IEEE P802.11
Wireless LANs

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| CID 10276 related to 27.5.5 |
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Abstract

This document provides proposals for CID 10276 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.***

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| --- | --- | --- | --- | --- |
| 10276 | 175.22 | The short feedbacks mechanism is suitable for collecting information from the STAs like PS-Poll information or BSS color information the STAs detect in PPDUs from OBSS. | Define specification of short feedback to collect PS-Poll information and BSS color information the STAs detect in OBSS PPDUs. By allocating keys (indexes) on each RU and the AP announces the allocations to STAs, the collecting mechanism can be realized. | Revised – agree with the commenter for the PS-Poll concept. Make the changes as defined in doc 1299r0. For BSS color, further details need to be provided.  |

**Discussion**

In order to respond to the comment that intends to use NDP feedback report procedure to signal a PS-Poll, we include in this document:

* A new type for the NDP feedback report poll trigger frame, specifically for PS-Poll indication
* The inclusion of the PS-Poll type in the NDP feedback report protocol description
* The inclusion that the reception of a PS-Poll NDP feedback report response is equivalent to the reception of a PS-Poll.
* The modification of the power save protocols, especially TWT, in order to take into account a resource request feedback or a ps-poll feedback from a PS STA as an indication that the PS STA is in the awake state.
1. **Proposed changes**

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

* NDP Feedback Report Poll variant

(#6144)The NDP Feedback Report Poll Trigger frame(#8485) format is defined in Figure 9-52c (Trigger frame).

The RA field is set to the broadcast address.

The Common Info field of the NDP Feedback Report Poll Trigger frame is defined in Figure 9-52d (Common Info field).

The BW subfield indicates the bandwidth of the NDP feedback report response and is defined in Table 9-25b (BW subfield encoding).

The CS Required subfield of the NDP Feedback Report Poll Trigger frame(#Ed) may be set to 0.

The STBC, LDPC Extra Symbol Segment, 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 subfield(#7323) is not present.

The User Info field for NDP Feedback Report Poll Trigger frame is defined in Figure 9-52l (User Info field for the NDP Feedback Report Poll variant).

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| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  | Starting AID | Reserved | Feedback Type | Reserved | Target RSSI | Multiplexing Flag |
| Bits: | 12 | 9 | 4 | 7 | 7 | 1 |
| * User Info field for the NDP Feedback Report Poll variant
 |

The Feedback Type subfield encoding is defined in Table 9-25k (Feedback Type subfield encoding).

|  |
| --- |
| * Feedback Type subfield encoding
 |
| Value | Description |
| 0 | Resource request |
| 1 | PS-Poll |
| 2-15 | Reserved |

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 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 9-25h (Target RSSI subfield encoding).

The total number of STAs, *NSTA*, that are scheduled to respond to the NDP Feedback Report Poll Trigger frame is calculated by the following equation:

*NSTA* = 18  2*BW*)  (*Multiplexing Flag*)

where *BW* is the value indicated in the BW subfield of the NDP Feedback Report Poll Trigger frame, *Multiplexing Flag* is the value indicated in the Multiplexing Flag subfield of the NDP Feedback Report Poll Trigger frame.

The Multiplexing Flag subfield indicates the number of STAs that are multiplexed with P-matrix codes on the same set of tones in the same RU, and is encoded as the number of STAs minus 1.

***TGax editor: Modify the 27.5.5 NDP feedback report procedure as follows***

* NDP feedback report procedure
* General

The NDP feedback report is a mechanism for an HE AP to collect short feedback from multiple HE STAs in a more efficient manner than with HE TB PPDU. The feedback (e.g. resource requests) is sent without data payloads in response to a Trigger frame. The feedback is not for channel sounding.

(#6144)An HE AP sends an NDP Feedback Report Poll 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 TB PPDU without data payloads. An HE non-AP STA uses the information carried in the NDP Feedback Report Poll Trigger frame(#8485) 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.

* STA behavior

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 Trigger frame(#8485) 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 Trigger frame(#8485)
* The STA is scheduled by the NDP Feedback Report Poll Trigger frame(#8485)
* 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 Trigger frame, as described in 27.5.5.4 (NDP feedback report types).

If a STA does not satisfy all of the above conditions, it is not required to respond to the NDP Feedback Report Poll Trigger frame.

