer Status Report Poll (BSRP) |
| 5 | GCR MU-BAR |
| 6 | Bandwidth Query Report Poll (BQRP) |
| 7 | NDP feedback Report Poll |
| 8-15 | Reserved |

***TGax editor: Add section 9.3.1.23.8 NDP Feedback Report Poll variant as follows:***

**9.3.1.23.8 NDP feedback report poll variant (#6144, #7387, #9101, #9573)**

The NDP Feedback Report Poll variant Trigger frame format is as defined in Figure 9-52a (Trigger frame).

The RA field is set to the broadcast address.(#2894)

The Common Info field of the NDP Feedback Report Poll variant Trigger frame is defined in Figure 9-52b (Common Info field(#2134)(#101)).

The Trigger Type subfield is set to 7 to indicate NDP Feedback Report Poll variant.

The BW subfield indicates the bandwidth of the NDP feedback report response and is defined in

Table 9-25b (BW subfield encoding).(#101).

The CS Required subfield of the NDP feedback report poll variant trigger frame may be set to 0.

The STBC, LDPC extra symbol, packet extension, and Doppler subfields are reserved.

The Number of HE-LTFs subfield of the Common Info field indicates the number of HE-LTF symbols present in the NDP feedback report response and is set to 2 for 2 HE-LTF symbols.

The GI and LTF Type subfield of the Common Info field is set to 2.

The Trigger Dependent Common Info field is not present.

The User Info field for NDP feedback report poll variant trigger frame is defined in Figure 9-52x (User Info field for NDP feedback report poll variant trigger frame).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Starting AID | Reserved | Reserved | Feedback Type | Reserved | Target RSSI | Multiplexing Flag |
| Bits: | 12 | 8 | 1 | 4 | 7 | 7 | 1 |

**Figure 9-52x - User Info field for the NDP feedback report poll variant**

The Feedback Type subfield encoding is defined in table 9-ax11 (Feedback Type subfield encoding).

**Table 9-ax11—Feedback Type subfield encoding**

|  |  |
| --- | --- |
| Value | Description |
| 0 | Resource request |
| 1-15 | Reserved |

~~The Feedback Size subfield defines the number of bits of the feedback, and its encoding is defined in table 9-ax12 (Feedback Type subfield encoding).~~

**~~Table 9-ax12—Feedback Size subfield encoding~~**

|  |  |
| --- | --- |
| ~~Value~~ | ~~Description~~ |
| ~~0~~ | ~~1 bit feedback~~ |
| ~~1-63~~ | ~~Reserved~~ |

~~If the Scheduling Type field is set to 0,~~ The scheduled HE non-AP STAs are identified by a range of AIDs. The Starting AID field defines the first AID of the range of AIDs that are scheduled to respond to the NDP feedback report poll variant Trigger frame.

The Target RSSI subfield indicates the target received signal power of the NDP feedback report response for all scheduled STAs. The resolution for the Target RSSI subfield is 1 dB. The Target RSSI subfield encoding is defined in Table 9-ax8 (Target RSSI subfield encoding).(#663)

The total number of STAs that are scheduled to respond to the NDP feedback report poll variant Trigger frame, called NSTAs, is calculated by the following equation:

If BW= 0 or 1: NSTAs = 18 x (BW+1) x (Multiplexing Flag) ~~/ (Feedback Size +1)~~

If BW = 2: NSTAs = 72 x (Multiplexing Flag) ~~/ (Feedback Size +1)~~

If BW = 3: NSTAs = 144 x (Multiplexing Flag) ~~/ (Feedback Size +1)~~

Where BW is the value indicated in the *BW* subfield of the NDP feedback report poll variant trigger frame, Multiplexing Flag is the value indicated in the *Multiplexing Flag* subfield of the NDP feedback report poll variant trigger frame~~, and Feedback Size is the value indicated in the~~ *~~Feedback Size~~* ~~subfield of the User Info field of the NDP feedback report poll variant trigger frame~~.

