IEEE P802.11
Wireless LANs

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| Re-organizing HCCA TXOP negotiation text |
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Abstract

This document provides normative text as a proposal to resolve CIDs 3041, 3043 and 3044. Changes from P802.11aa D4.0 are shown using Word track changes feature.

**10.aa24.2 HCCA TXOP negotiation**

described in this clause

When dot11ProtectedHCCATXOPNegotiationActivated is true, dot11RSNAEnabled shall be true. (#3087)

Overlapping HCCA APs that are able to directly exchange frames without the use of a third party STA and signal support for public or protected TXOP negotiation (as indicated by the Public TXOP Negotiation or Protected TXOP Negotiation fields equal to 1 in the Extended Capabilities information element in Beacon frames), coordinate their TXOP schedules using HCCA TXOP Advertisement and HCCA TXOP Response frames. In this clause an overlapping HCCA AP that is able to directly exchange frames without the use of a third party STA is referred to as a collaboration candidate.

The HCCA TXOP Update Count element is included in the Beacon frame to indicate that an HCCA TXOP schedule has changed. The Update Count field of the HCCA TXOP Update Count element is incremented (modulo 256) each time a TS with an access policy of HCCA or HEMM is created or deleted. An HCCA AP for which dot11PublicHCCATXOPNegotiationActivated is true or dot11ProtectedHCCATXOPNegotiationActivated is true shall advertise the Duration, Service Interval (SI) and Start Times for each HCCA TXOP reservation in a TXOP Reservation field as described in 8.4.1.aa32.

HCCA ImplementedImplementedone or moreentries

Before accepting a TSPEC request that has the Access Policy subfield of the TSPEC element equal to HCCA or HEMM, an HC for which dot11PublicTXOPNegotiationImplemented is true or dot11ProtectedTXOPNegotiationImplemented is true should examine all dot11APCEntry entries that are present in dot11APCTable.

When an AP with dot11PublicHCCATXOPNegotiationActivated true or with dot11ProtectedHCCATXOPNegotiationActivated true receives a TSPEC request that has the Access Policy subfield of the TSPEC element equal to HCCA or HEMM it shall send an HCCA TXOP advertisement to each collaboration candidate. These HCCA TXOP advertisements shall have the TXOP Reservation field set to the TXOP that the AP is attempting to schedule.

An AP with dot11ProtectedTXOPNegotiationActivated true shall send the HCCA TXOP advertisement using a Protected HCCA TXOP Advertisement Protected Dual of Public Action frame to each collaboration candidate that indicates support for protected HCCA TXOP negotiation (as indicated by the Protected TXOP Negotiation field equal to 1 in the Extended Capabilities information element in Beacon frames from the peer AP).

An AP with dot11PublicTXOPNegotiationActivated true shall send the HCCA TXOP advertisement using a HCCA TXOP Advertisement Public Action frame to each collaboration candidate that indicates support for public HCCA TXOP negotiation (as indicated by the Public TXOP Negotiation field equal to 1 in the Extended Capabilities information element in Beacon frames from the collaboration candidate) unless the HCCA TXOP advertisement has already been transmitted to this collaboration candidate using a Protected HCCA TXOP Advertisement Protected Dual of Public Action frame.

NOTE⎯When peer APs have both public and protected TXOP negotiation activated, protected TXOP negotiation is used.

The AP shall not send an ADDTS Response action frame to the requesting STA until one of the following conditions occurs:

1. The AP has received an HCCA TXOP Response frame from all the APs to which HCCA TXOP advertisements were sent, with the status field equal to 0 (“Successful”).
2. At least two beacon frames have been received from all the APs to which HCCA TXOP advertisements were sent.
3. A beacon containing the HCCA TXOP Update Count element is received from all the APs to which HCCA TXOP advertisements were sent
4. A period of three dot11BeaconPeriod TU has elapsed.

If an AP receives another TSPEC request while waiting for one of the above conditions to occur, it shall delay processing this additional TSPEC request until one of the above conditions occurs.

with

withall dot11APCEntry entriesfrom dot11APCTable that have dot11APCEntryMACAddress equal to the MAC address of Public Action

with

withathat indicates support for protected HCCA TXOP negotiation

withall dot11APCEntry entries from dot11APCTable that have dot11APCEntryMACAddress equal to the MAC address of Protected Dual of Public Action

If the HCCA TXOP Advertisement frame (either protected or public) has not been discarded due to the procedures above, the AP shall create a dot11APCEntry in the dot11APCTable for each TXOP reservation in the Active TXOP Reservations field of the (Protected) HCCA TXOP Advertisement frame.

 ReservationsPending TXOP Reservations field of the create a dot11APCEntry entry in the dot11APCTable for each TXOP Reservation in the Pending TXOP Reservations field

If the HCCA Advertisement was sent using a Public Action frame, the HCCA TXOP Response shall be sent using a Public Action frame.

If the HCCA Advertisement was sent using a Protected Dual of Public Action frame, the HCCA TXOP Response shall be sent using a Protected HCCA TXOP Response Protected Dual of Public Action frame.

If the AP detects that the TXOP given in the HCCA TXOP Advertisement frame is in conflict with an existing accepted HCCA TXOP and this AP is not itself in the process of processing an ADDTS request, it shall send a (Protected) HCCA TXOP Response frame with the status field set to <ANA> (“The TS schedule conflicts with an existing schedule; an alternative schedule is provided”) and the Alternate Schedule field set to a period of time that does not conflict with any currently accepted HCCA TXOPs and the Avoidance Request field absent. The duration sub-field of the Alternate Schedule field should be greater than or equal to the duration sub-field of the Pending TXOP Reservations field in the (Protected) HCCA TXOP Advertisement frame. The duration sub-field of the Alternate Schedule field may be less than the duration sub-field of the Pending TXOP Reservations field in the (Protected) HCCA TXOP Advertisement frame, when there is an insufficient period of time that does not conflict with currently accepted HCCA TXOPs.