A STA is scheduled to respond to the NDP Feedback Report Poll Trigger frame if its AID is greater than or equal to the starting AID and less than starting AID + *NSTA*, using the Starting AID subfield in the eliciting Trigger frame, and with *NSTA* the total number of STAs that are scheduled to respond to the NDP Feedback Report Poll Trigger frame. *NSTA* is calculated by the following equation, with BW subfield and Multiplexing Flag subfield from the eliciting Trigger frame:

*NSTA* = 18  2*BW*  (*Multiplexing Flag*)

* Transmission of the HE NDP feedback report response

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

A STA transmitting an NDP feedback report response to a Trigger frame, shall set the TXVECTOR parameter as for transmitting an HE TB PPDU in response to a Trigger frame as described in 27.5.2.3 (STA behavior for UL MU operation(#8151)), except for the following parameters:

* FORMAT shall be set to HE\_TRIG
* PSDU\_LENGTH shall be set to 0
* The RU\_ALLOCATION parameter shall be set to be maximum RU size for the BW
* The RU\_TONE\_SET\_INDEX 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:
* RU\_TONE\_SET\_INDEX = (AID  Starting AID) mod (18 x 2BW)
* 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 in the User Info field of the eliciting Trigger frame:
* STARTING\_STS\_NUM = (floor((AID  Starting AID) / 18 / 2BW ))
* 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 TB 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 (see 28.3.14.2 (Power pre-correction))

A STA transmitting an NDP feedback report response to a Trigger frame shall modulate the assigned tones as descried in 27.5.5.2.2 (Modulation of the assigned tones).

* Modulation of the assigned tones

Each STA that is scheduled for providing a feedback report is assigned a STARTING\_STS\_NUM and an RU\_TONE\_SET of 12 tones to transmit a bit FEEDBACK\_STATUS. Its set of 12 tones is divided into 2 groups of 6 tones, as described in Table 28-ZZ HE-LTF tone mapping for the HE Trigger-based NDP feedback PPDU:

* If FEEDBACK\_STATUS = 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 FEEDBACK\_STATUS = 0, the STA shall send energy on the second group of 6 tones and quiet the first group of tones, on its assigned RU\_TONE\_SET of 12 tones on its assigned RU\_allocation.
* AP behavior
* Reception of NDP feedback report responses

Following the transmission from an AP of an NDP Feedback Report Poll Trigger frame, multiple STAs may simultaneously send NDP feedback report responses to the AP. Based on the RXVECTOR parameter NDP\_REPORT, which provides the vector of the detected bits for each P-matrix code on each RU\_TONE\_SET\_INDEX, 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, except when the NDP feedback report responses are sent in response to an NDP Feedback Report poll with the type subfield set to "1" for "PS-Poll".

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

An HE AP may send an NDP Feedback Report Poll 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 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.

Each STA that is scheduled for providing a feedback report is assigned a STARTING\_STS\_NUM and an RU\_TONE\_SET\_INDEX of 12 tones to transmit a bit FEEDBACK\_STATUS.

The meaning of the values of that bit *b* is defined in Table 27-1 (Meaning of the values for FEEDBACK\_STATUS with the resource request type):

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| * Meaning of the values for FEEDBACK\_STATUS with the resource request type
 |
| 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 Resource 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.

The HE AP shall consider the reception of an NDP Feedback Report response with FEEDBACK\_STATUS equal to 0 or 1 in response to a NDP Feedback Report Poll trigger frame with the type subfield set to “0” for Resource request as an indication that the STA is in the awake state. When sent during an announced TWT SP, this indication signals that the STA intends to be in the awake state during the TWT SP.

* NDP feedback report with power-save poll type

An HE AP may send an NDP Feedback Report Poll Trigger frame with the type subfield set to "1" for "PS-Poll".

If the Feedback Type subfield in the User Info field of the NDP Feedback Report Poll Trigger frame is set to 1 for "PS-Poll", a PS STA that is scheduled may send an NDP feedback report response in order to signal to the AP that it is in the awake state.

Each STA that is scheduled for providing a feedback report is assigned a STARTING\_STS\_NUM and an RU\_TONE\_SET\_INDEX of 12 tones to transmit a bit FEEDBACK\_STATUS.

The meaning of the values of that bit *b* is defined in Table 27-1 (Meaning of the values for FEEDBACK\_STATUS with the resource request type):

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| * Meaning of the values for FEEDBACK\_STATUS with the resource request type
 |
| Value | Description |
| 0 | Indicates that the PS STA is in the awake state and does not have traffic to send in UL. |
| 1 | Indicates that the PS STA is in the awake state and has traffic to send in UL (its buffer queues are not empty). |

The HE AP shall respond, after a SIFS after the NDP Feedback Report responses, either with a Data or Management frame or with an Ack or a Multi-STA BA for each of the HE STAs that sent an NDP Feedback Report response with a FEEDBACK\_STATUS equal to 0 or 1.

The HE AP shall consider the reception of an NDP Feedback Report response with FEEDBACK\_STATUS equal to 0 or 1 in response to a NDP Feedback Report Poll trigger frame with the type subfield set to “1” for PS-Poll as an indication that the STA is in the awake state and uses that indication for all power management operation described in 11.2.3 Power management in a non-DMG infrastructure nework and 27.7 TWT operation. When sent outside of a TWT SP, this indication is equivalent to the reception of a PS-Poll or an APSD trigger frame. When sent during an announced TWT SP, this indication indicates that the STA intends to be in the awake state during the TWT SP.