IEEE P802.11
Wireless LANs

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| CR for NFRP |
| Date: 2018-07-09 |
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Abstract

This document provides CR for CIDs 20260, 20261, 20362, 20363, 20575, 21134, 21135, 21136, 20420, 21142

Rev 1: remove CID20364 – to be handled in a separate document

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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| **CID** | **Commenter** | **Clause Number(C)** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 20260 | Jarkko K, neckt | 26.5.6.5 | 350.55 | DL frames delivery after NDP feedback to a non-AP STA in PS mode is not clear: - The STA may not have configured the APSD for all its ACs. In this case the DL frame may not be transmitted to the STA- The buffered frame may not be from delivery enabled AC. In this case the APSD SP is not initiated and no DL frame is transmitted.If a TWT SP is initiated, then there may be confusion when the TWT SP is terminated. There may be multiple BC TWT SPs ongoing at the same time and it is unclear how long the STA should remain awake. The APSD SPs are terminated when the TWT SP is terminated.To simpify the operation, the AP could consider the PS-mode STA to have transitioned to active mode when AP receives an NDP as a response to NFRP trigger. Thus, there is no ambiguity when AP may send DL frame to the STA. | Please change the If a STA in power saving mode responds to a NFRP Trigger, then the AP shall consider the STA in active mode. | Revised – For TWT, there are no issue, as all indications that the STA is awake is treated the same way. For legacy PS mode, NFRP response is equivalent to Ps-Poll. For U-APSD, an ambiguity exists when only some ACs are delivery-enabled, in which case there is a difference between a Ps-Poll and a trigger. In such case, the NFRP response is equivalent to the U-APSD trigger.Make changes throughout the section 11.2 Power management in order to clarify how power save mechanisms work with an indication that the STA is in the awake state thanks to NFRP response. Apply the changes marked as CID20260 in this document. |
| 20261 | Jarkko Kneckt | 26.5.6.5 | 350.55 | The clause 26.5.6.5 should be merged to 26.5.6.4, because they both discuss on the same trigger type. 26.5.6.5 provides instructions how to operate with power saving STAs. | Please merge the clause 26.5.6.5 to the clause 26.5.6.4. | Reject – it is clearer to have separate sections, as one is about the description of operation with a specific Feedback type, and there could be other types, while the other is about power save operations, disregards of the types used. |
| 20362 | Laurent Cariou | 11.2.3 | 2144.18 | As described in 26.5.6.5, the transmission of a response to an NFRP trigger frame is an indication that the STA is in the awake state. This condition should be clarified for legacy power save mechanisms throughout section 11.2.3 | Define the condition to transition to the awake state based on the transmission of a response to an NFRP trigger frame, for the power save mechnaisms defined thoughout section 11.2.3. | Revised – agree with the commenter. Include a response to an NFRP trigger as an indication that the STA is in the awake state throughout the section 11.2.3. Apply the changes marked as CID20362 in this document. |
| 20363 | Laurent Cariou | 11.2.3 | 2144.18 | As described in 26.5.6.5, the transmission of a response to an NFRP trigger frame is an indication that the STA is in the awake state. It should be clarified that this triggers the delivery from the AP of DL BUs for the power save mechanisms throughout section 11.2.3 | Define the condition for the AP to delliver DL BUs to a STA that transitioned to the awake state based on the transmission of a response to an NFRP trigger frame, for the power save mechnaisms defined thoughout section 11.2.3. | Revised – agree with the commenter. Include a response to an NFRP trigger as an indication that the STA is in the awake state throughout the section 11.2.3. Apply the changes marked as CID20363 in this document. |
| 20575 | Mark RISON | 26.5.6.4 | 350.16 | "An HE AP may send an NFRP Trigger frame with the type subfield set to 0." -- not clear what subfield is being referred to. I think it's the Feedback Type subfield. However, since all values other than 0 are reserved, this is not a very useful statement anyway | Delete the cited text at the referenced location. In the referenced subclause change "is set to 0" to "is Resource request". Change 26.5.6.5 to start "An HE AP that sends an NFRP Trigger frame to a non-AP STA and receives" | Revised – agree with the commenter. This sentence is actually not needed and can be deleted as proposed by the commenter. Apply the changes marked as CID 20575 in this document. |
| 21134 | Pascal VIGER | 26.5.6.1 | 348.06 | Text tells that NDP feedback is more efficient than HE TB PPDU. This is judgment , not a specification. Remove the end of the sentence. | Remove the end of the sentence: "in a more efficient manner than with an HE TB PPDU". | Revised – agree with the comment. Apply the changes marked as CID21134 in this document. |
| 21135 | Pascal VIGER | 26.5.6.2.1 | 349.04 | HE TB feedback NDP is not defined in 27.3.4 (HE PPDU formats) but in 27.3.17 (HE TB feedback NDP). | as per comment | Revised – agree with the comment. Apply the changes marked as 21135 in this document. |
| 21136 | Pascal VIGER | 26.5.6.4 | 350.47 | It would be nice to have an illustration of the NDP procedure (as is the case for UORA), in order to correctly understand the behavior. As example, it could clearly show the difference between stations that do not answer and those which do answer with a feedback\_status = 0. | add an illustration by a figure and corresponding explanation text | Reject – a figure is not needed for this. |
| 20420 | Mark Hamilton | 9.3.1.22.9 | 115.46 | The Feedback Type field (in the User Info field of NFRP Trigger frames) adds no information since it is always zero.  For now, leave this a reserved field, that could be used for a number of purposes in the future (including some potential feedback type indicator). | Merge the "Feedback Type" field with the following "Reserved" field in Figure 9-64l.  Remove Table 9-31i and associated text.  Change "If the Feedback Type subfield in the User Info field of the NFRP Trigger frame is set to 0" to "Upon reciept of an NFRP Trigger frame" at P350.19.  Delete "with the Feedback Type subfield in the User Info field set to 0" at P350.57. | Reject – New feedback types are likely to be defined. It is clearer to keep this field. |
| 21142 | Pascal VIGER | 9.3.1.22.9 | 116.9 | Sentence "Multiplexing Flag subfield indicates the number of STAs that are multiplexed" is incorrect as this sentence lets us expect a number value. The Multiplexing Flag subfield is represented as a 1-bit flag, so can not indicate a number. | please correct accordingly:- either: the sentence can be corrected as "Multiplexing Flag subfield indicates that the STAs are multiplexed on the same set of tones",- or: the so-called flag should be larger than a bit. | Reject – the sentence is not incorrect as the field encodes a number of STAs that can be either 1 or 2, and the spec clearly defines how these field is encoded. |