The Multiplexing Flag defines the number of STAs that are multiplexed with P-matrix codes on the same set of tones in the same RU.

**9.4.2.218.2 HE MAC Capabilities Information field**

***TGax editor: Modify figure 9-589ck - HE MAC Capabilities Information field format as described below***

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B25 | | B26 | B27    B28 | B29 | B30    B31 | B32 | B33  B39 |
|  | OMI A-Control Support | | OFDMA RA Support | Maximum A-MPDU Length Exponent | Downlink MU-MIMO on Partial Bandwidth Rx | UL MU-MIMO | NDP feedback report support | Reserved |
| Bits: | 1 | | 1(#Ed) | 2(#2278) | 1 | 2 | 1 | 9 |
|  | | * HE MAC Capabilities Information field format | | | | | | |

***TGax editor: Add a new line in Table 9-262z - Subfields of the HE MAC Capabilities Information field for NDP feedback report support, as described below***

|  |  |  |
| --- | --- | --- |
| Subfield | Definition | Encoding |
| NDP feedback report support | Indicates support for a non-AP STA to follow the NDP feedback report procedure and respond to the NDP Feedback Report Poll variant Trigger frame. | Set to 1 if supported.  Set to 0 otherwise. |

***TGax editor: Add section 9.4.2.xxx NDP feedback report parameter set element as follows:***

9.4.2.xxx NDP feedback report Parameter Set element

The format of the NDP feedback report Parameter Set element is defined in Figure 9-xxx (NDP feedback report Parameter Set element).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | Element ID | Length | Element ID Extension | Resource Request Buffer Threshold Exponent |
| Octets: | 1 | 1 | 1 | 1 |

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

The Resource Request Buffer Threshold Exponent is used to calculate the buffer threshold between two different resource requests, as defined in 27.5.2.7.3.1. The Resource request buffer threshold value is equal to 2(Ressource Request Buffer Threshold Exponent) octets.

***TGax editor: Add the following to subclause 27.5.2.7 NDP feedback report procedure)***

27.5.2.7 NDP feedback report procedure (#8304, #7386)

An HE AP sends an NDP Feedback Report Poll variant Trigger frame to solicit NDP feedback report response from many STAs that are identified by a range of scheduled AIDs in the Trigger frame. The NDP feedback report response from an HE non-AP STA is an HE trigger-based PPDU without data payloads. An HE non-AP STA uses the information carried in the NDP Feedback Report Poll variant trigger frame to know if it is scheduled, and in this case, to derive the parameters for the transmission of the response.

In this subclause, the NDP feedback report procedure is described.

**27.5.2.7.1 STA behavior**  (#8304, #7386)

A STA shall set the NDP feedback report support subfield in the HE Capabilities element to 1 if it supports NDP feedback report and set it 0, otherwise.

A STA shall not transmit an NDP feedback report response unless it is explicitly enabled by an AP in one of the operation modes described in this subclause. The inter frame space between a PPDU that contains an NDP feedback report poll variant Trigger frame and the NDP feedback report poll response is SIFS. A STA shall commence the transmission of an NDP feedback report response at the SIFS time boundary after the end of a received PPDU, when all the following conditions are met:

- The received PPDU contains an NDP feedback report poll variant Trigger frame

- The STA is scheduled by the NDP feedback report poll variant Trigger frame

- The NDP feedback report support subfield in HE MAC Capabilities Information field is set to 1

- The STA intends to provide a response to the type of the NDP feedback contained in the NDP feedback report poll variant Trigger frame, as described in section 27.5.2.7.3.

