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.

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 0073r1 without the green text. |
| 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 0073r1 without the green text. |
| 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 0073r1 without the green text. |
| 8304 | 174.24 | "The NDP feedback report is a mechanism for an HE AP to collect short feedbacks from a very high numberof HE STAs, in an efficient manner. The feedbacks (e.g. resource requests) are sent without data payloads inresponse to a Trigger frame. The feedbacks are not for channel sounding. This mechanism is optional fornon-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 0073r1 without the green text. |
| 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 0073r1 without the green text. |
| 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 0073r1 without the green text. |

1. **Proposed changes**

**Blue text refers to the inclusion of the groupID concept.**

**Green text is not part of the proposed changes and is dependent on the PHY design under discussion.**

**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 5 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 shall 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. The number of HE-LTF subfield encoding is defined in Table 22-13.

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

The Trigger Dependent Common Info field is present and is defined in Figure 9-52i (Trigger Dependent Common Info field for the NDP Feedback Report Poll variant(#614)).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Feedback type | Feedback size | Scheduling type | groupID | Starting STA | Target RSSI | Number of users per set of tones | Resource request buffer threshold |
| Bits: | 4 | 6 | 2 | 6 | 11 | 7 | 2 | 4 |

**Figure 9-52i - Trigger Dependent Common 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 | 2 bits feedback |
| 2-63 | Reserved |

 If the Scheduling type field is set to 0, the scheduled HE non-AP STAs are identified by a range of AIDs.

If the Scheduling type field is set to 1, the scheduled HE non-AP STAs are identified by a groupID and a range of indexes.

If the Scheduling type field is set to 0:

* the groupID field is reserved
* the Starting STA field defines the first AID of the range of AIDs that are scheduled to respond to the NDP feedback report poll variant Trigger frame.

If the Scheduling type field is set to 1:

* the groupID field is set to the groupID value that is scheduled.
* the Starting STA field defines the first index of the range of indexes in the group ID that are scheduled to respond to the NDP feedback report poll variant Trigger frame.

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 (Number of users per set of tones) / (Feedback size +1)

If BW = 2: NSTAs = 72 x (Number of users per set of tones) / (Feedback size +1)

If BW = 3: NSTAs = 144 x (Number of users per set of tones) / (Feedback size +1)

Where BW is the value indicated in the *BW* subfield of the NDP feedback report poll variant trigger frame, (Number of users per set of tones) is the value indicated in the *Number of users per set of tones* subfield of the NDP feedback report poll variant trigger frame, and (Feedback size) is the value indicated in the *Feedback size* subfield of the trigger dependent common info field of 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 number of users per set of tones defines the number of users that are multiplexed with P-matrix codes on the same set of tones in the same RU.

The Resource request buffer threshold indicates the buffer threshold between two different resource requests, as defined in 27.5.2.7.3.1.

If the feedback type field is set to zero for “resource request” type, the User Info field of the NDP Feedback Report Poll variant Trigger frame is not present.

**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 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 fom 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 field is set to 0, 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 STA and lower than Starting STA + NSTAs, using the Starting STA 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 can be calculated by the following equation, with BW subfield, Number of Users per set of tones subfield and Feedback size subfield from the eliciting Trigger frame:

* If BW= 0 or 1: NAIDs = 18 x (BW+1) x (Number of Users per set of tones) / (Feedback size +1)
* If BW = 2: NAIDs = 72 x (Number of Users per set of tones) / (Feedback size +1)
* If BW = 3: NAIDs = 144 x (Number of Users per set of tones) / (Feedback size +1)

If the Scheduling type field is set to 1, a STA is scheduled to respond to the NDP feedback report poll variant Trigger frame if:

* the STA is a member of the group ID indicated in the group ID subfield
* and its index in the group ID is larger than or equal to Index start and lower than Starting STA + NSTAs, using the Starting STA 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 can be calculated by the following equation, with BW subfield, Number of Users per set of tones subfield and Feedback size subfield from the eliciting Trigger frame:
	+ If BW= 0 or 1: NAIDs = 18 x (BW+1) x (Number of Users per set of tones) / (Feedback size+1)
	+ If BW = 2: NAIDs = 72 x (Number of Users per set of tones) / (Feedback size +1)
	+ If BW = 3: NAIDs = 144 x (Number of Users per set of tones) / (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 26.3.4.