1. **Proposed changes**

***TGax editor: Change the following section 26.5.6 NDP Feedback report procedure***

* NDP feedback report procedure
* General

The NDP feedback report procedure allows an HE AP to collect feedback that is not channel sounding from multiple non-AP HE STAs(#16592). (#21134)

An HE AP sends an NFRP Trigger frame to solicit NDP feedback report response from many non-AP STAs(#16592) that are identified by a range of scheduled AIDs in the Trigger frame. The NDP feedback report response from a non-AP STA(#16592) is an HE TB feedback NDP(#15768) (see 27.3.17 (HE TB feedback NDP)). A non-AP STA(#16592) uses the information carried in the NFRP Trigger frame to know if it is scheduled, and in this case, to derive the parameters for the transmission of the response. (#21135)

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

* STA behavior

A non-AP STA(#16592) 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 non-AP STA(#16592) 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 NFRP Trigger frame and the NDP feedback report poll response is SIFS. A non-AP STA(#16592) shall commence the transmission of an NDP feedback report response at the SIFS time boundary after the end of a received PPDU, if(#15354) all the following conditions are met:

* The received PPDU contains an NFRP Trigger frame
* The non-AP STA(#16592) is scheduled by the NFRP Trigger frame
* The NDP feedback report support subfield in HE MAC Capabilities Information field is set to 1
* The non-AP STA(#16592) intends to provide a response to the type of the NDP feedback contained in the NFRP Trigger frame, as described in 26.5.6.4 (NDP feedback report with resource request type).

A non-AP STA(#16592) that does not satisfy all of the above conditions shall not respond to the NFRP Trigger frame.