~~If the Scheduling Type subfield is set to 0 in the User Info field of the eliciting NDP feedback report poll variant Trigger frame,~~ A STA is scheduled to respond to the NDP feedback report poll variant Trigger frame if its AID is larger than or equal to Starting AID and lower than Starting AID + NSTAs, using the Starting AID subfield in the eliciting trigger frame, and with NSTAs the total number of STAs that are scheduled to respond to the NDP feedback report poll variant Trigger frame. NSTAs is calculated by the following equation, with BW subfield and Multiplexing Flag subfield ~~and Feedback Size subfield~~ from the eliciting Trigger frame:

* If BW= 0 or 1: NAIDs = 18 x (BW+1) x (Multiplexing Flag) ~~/ (Feedback Size +1)~~
* If BW = 2: NAIDs = 72 x (Multiplexing Flag) ~~/ (Feedback Size +1)~~
* If BW = 3: NAIDs = 144 x (Multiplexing Flag) ~~/ (Feedback Size +1)~~

**27.5.2.7.1.1 Transmission of the HE NDP feedback report response**

An NDP feedback report response is an HE NDP feedback report PPDU, as defined in 28.3.17 HE preamble format for NDP feedback report PPDU.

A STA transmitting an NDP feedback report response to a Trigger frame, shall set the TXVECTOR parameter as for transmitting an HE trigger-based PPDU as described in subsection 27.5.2.3, except for the following parameters:

* The RU\_allocation parameter shall be set with the following equation, with the values of the Starting AID subfield~~, the Feedback Size subfield~~ and the BW subfield of the eliciting NDP feedback report poll variant trigger frame:
  + RU\_allocation = 61 + ( floor( (AID-Starting AID) x ~~(Feedback Size +1)~~ / (18) )) mod ((BW+1)x(BW+1)), if BW= 0,1 or 2
  + RU\_allocation = 61 + ( floor( (AID-Starting AID) ~~x (Feedback Size +1)~~ / (18) )) mod (4) +128 x (floor((AID-Starting AID) ~~x (Feedback Size +1)~~ /72)) mod (2) , if BW= 3
* The RU\_TONE\_SET parameter shall be set with the following equation, with the value of the Starting AID subfield in the User Info field of the eliciting Trigger frame~~, if the value in the Feedback Size subfield in the User Info field of the eliciting Trigger frame is equal to 0~~ :
  + RU\_TONE\_SET = (AID-Starting AID) mod (18/~~(Feedback Size+1)~~)

* The NUM\_STS parameter shall be set to 1
* The STARTING\_STS\_NUM parameter shall be set with the following equation, with the values of the Starting AID subfield ~~and of the Feedback Size subfield~~ in the User Info field of the eliciting Trigger frame:
  + STARTING\_STS\_NUM = (floor((AID-Starting AID) x ~~(Feedback Size +1)~~ / 18 / (BW +1) / (BW + 1) )), if BW= 0, 1 or 2
  + STARTING\_STS\_NUM = (floor((AID-Starting AID) x ~~(Feedback Size +1)~~ / 144 )), if BW= 3
* The MCS parameter shall be set to 0
* The DCM parameter shall be set to 0
* The FEC\_CODING parameter shall be set to 0
* The TXPWR\_LEVEL\_INDEX parameter shall be set to the value based on the Transmit Power Control for HE Trigger -based PPDU and based on the value of the AP Tx Power subfield and the Target RSSI subfield in the User Info field of the eliciting Trigger Frame (**26.3.15.2 Power pre-correction**)

A STA transmitting an NDP feedback report response to a Trigger frame shall modulate the assigned tones as descried in section 27.5.2.7.1.2 Modulation of the assigned tones.

**27.5.2.7.1.2 Modulation of the assigned tones**

~~If the Feedback Size subfield in the User Info field of the NDP feedback report poll variant trigger frame is set to 0 for a “one bit feedback”,~~ Each STA that is scheduled for providing a feedback is assigned an RU\_allocation, a STARTING\_STS\_NUM and an RU\_TONE\_SET of 12 tones to transmit a bit *b*. Its set of 12 tones is divided into 2 groups of 6 tones, as described in Table 28-xxx RU\_TONE\_SET for NDP Feedback Response in 20 MHz:

* If the bit to transmit *b* = 1, the STA shall send energy on the first group of 6 tones and quiet the second group of tones, on its assigned RU\_TONE\_SET of 12 tones on its assigned RU\_allocation.
* If *b* = 0, the STA shall send energy on the second group of 6 tones tone set and quiet the first group of tones, on its assigned RU\_TONE\_SET of 12 tones on its assigned RU\_allocation.

