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Wireless LANs

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Abstract

This document contains proposed changes to Annex N of 802.11-2012

This is to satisfy CIDs 1112, 1113, 1114, 1115, 1116, 1117, 1458

**Annex N**

(informative)

**TSPECs and Admission control**

**N.1 Example use of TSPEC for admission control**

Admission control, in general, depends on vendors’ implementations of schedulers, available channel capacity, link conditions, retransmission limits, and the scheduling requirements of a given TSPEC. However, for any given channel capacity, link conditions, and retransmission limits, some TSPEC constructions might be categorically rejected because a scheduler cannot create a meaningful schedule for hat TSPEC. There must, for example, be a minimum number of specified fields in the TSPEC in order for the admission control mechanism to create a valid TSPEC. Table N-1 (Admissible TSPECs) below lists the valid TSPEC parameters that must be present for all admission control algorithms to admit a TSPEC. This represents a set of necessary parameters in order for TSPEC to be admitted; it is not sufficient in and of itself to guarantee TSPEC admittance, which depends upon channel conditions and other factors. Such TSPECs are said to be *admissible*. In the table, S means specified, X means unspecified, and Opt means “optional”.

Note to editor: “Unspecified non-QoS traffic (HCCA)” column is deleted

**Table N-1—Admissible TSPECs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **TSPEC**  **parameter** | **Continuous time QoS**  **traffic (HCCA)** | **Controlled- access CBR traffic (HCCA)** | **Bursty traffic**  **(HCCA)** |  | **Contention- based traffic (EDCA)** |
| Nominal MSDU Size | S | S | X | t | S |
| Minimum  Service Interval | S | Nominal MSDU size/mean data rate, if specified (VoIP typically uses this) | S  Usually set to zero or a small number (e.g.1) |  | X |
| Maximum  Service Interval | S | Same as Minimum SI) | S |  | Opt  (Used to indicate aggregation limit) |
| Inactivity  Interval | Always specified | | | | X |
| Suspension  Interval | Opt | | | | |
| Minimum Data  Rate | Specified if peak data rate is specified | Equal to mean data rate | X |  | Specified  If peak data rate is specified |
| Mean Data Rate | S | S | Opt |  | S |
| Burst Size | X | X | S |  | Opt |
| Minimum PHY Rate | Always specified | | | | |

**Table N-1—Admissible TSPECs *(continued)***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **TSPEC**  **parameter** | **Continuous time QoS**  **traffic (HCCA)** | **Controlled- access CBR traffic (HCCA)** | **Bursty traffic**  **(HCCA)** |  | **Contention- based traffic (EDCA)** |
| Peak Data Rate | Opt  Should be specified if Minimum Data Rate Specified | Equal to Mean  Data Rate | Opt |  | Opt  Should be specified  If Minimum Data Rate is specified |
| Delay Bound | S | S | Opt | - | Opt |
| Surplus Bandwidth Allowance | S | | |  | S |
| Medium Time | (not specified by non-AP STA; only an output from the HC) | | | | |

**N.2 Recommended practices for contention-based admission control**

**N.2.1 Use of ACM (admission control mandatory) subfield**

It is recommended that admission control not be required for the access categories AC\_BE and AC\_BK. The

ACM subfield for these categories should be set to 0. The AC parameters chosen by the AP should account for unadmitted traffic in these ACs.

When dot11SSPNInterfaceActivated is true, it is recommended that any STA authenticated through an SSPN interface use admission control to access categories AC\_VO and AC\_VI to ensure network utilization

consistent with the policy imposed by the SSPN for admission. AC parameters chosen by the AP should further account for any unadmitted traffic in AC\_VO and AC\_VI that may be reserved for users of a particular SSPN.

**N.2.2 Deriving medium time**

It is recommended that the AP use the following procedure to derive Medium Time in its ADDTS response.

There are two requirements to consider: 1) the traffic requirements of the application, and 2) the expected error performance of the medium.

The application requirements are captured by the following TSPEC parameters: Nominal MSDU Size and Mean Data Rate.

The medium requirements are captured by the following TSPEC parameters: Surplus Bandwidth Allowance, Minimum PHY Rate and, for aggregation, Nominal MSDU Aggregation.