A non-AP STA(#16592) is scheduled to respond to the NFRP Trigger frame if all the following conditions are met:

* The non-AP STA(#16592) is associated with the BSSID indicated in the TA field of the NFRP Trigger frame or the non-AP STA(#16592) (19/0028r4)is associated with a nontransmitted BSSID of a multiple BSSID set and the TA field of the NFRP Trigger frame is set to the transmitted BSSID of that multiple BSSID set.
* The non-AP STA’s(#16592) 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 non-AP STAs(#16592) that are scheduled to respond to the NFRP Trigger frame. *NSTA* is calculated by the following equation, with UL BW subfield and Multiplexing Flag subfield from the eliciting Trigger frame:
*NSTA* = 18 × 2*BW* × (*Multiplexing Flag + 1*)

A non-AP STA(#16592) shall obtain NDP feedback report parameter values from the most recently received NDP Feedback Report Parameter Set element carried in a Beacon, Probe Response, or (Re)Association frame from its associated AP unless the non-AP STA(#16592) is associated with a nontransmitted BSSID of a multiple BSSID set, in which case it shall follow the rules in 11.1.3.8 (Multiple BSSID procedure) to determine the NDP feedback parameter values.(19/0028r4) If the NDP Feedback Report Parameter Set element is not received in a Management frame with a TA equal to the BSSID of the associated AP or to the transmitted BSSID of the multiple BSSID set, the non-AP STA(#16592) shall use default values for the NDP Feedback Report parameters.

* Transmission of the HE NDP feedback report response

An NDP feedback report response is an HE TB feedback NDP(#15768), as defined in 27.3.4 (HE PPDU formats)(#16697).

A non-AP STA(#16592) transmitting an NDP feedback report in 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 26.5.3.3 (Non-AP STA behavior for UL MU operation), except for the following parameters:

* The FORMAT parameter shall be set to HE\_TB
* The APEP\_LENGTH parameter 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 = 1 + ((AID – Starting AID) mod (18 × 2*BW*))(#15823)
* The NUM\_STS parameter shall be set to 1
* The SPATIAL\_REUSE parameter shall be set to SRP\_DISALLOW
* 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 = (AID – Starting AID) / 18 / 2*BW*
* 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 UL Target RSSI subfield in the User Info field of the eliciting Trigger Frame (see 27.3.14.2 (Power pre-correction))

NOTE—The subcarriers for each RU\_TONE\_SET index are contained in a 20 MHz channel and can be transmitted by a 20 MHz operating STA.(#15819)

* AP behavior
* General

An AP 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.(18/1498r4)

An AP may include the NDP Feedback Report Parameter Set element in Beacon frames, Probe Responses frames and (Re)Association frames in order to modify parameters for NDP Feedback Report operation. The procedure of NDP Feedback report described in this subclause allows operation even if the NDP Feedback Report Parameter Set element is not sent by the AP.(#15836)

The NFRP Trigger frame shall be transmitted in a non-HT PPDU or HT PPDU, or as an EOF-MPDU in a VHT, HE ER SU PPDU or HE SU PPDU.

An AP that transmits an NFRP Trigger frame shall set the TA field of the frame to the MAC address of the AP, unless(#15356) dot11MultiBSSIDImplemented(19/0028r4) is true and the Trigger frame is directed to STAs from at least two different BSSs of a multiple BSSID set, in which case, the AP shall set the TA field of the frame to the transmitted BSSID.

* Reception of NDP feedback report responses

Following the transmission from an AP of an NFRP Trigger frame, multiple STAs may simultaneously send NDP feedback report responses to the AP. Based on the RXVECTOR parameter NDP\_REPORT, which provides the detected status array for the resources of each spatial stream and tone set assigned by the Trigger frame, the AP can derive the list of AIDs from the resources of which an NDP feedback report response was sent, and their response.

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

* NDP feedback report with resource request type(#15926)

 (#20575)If the Feedback Type subfield in the User Info field of the NFRP Trigger frame is set to 0(18/1498r4), 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 STA does not have a resource request to make or does not have any nonzero buffer status to report, or does not want to indicate to the AP that is is in the awake state, it shall not respond to the NFRP Trigger frame.

Each STA that is scheduled is assigned a STARTING\_STS\_NUM and an RU\_TONE\_SET\_INDEX to transmit a FEEDBACK\_STATUS bit.