**27.5.2.7.2 AP behavior**  (#8304, #7386)

**27.5.2.7.2.1 Reception of NDP feedback report responses**

Following the transmission from an AP of an NDP feedback report poll variant trigger frame, multiple STAs may simultaneously send NDP feedback report responses to the AP. Based on the RxVECTOR NDP\_REPORT, which provides the vector of the detected bits for each P-matrix code on each RU\_TONE\_SET of each RU, the AP can derive the list of AIDs for which an NDP feedback report response was sent, and their response.

The AP shall not send any acknowledgement in response to the reception of NDP feedback report responses.

**27.5.2.7.3 NDP feedback report types** (#8304, #7386)

**27.5.2.7.3.1 NDP feedback report with resource request type**

An HE AP may send an NDP feedback report poll variant trigger frame with the type subfield set to “0” for “resource request”.

~~If the Feedback Type subfield in the User Info field of the NDP feedback report poll variant trigger frame is set to 0 for “resource request”, the Scheduling Type subfield shall be set to 0.~~

If the Feedback Type subfield in the User Info field of the NDP feedback report poll variant trigger frame is set to 0 for “resource request”, a STA that is scheduled may send an NDP feedback report response in order to signal to the AP that it has packets in its queues and would like to be triggered in UL MU.

~~If the Feedback Size subfield in the User Info field of the NDP feedback report poll variant trigger frame is set to 0 for a “one bit feedback”,~~ Each STA that is scheduled for providing a feedback is assigned an RU\_TONE\_SET, a STARTING\_STS\_NUM and an RU\_TONE\_SET of 12 tones to transmit a bit *b*.

The meaning of the values of that bit *b* is defined in table 9-ax13:

**Table 9-ax13— Meaning of the values for b0 with the resource request type**

|  |  |
| --- | --- |
| *b* Value | Description |
| 0 | Resource request with buffered bytes for transmission between 1 and the Resource request buffer threshold. |
| 1 | Resource request with buffered bytes for transmission above the Ressource request buffer threshold. |

The Resource request buffer threshold is equal to 2(Resource request buffer threshold exponent) octets, using the Resource Request Buffer Threshold Exponent subfield in the most recently received NDP feedback report Parameter Set element sent by the AP to which the STA is associated. The Resource request buffer threshold is equal to 256 octets if no NDP feedback report Parameter Set element has been sent by the AP to which the STA is associated.

***TGax editor: Add a new line for RxVector NDP\_REPORT and a new line for TxVector RU\_TONE\_SET as follows in Table 26-1—TXVECTOR and RXVECTOR parameters***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Condition | Value | TXVECTOR | RXVECTOR |
| NDP\_REPORT | The NDP report is carried in the RXVECTOR parameter NDP\_REPORT when receiving an NDP feedback report response, sent in response to the transmission of a NDP feedback report poll variant trigger frame. |  | N | Y |
| RU\_TONE\_SET | FORMAT is HE NDP feedback report PPDU | Indicates the RU tone set used for an NDP feedback report PPDU.  Details in 28.3.17 HE preamble format for NDP feedback report PPDU | Y | N |
| Otherwise | Not present | N | N |

***TGax editor: create a new section 28.3.17 HE preamble format for NDP feedback report PPDU***

28.3.17 HE preamble format for NDP feedback report PPDU

The format of an HE NDP feedback report PPDU is shown in Figure 28-xx (HE NDP feedback report PPDU format).