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 STA subfield, the Number of users per set of tones subfield and the BW subfield of the eliciting NDP feedback report poll variant trigger frame:
	+ RU\_allocation = 61 + ( floor( (AID-Starting STA) x (Symbol size +1) / (18) )) mod ((BW+1)x(BW+1)), if BW= 0,1 or 2
	+ RU\_allocation = 61 + ( floor( (AID-Starting STA) x (Symbol size +1) / (18) )) mod (4) +128 x (floor((AID-Starting STA) x (Symbol 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 AID start subfield in the Common Info field of the eliciting Trigger frame, if the value in the Symbol size subfield in the Common Info field of the eliciting Trigger frame is equal to 0 :
	+ RU\_TONE\_SET = (AID-AIDstart) mod (18/(symbol 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 AID start subfield, of the Number of users per set of tones subfield and of the Symbol size subfield in the Common Info field of the eliciting Trigger frame:
	+ STARTING\_STS\_NUM = (floor((AID-Starting STA) x (Symbol size +1) / 18 / (BW +1) / (BW + 1) )), if BW= 0, 1 or 2
	+ STARTING\_STS\_NUM = (floor((AID-Starting STA) x (Symbol 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 Common 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 then 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 Symbol size subfield in the common 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, a P-matrix code and a set of 12 tones to transmit a bit *b0*. Its set of 12 tones is divided into 2 groups of 6 tones:

* If the bit to transmit *b0* = 1, the STA shall send energy on the first group of 6 tones and quiet the second group of tones, on its assigned set of 12 tones on its assigned RU.
* If *b0* = 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 set of 12 tones on its assigned RU.

If the Symbol size subfield in the common info field of the NDP feedback report poll variant trigger frame is set to 1 for a “two bits feedback”, each STA that is scheduled for providing a feedback is assigned an RU, a P-matrix code and 2 sets (*s0* and *s1*) of 12 tones to transmit respectively a bit *b0* and a bit *b1*. Each of its sets of 12 tones is divided into 2 groups of 6 tones:

* If the bit to transmit *b0* = 1, the STA shall send energy on the first group of 6 tones and quiet the second group of tones, on its assigned set of 12 tones *s0* on its assigned RU.
* If *b0* = 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 set of 12 tones *s0* on its assigned RU.
* If the bit to transmit *b1* = 1, the STA shall send energy on the first group of 6 tones and quiet the second group of tones, on its assigned set of 12 tones *s1* on its assigned RU.
* If *b1* = 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 set of 12 tones *s1* on its assigned RU.

**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, many STAs may simultaneously send NDP feedback report responses to the AP. All the NDP feedback report responses from different users are orthogonal as a unique combination of Set of tones, RU\_allocation and STARTING\_STS\_NUM is associated with a STA’s AID.

Based on the RxVECTOR NDP\_REPORT, which provides the vector of the detected bits for each P-matrix code on each set of tones 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 acknowledgements 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 type subfield in the common info field of the NDP feedback report poll variant trigger frame is set to 0 for “resource request”, the Scheduling type subfield may be set to 0 or 1.

If the type subfield in the common 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 Symbol size subfield in the common 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, a P-matrix code and a set of 12 tones to transmit a bit *b0*.

The meaning of the values of that bit b0 is defined in the following table:

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

|  |  |
| --- | --- |
| *b0* Value | Description |
| 0 | Resource request with buffered bytes for transmission between 1 and Ressource request buffer threshold field in the eliciting NDP feedback report poll variant trigger frame |
| 1 | Resource request with buffered bytes for transmission above Ressource request buffer threshold field in the eliciting NDP feedback report poll variant trigger frame |

If the Symbol size subfield in the common info field of the NDP feedback report poll variant trigger frame is set to 1 for a “two bits feedback”, each STA that is scheduled for providing a feedback is assigned an RU, a P-matrix code and 2 sets of 12 tones to transmit 2 bits *b0* and *b1*.

The meaning of the values of *b0* is defined in table 9-ax13, and *b1* is equal to *b0*.

 ***TGax editor: Add a new line for TxVector NDP\_REPORT 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 |

**28.3.4 HE PPDU formats**

***TGax editor: Add the following text to section 28.3.4***

The HE NDP feedback report PPDU has the following properties:

* It uses the HE trigger-based PPDU format but without the Data field
* Has a Packet Extension field that is 4 μs in duration