The meaning of the FEEDBACK\_STATUS bit is defined in Table 26-3 (FEEDBACK\_STATUS description):

|  |
| --- |
| * FEEDBACK\_STATUS description
 |
| FEEDBACK\_STATUS | 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 the STA did not receive an NDP Feedback Report Parameter Set element from the AP to which the STA is associated.

(#17126)

* Power save operation with NDP feedback report procedure

(#15830)An HE AP that sends an NFRP Trigger frame with the Feedback Type subfield in the User Info field set to 0 to a non-AP STA and receives an NDP Feedback Report response from the STA shall assume the STA to be or to have transitioned to the awake state and follow the rules defined in 11.2.3 (Power management in a non-DMG infrastructure network) and 26.8 (TWT operation) to deliver DL BUs to the STA.

NOTE—After receiving the NDP Feedback Report response the AP delivers DL BUs to the STA as defined in 11.2.3.1 (General) when the STA operates in non-APSD PS mode, as defined in 11.2.3.5 (Power management with APSD) when the STA operates in APSD PS mode, and as defined in 26.8 (TWT operation) when the STA operates within TWT SPs.

***TGax editor: Change the following section 11.2.3.1 General as follows (#20260, #20362, #20363)***

* Power management in a non-DMG infrastructure network
* General

[…]

In a BSS operating under the DCF or EDCA, (#65)upon determining that a BU is currently buffered in the AP, a STA operating in the normal (non-APSD) PS mode transmits a (11ah)(NDP) PS-Poll frame or an NDP feedback report response (see 26.5.6 (NDP feedback report procedure)) to the AP, which responds with the corresponding buffered BU immediately, or acknowledges the (11ah)(NDP) PS-Poll frame and responds with the corresponding BU at a later time.(M53)

***TGax editor: Change the following section 11.2.3.4 TIM types as follows (#20260, #20362, #20363)***

* TIM types

[…]

The third and fourth lines in Figure 11-10 (Infrastructure power management operation(#65)) depict the activity of two STAs operating with different power management requirements. Both STAs power-on their receivers when they need to listen for a TIM. This is indicated as a ramp-up of the receiver power prior to the TBTT. The first STA, for example, powers up its receiver and receives a TIM in the first Beacon frame; that TIM indicates the presence of a buffered BU for the receiving STA. The receiving STA then generates a PS-Poll frame or an NDP feedback report response (see 26.5.6 (NDP feedback report procedure)), which elicits the transmission of the buffered BU from the AP. Non-GCR-SP group addressed BUs are sent by the AP subsequent to the transmission of a Beacon frame containing a DTIM. The DTIM is indicated by the DTIM count field of the TIM element having a value of 0.

***TGax editor: Change the following section 11.2.3.5.1 Power management with APSD procedures as follows (#20260, #20362, #20363)***

* Power management with APSD
* Power management with APSD procedures

QoS APs capable of supporting automatic power save delivery (APSD) shall signal this capability through the use of the APSD subfield in the Capability Information field in Beacon, Probe Response, and (Re)Association Response frames.

QoS STAs use the Power Management subfield in the Frame Control field of a frame to indicate whether it is in active or PS mode. As APSD is a mechanism for the delivery of downlink BUs to power-saving STAs, the frames transmitted by a STA in PS mode that is using APSD have the Power Management subfield in the Frame Control field set to 1, thereby causing buffering to take place at the AP.

APSD defines two delivery mechanisms, namely *unscheduled APSD* (U-APSD) and *scheduled APSD* (S‑APSD). STAs may use U-APSD to have some or all of their BUs delivered during unscheduled SPs. STAs may use S-APSD to schedule delivery of some or all of their BUs during scheduled SPs.

If there is no unscheduled SP in progress, the unscheduled SP begins when the AP receives a trigger frame from a STA, which is a QoS Data or QoS Null frame using an AC the STA has configured to be trigger-enabled, or an NDP feedback report response (see 26.5.6 (NDP feedback report procedure)). An A‑MPDU that contains one or more trigger frames acts as a trigger frame. An unscheduled SP ends after the AP has attempted to transmit at least one BU using a delivery-enabled AC and destined for the STA, but no more than the number indicated in the Max SP Length field of the QoS Capability element of the STA’s (Re)Association Request frame if the field has a nonzero value.