Figure 28-xx (HE NDP feedback report PPDU format).

The HE NDP feedback report PPDU has the following properties:

* uses the HE trigger-based PPDU format but without the Data field
* Has a Packet Extension field that is 4 μs in duration
* Has two 4x HE-LTF symbols with 16us per HE-LTF symbol
* The generation of HE-LTF symbols shall follow the procedure in 28.3.6.9 (Construction of HE-LTF) with the following exceptions:
  + The 4x HE-LTF sequence defined in 28.3.10.10 (HE-LTF) is mapped only on the subcarrier indices included in the TxVector RU\_TONE\_SET.
  + Pilot shall not be transmitted in the HE-LTF
  + The RU\_TONE\_SET is defined in Table 28-yyy.

**Table 28-xxx RU\_TONE\_SET for NDP Feedback Response in 20 MHz**

|  |  |  |
| --- | --- | --- |
| **RU\_TONE\_SET** | **b = 1 Subcarrier Indices** | **b = 0 Subcarrier Indices** |
| 1 | -113, -77, -41, 6, 42, 78 | -112, -76, -40, 7, 43, 79 |
| 2 | -111, -75, -39, 8, 44, 80 | -110, -74, -38, 9, 45, 81 |
| 3 | -109, -73, -37, 10, 46, 82 | -108, -72, -36, 11, 47, 83 |
| 4 | -107, -71, -35, 12, 48, 84 | -106, -70, -34, 13, 49, 85 |
| 5 | -105, -69, -33, 14, 50, 86 | -104, -68, -32, 15, 51, 87 |
| 6 | -103, -67, -31, 16, 52, 88 | -102, -66, -30, 17, 53, 89 |
| 7 | -101, -65, -29, 18, 54, 90 | -100, -64, -28, 19, 55, 91 |
| 8 | -99, -63, -27, 20, 56, 92 | -98, -62, -26, 21, 57, 93 |
| 9 | -97, -61, -25, 22, 58, 94 | -96, -60, -24, 23, 59, 95 |
| 10 | -95, -59, -23, 24, 60, 96 | -94, -58, -22, 25, 61, 97 |
| 11 | -93, -57, -21, 26, 62, 98 | -92, -56, -20, 27, 63, 99 |
| 12 | -91, -55, -19, 28, 64, 100 | -90, -54, -18, 29, 65, 101 |
| 13 | -89, -53, -17, 30, 66, 102 | -88, -52, -16, 31, 67, 103 |
| 14 | -87, -51, -15, 32, 68, 104 | -86, -50, -14, 33, 69, 105 |
| 15 | -85, -49, -13, 34, 70, 106 | -84, -48, -12, 35, 71, 107 |
| 16 | -83, -47, -11, 36, 72, 108 | -82, -46, -10, 37, 73, 109 |
| 17 | -81, -45, -9, 38, 74, 110 | -80, -44, -8, 39, 75, 111 |
| 18 | -79, -43, -7, 40, 76, 112 | -78, -42, -6, 41, 77, 113 |
| Note:  For 40/80/160MHz UL packet, BW segments are assigned separately.  40 MHz:   * RU\_TONE\_SET 1 to 18: Add -128 to Subcarrier Indices in Table 28-xxx * RU\_TONE\_SET 19 to 36: Add +128 to Subcarrier Indices in Table 28-xxx   80 MHz:   * RU\_TONE\_SET 1 to 18: Add -384 to Subcarrier Indices in Table 28-xxx * RU\_TONE\_SET 19 to 36: Add -128 to Subcarrier Indices in Table 28-xxx * RU\_TONE\_SET 37 to 54: Add +128 to Subcarrier Indices in Table 28-xxx * RU\_TONE\_SET 55 to 72: Add +384 to Subcarrier Indices in Table 28-xxx   80+80 MHz and 160 MHz:   * Same process as 80 MHz on the lower and upper 80 MHz | | |