If the AP detects that the TXOP given in the (Protected) HCCA TXOP Advertisement frame is in conflict with an in-progress ADDTS request for a HCCA TXOP for which HCCA TXOP Response frames have not been received, it shall send a (Protected)HCCA TXOP Response frame with the status field set to <ANA> (“The TS schedule conflicts with an existing schedule; an alternative schedule is provided”) with the Alternate Schedule and Avoidance Request fields set according to the following rules:

 If MIX(*MACr*) < MIX(*MACi*), the Alternate Schedule field is set to a value that does not conflict with any accepted HCCA TXOPs and also does not conflict with the TXOP of the in-progress ADDTS request. The Avoidance Request field is set to the TXOP of the in-progress ADDTS request.

 If MIX(*MACr*) > MIX(*MACi*), the Alternate Schedule field is set to the value from the TXOP Reservation from the TXOP Advertisement frame. The Avoidance Request field is set to a time period that does not conflict with any accepted HCCA TXOPs nor the TXOP in the Alternate Schedule field and has sufficient duration and service interval to meet the requirements of the in-progress ADDTS request.

Where:

*MACr* is the MAC address of the AP that received the TXOP Advertisement frame

*MACi* is the MAC address of the AP that sent the TXOP Advertisement frame

The MIX function takes the 6 octets of a MAC address and computes a new 6 octet value:

MIX(*MAC*) = *MAC*[4] || *MAC*[5] || *MAC*[0] || *MAC*[1] || *MAC*[2] || *MAC*[3]

Table 10-aa3 provides a summary of the values used in a TXOP Response Frame.

**Table 10-aa3—Contents of HCCA TXOP Response frame**

| **Case** | **Status Code** | **Alternate Schedule Field** | **Avoidance Request Field** |
| --- | --- | --- | --- |
| No conflict with existing or in-progress schedules | “OK” | Not present | Not Present |
| Conflicts with existing schedule, no ADDTS request in progress | “The TS schedule conflicts with an existing schedule; an alternative schedule is provided” | Period of time that does not conflict with any currently accepted HCCA TXOPs | Not Present |
| Conflict in-progress schedules, MIX(*MACr*) < MIX(*MACi*)  | “The TS schedule conflicts with an existing schedule; an alternative schedule is provided” | Period of time that does not conflict with any currently accepted HCCA TXOPs nor the in-progress ADDTS request | Schedule of in-progress ADDTS request |
| Conflict in-progress schedules, MIX(*MACr*) > MIX(*MACi*) | “The TS schedule conflicts with an existing schedule; an alternative schedule is provided” | Same schedule that was in the TXOP Advertisement | Period of time that does not conflict with any currently accepted HCCA TXOPs nor the period given in the Alternate Schedule field |

The AP shall keep a record of the TXOP proposed in the alternate schedule field in a TXOP avoidance record and should avoid scheduling any new HCCA TXOPs in this proposed period until any of the following conditions occurs:

* A period of dot11HCCATXOPBeaconTimeout multiplied by dot11BeaconPeriod TUs has elapsed
* The AP with dot11PublicTXOPNegotiationActivated true receives a HCCA TXOP Advertisement Public Actionframe from the AP to which the HCCA TXOP Response frame was sent.
* The AP with dot11ProtectedTXOPNegotiationActivated true receives a Protected HCCA TXOP Advertisement Protected Dual of Public Action frame from the AP to which the Protected HCCA TXOP Response frame was sent.

If an AP with dot11PublicTXOPNegotiationActivated true receives an HCCA TXOP Response Public Action frame with the status field equal to <ANA> (“The TS schedule conflicts with an existing schedule; an alternative schedule is provided”) the AP should create a new schedule for the TSPEC request using the suggestion provided in the HCCA TXOP Response Public Action frame. If an AP with dot11ProtectedTXOPNegotiationActivated true receives a Protected HCCA TXOP Response Protected Dual of Public Action frame with the status field equal to <ANA> (“The TS schedule conflicts with an existing schedule; an alternative schedule is provided”) the AP should create a new schedule for the TSPEC request using the suggestion provided in the Protected HCCA TXOP Response Protected Dual of Public Action frame.

If an AP creates a new schedule in response to a (Protected) HCCA TXOP Response, it shall send a new HCCA TXOP advertisement to each collaboration candidate, using the procedures previously defined in this clause.

After one or more HCCA TXOP advertisements that cause the reception of a (Protected) HCCA TXOP Response with the status field equal to <ANA> (“The TS schedule conflicts with an existing schedule; an alternative schedule is provided”) the AP may terminate the HCCA TXOP advertisement procedure and respond to the ADDTS Request with a non-zero Status Code (decline the ADDTS Request) or a zero Status Code (accept the ADDTS Request regardless of potential HCCA TXOP conflicts).

**Annex C**

(normative)

* **ASN.1 encoding of the MAC and PHY MIB**

dot11APCEntryMACAddress OBJECT-TYPE

SYNTAX MacAddress

MAX-ACCESS read-write

STATUS current

DESCRIPTION

“This is a control variable.

It is written by an external management entity or the SME.

Changes take effect as soon as practical in the implementation.

This attribute contains the MAC address of the peer AP that has scheduled an HCCA TXOP in the time period defined by dot11APCEntryAvoidanceDuration, dot11APCEntryAvoidanceServiceInterval and dot11APCEntryAvoidanceOffset.”

::= { dot11APCTableEntry 5 }

**References:**