[…]

***TGax editor: Change the following section 11.2.3.6 AP operation as follows (#20260, #20362, #20363)***

* AP operation(M53)

[…]

* If a STA has set up a scheduled SP, it shall automatically wake up at each SP. Therefore, the APSD-capable AP shall transmit frames associated with admitted traffic with the APSD subfield equal to 1 in the TSPECs buffered for the STA during a scheduled SP. If the STA has set up to use unscheduled SPs, the AP shall buffer BUs using delivery-enabled ACs until it has received a trigger frame using a trigger-enabled AC or an NDP feedback report response (see 26.5.6 (NDP feedback report procedure)) from the non‑AP STA, which indicates the start of an unscheduled SP. A trigger frame or NDP feedback report response received by the AP from a STA that already has an unscheduled SP underway shall not trigger the start of a new unscheduled SP. The AP transmits BUs destined for the STA and using delivery-enabled ACs during an unscheduled SP. The bit for AID 0 (zero) in the Bitmap Control field of the TIM element shall be set to 1 when non-GCR-SP (11ak)non-SYNRA group addressed traffic (11ah)that is not to be delivered using group AID is buffered, according to 9.4.2.5 (TIM element).

[…]

* When the AP receives a PS-Poll frame from a STA that is in PS mode, it shall forward to the STA (#263)a buffered BU. The AP shall respond after a SIFS either with a Data or Management frame, or with an Ack frame; in which case the corresponding Data or Management frame is delayed. When the AP receives an NDP feedback report response from a STA that is in PS mode, it shall forward to the STA (#263)a buffered BU. The AP may respond after a SIFS either with a Data or Management frame; if it does not, the corresponding Data or Management frame is delayed. Until the transmission of this BU either has succeeded or is presumed failed (when maximum retries are exceeded), the AP shall acknowledge but ignore all PS-Poll frames or NDP feedback report response from the same STA. This prevents a retried PS-Poll frame or NDP feedback report response from being treated as a new request to deliver a buffered BU.

[…]

***TGax editor: Change the following section 11.2.3.7 Receive operation for STAs in PS mode as follows (#20260, #20362, #20363)***

* Receive operation for STAs in PS mode(M53)

A STA in PS mode shall operate as follows to receive a BU from the AP(M53).

The following rules describe operation of a STA in PS mode(M53):

* The STA (11ah)with dot11NonTIMModeActivated equal to false shall wake up early enough to be able to receive the first Beacon frame scheduled for transmission at the time corresponding to the last TBTT or (11ah)TSBTT for which the STA was awake plus the time interval indicated by the ListenInterval parameter of the MLME-ASSOCIATE.request or MLME REASSOCIATE.request primitive. (11ah)The STA with dot11NonTIMModeActivated equal to true is not required to wake up to receive a Beacon frame and shall transmit at least one PS-Poll or trigger frame that is individually addressed to the associated AP every listen interval starting from the last known transition of the S1G STA in non-TIM mode(#1116) in doze state unless it follows the TWT or NDP Paging procedure.

NOTE—The STA might wake for a TBTT (11ah)or TSBTT that is earlier than this deadline. In that case the previous requirement is reset based on a new “last TBTT (11ah)or TSBTT”.

* When the STA detects that the bit corresponding to its AID is 1 in the TIM, the STA shall issue a PS-Poll frame, an NDP feedback report response (see 26.5.6 (NDP feedback report procedure)), or a trigger frame if the STA is using U-APSD and all ACs are delivery-enabled, to retrieve the buffered BU. The PS-Poll or trigger frame shall be transmitted after a random delay uniformly distributed between zero and aCWmin slots following a DIFS. The NDP feedback report response is sent in response to an NFRP trigger frame.

[…]

***TGax editor: Change the following section 11.2.3.8 Receive operation using APSD as follows (#20260, #20362, #20363)***

* Receive operation using APSD

A STA using APSD shall operate as follows to receive a BU from the AP:

* If a scheduled SP has been set up, the STA wakes up at its scheduled start time. (The STA shall wake up early enough to receive transmissions at the scheduled SP.)
* If the STA is initiating an unscheduled SP, the STA wakes up and transmits a trigger frame or an NDP feedback report response (see 26.5.6 (NDP feedback report procedure)) to the AP. When one or more ACs are not delivery-enabled, the STA may retrieve BUs using those ACs by sending PS-Poll frames to the AP.

[…]