The following formula describes how Medium Time, in units of 32s periods per second, may be calculated:

Medium Time =  
 ceiling (Surplus Bandwidth Allowance  
 / 0x2000  
 × Packets Per Second  
 × Frame Exchange Time  
 / 32)

where:

1) for non-A-MSDU and non-A-MPDU (i.e. TS Info Ack Policy = 00 (Normal acknowledgement), and Burst Size Definition = 0 (or Burst Size Definition = 1 and Nominal MSDU Aggregation = 0)):

Packets Per Second =  
 ceiling (Mean Data Rate  
 / 8  
 / Nominal MSDU Size)

Frame Exchange Time =  
 duration (Nominal MPDU Size, Minimum PHY Rate)  
 + SIFS Time  
 + duration (ACK Size, ACK Rate)

Nominal MPDU Size =  
 MAC Header Size  
 + Nominal MSDU Size  
 + Security Encapsulation Size  
 + FCS Size

2) for A-MSDU but not A-MPDU (i.e. TS Info Ack Policy = 00 (Normal acknowledgement), and Burst Size Definition = 1, and Nominal MSDU Aggregation > 0):

Packets Per Second =  
 ceiling (Mean Data Rate  
 / 8  
 / Nominal MSDU Size  
 / Nominal MSDU Aggregation)

Frame Exchange Time =  
 duration (Nominal A-MSDU Size, Minimum PHY Rate)  
 + SIFS Time  
 + duration (ACK Size, ACK Rate)

Nominal A-MSDU Size =  
 MAC Header Size  
 + Nominal MSDU Aggregation  
 × Nominal A-MSDU Subframe Size  
 – Pad Size  
 + Security Encapsulation Size  
 + FCS Size

Nominal A-MSDU Subframe Size =  
 A-MSDU Subframe Header Size  
 + Nominal MSDU Size  
 + Pad Size

Pad Size =  
 3  
 – (A-MSDU Subframe Header Size  
 + Nominal MSDU Size  
 + 3)  
 mod 4

3) for A-MPDU (i.e. TS Info Ack Policy = 11 (HT-immediate block acknowledgement); includes case where MSDUs aggregated in A-MSDUs and these are further aggregated in A-MPDUs):

Packets Per Second =  
 ceiling (Mean Data Rate  
 / 8  
 / Nominal MSDU Size  
 / Nominal MSDU Aggregation)

Frame Exchange Time =  
 duration (Nominal A-MPDU Size, Minimum PHY Rate)  
 + SIFS Time  
 + duration (BlockAck Size, BlockAck Rate)

Nominal A-MPDU Size =  
 Nominal MSDU Aggregation  
 × Nominal A-MPDU Subframe Size  
 – Pad Size

Nominal A-MPDU Subframe Size =  
 MPDU Delimiter Size  
 + MAC Header Size  
 + Nominal MSDU Size  
 + Security Encapsulation Size  
 + FCS Size  
 + Pad Size

Pad Size =  
 3  
 – (MAC Header Size  
 + Nominal MSDU Size  
 + Security Encapsulation Size  
 + 3)  
 mod 4

and where:

Sizes are in octets; Rates are in bps; durations and Times are in s; Surplus Bandwidth Allowance is the unsigned integer value passed

MAC Header Size = 26

A-MSDU Subframe Header Size = 14

MPDU Delimiter Size = 4

Security Encapsulation Size = 16 (CCMP), 20 (TKIP), 8 (WEP) or 0 (open system)

ACK Size = 14

BlockAck Size = 32

FCS Size = 4

SIFS Time = 10 when operating in the 2.4 GHz band, 16 when operating in the 5 GHz band

ACK/BlockAck Rate is the rate used for the ACK/BlockAck frame, given the Minimum PHY Rate, subject to the corresponding multirate rules

duration () is the PLME-TXTIME primitive defined in clauses 10.4.6 and 7 that returns the duration of a PPDU based on the PSDU size and the PHY data rate and PHY employed, e.g. clauses 17.4.3, 18.3.4, 19.8.3 (19.8.3.1 assuming ERP-OFDM), and 20.4.3

Notes:

* + Division does not truncate.
  + Any signal extension is included, even for the acknowledgement frame which ends the frame exchange.
  + If protection frames are used, then they are included in the Frame Exchange Time too. Each frame contributes an additional term:

Frame Exchange Time +=  
 duration (Protection Frame Size, Protection Frame Rate)  
 + SIFS Time

where:

RTS Protection Frame Size = 20

CTS Protection Frame Size = 14

Protection Frame Rate is the rate used for the protection frame, given the Minimum PHY Rate, subject to the corresponding multirate and protection rules

An AP may assume that a STA will use CTS-to-self protection if an ERP Information element directs use of protection.

* + The assumption is made that HT Control headers and beamforming frames are not normally used and so their contribution to Medium Time is negligible.
  + The AP should increase the Nominal A-MPDU Subframe Size where necessary to account for the Minimum MPDU Start Spacing. For example, if the Minimum PHY Rate is 65 Mbps and the Minimum MPDU Start Spacing is 16s then the minimum Nominal A-MPDU Subframe Size is 132 octets (including 2 octets of pad).
  + The STA should not request TSPEC parameters which would result in violation of other applicable constraints such as the receiver’s maximum A-MSDU or A-MPDU size, any maximum PPDU duration, or, for uplink or bidirectional TSPECs, any non-zero TXOP Limit. The AP should reject such requests. The AP should also reject requests which cannot be satisfied for reasons which the STA cannot always be aware of, such as, for uplink or bidirectional TSPECs, the AP’s maximum Block Ack Buffer Size. The STA should not request TSPEC parameters which cannot be satisfied for reasons which the AP cannot always be aware of, such as, for downlink or bidirectional TSPECs, the STA’s maximum Block Ack Buffer Size.

**N.3 Guidelines for deriving service schedule parameters**

The HC establishes the SI for each admitted TS for a STA to derive the aggregate minimum SI contained in the STA’s service schedule. The SI for each TS is equal to the maximum SI contained in the TSPEC, if it exists; otherwise, it is the nominal MSDU size divided by the mean data rate. The SI contained in the service schedule is equal to the smallest SI for any TSPEC.

The HC can use an aggregate “token bucket specification” to police a STA’s admitted flows. The HC must derive the aggregate mean data rate and aggregate burst size to establish the aggregate token bucket specification. The aggregate mean data rate is equal to the sum of the mean data rates of all of the STA’s admitted TSs. The aggregate burst size is equal to the sum of the burst size of all of the STA’s admitted TSs. An aggregate token bucket is initialized with the aggregate burst size. Tokens are added to the token bucket at the aggregate mean data rate. Alternatively the method of summing TSPECs for statistical multiplexing, as described in Annex X.2.3, can be used.

When dot11SSPNInterfaceActivated is true, the HC polices all traffic flows from a non-AP STA authenticated against the maximum authorized data rates stored in the dot11InterworkingTable. Each SSPNauthenticated STA is given a maximum bandwidth allowance by the SSPN for each access category as well as scheduled access. The AP polices the SSPN-authenticated STA traffic flows to the maximum bandwidth allowance provided by the SSPN.

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Typically, it can be assumed that the scheduler would attempt to schedule TXOPs distributed throughout a small multiple of beacon intervals (if not a single beacon interval). In addition, TXOP limits would typically be chosen to be as short as possible (within the constraints of the minimum PHY rate, acknowledgment policy, and so forth), consistent with the goal of maximizing throughput. In other words, because of overhead, not to mention the requirements for transmitting a single Poll frame, MPDU, and possibly ACK frame, the TXOPs need to be at least of certain duration.

**N.4 TSPEC construction**

TSPECs are constructed at the SME from application requirements supplied via the SME and with information specific to the MAC layer. There are no normative requirements on how any TSPEC is to be generated. However, in this subclause a description is given of how and where certain parameters can be chosen. The following parameters typically arise from the application: Nominal MSDU Size, Maximum MSDU Size, Minimum Service Interval, Maximum Service Interval, Inactivity Interval, Minimum Data Rate, Mean Data Rate, Burst Size, Peak Data Rate, and Delay Bound. The following parameters are generated locally within the MAC: Minimum PHY Rate and Surplus Bandwidth Allowance, although the Maximum Service Interval and Minimum Service Intervals can be generated within the MLME as well. This subclause describes how the parameters that are typically generated within the MAC can be derived.

Note that a TSPEC can also be generated autonomously by the MAC without any initiation by the SME. However, if a TSPEC is generated subsequently by the SME, the TSPEC generated autonomously by the MAC is overridden. If one or more TSPECs are initiated by the SME, the autonomous TSPEC, containing the same TSID is terminated.

Typically, TSPEC parameters not determined by the application are built upon the assumption that the following exist:

— A probability *p* of not transmitting the frame (because it would have exceeded its delay bound)

— An MSDU length (which can be considered fixed for constant-bit-rate applications)

— Application throughput and delay requirements

— A channel model of error, in particular a channel error probability for the (fixed) frame length

— Possibly country-specific limits on TXOP limits

**N.4.1 Surplus Bandwidth Allocation**

The channel model implies an error ratio and an assumption about dependency (joint probability distribution of channel errors sequentially, i.e., burst error probabilities).

For example, if the channel causes errors independently from frame to frame and the error probability is the same for all frames of the same length at all times, this channel would be said to be an independent, identically distributed error channel. With *p* as the probability of dropping the frame, and *pe* as the probability of the frame not being transmitted successfully (i.e., either the data frame or the ACK frame associated with it is in error), let *Np* be the number of retries required to maintain the probability of dropping the frame to be *p*.

The probability of any given packet being dropped in such a channel after *Np* retries is given by

*p*drop *= pe Np+1*

For example, in such a channel, if *pe* = 0.1 and *p*drop = 10–8, then up to seven retries are required. The scheduler should ensure that sufficient cumulative TXOP allocations are made to accommodate retransmissions within the delay bound.

The Surplus Bandwidth Allowance parameter ensures the requesting STA is allocated a minimum amount of excess time by the scheduler so that application dropped packet rates are bounded.

*Note to Editor: the rest of the original of this this section is deleted*. The following replaces it.

The probability of not successfully transmitting *k* packets is given by the cumulative distribution function of the Binomial Distribution.

The binomial probability mass function is:

Where, n is the number of trials and p is the probability of success for each trial.

The binomial cumulative distribution function is

Assuming a certain packet error ratio (PER), *Pe*, the number of extra packets, *N,* that are required in order to have a probability, *Pns*, of not successfully transmitting *S* packets is given:

Note: Using the BINOMDIST function *Pns = BINOMDIST (S, S+N, 1-Pe, TRUE)*

Then *SBA = (S+N)/S*

Now, if just one packet is lost, then the lost packet ratio, *LPR,* is *LPR = 1/(S+N)*

The condition where *Pns < LPR* represents a practical point for determining the value of N.

Medium Time used for EDCA Admission Control is based upon one second periods and HCCA Medium time, used to aggregate TSPECs (see Annex X.2.3) also uses the one second period. Hence, for each application, *S* is the number of packets that are desired to be sent in each one second period.

For example, consider a voice application:

PER, *Pe* = 0.1 or probability of success is 1- *Pe* = 0.9

Number of packets per second, S = 50

Probability of not having 50 successful packets, *Pns* = 0.87% for *N* = 13

Lost packet ratio for 1 lost packet, LPR = 1.59%

SBA = 1.26

Take the example of a video stream at 380 packets per second (about 4Mbps):

Number of packets per second, S = 380

Probability of not having 380 successful packets, *Pns* = 0.2% for *N* = 64

Lost packet ratio for 1 lost packet, LPR = 0.23%

SBA = 1.168

It can be seen that the value for SBA varies with *S*, the number of required packets per second.

A reasonable estimate for SBA is given by SBA = -.033 ln (*S*) + 1.37

Table N.4.1.A is a table of SBA for various values of S, and the SBA estimate derived by using the formula above.

Table N.4.1.A SBA vs Packets/sec

|  |  |  |
| --- | --- | --- |
| *S* Packets/sec | SBA | Estimated SBA |
| 50 | 1.26 | 1.241 |
| 95 | 1.221 | 1.220 |
| 190 | 1.189 | 1.197 |
| 285 | 1.179 | 1.183 |
| 380 | 1.168 | 1.174 |
| 475 | 1.164 | 1.167 |
| 570 | 1.160 | 1.161 |
| 665 | 1.156 | 1.156 |
| 760 | 1.154 | 1.151 |
| 855 | 1.151 | 1.147 |
| 950 | 1.151 | 1.144 |
| 1900 | 1.139 | 1.121 |

The values for SBA as shown in Table N.4.1.1 are based upon a one second time period and hence are what should be used in the TSEC for EDCA Admission Control. Also it should be the SBA value for HCCA Medium Time is considered, The value used in an HCCA TSPEC may be different, as will now be explained.

In an HCCA TSPEC the SBA relates the overhead required in each scheduled period. A voice stream, for example, only sends one packet every 20ms. Obviously an SBA of 1.26 is meaningless as it does not allow even one retry. To allow just one retry, the minimum SBA is 2.0, Similarly for a video example of say 6 packets per schedule period, to allow at least one retry would require an SBA of (6+1)/6 = 1.167

Hence, for an HCCA TSPEC,:

Calculate packets per SI PPSI = Mean Data rate bps /( Nominal MSDU x 8) x SI

Then Minimum HCCA SBA =MAX [SBA, (PPSI+1)/PPS]

Table N.4.1.B shows the recommended SBA values for HCCA TSPECs for various video streams

Table N.4.1.B HCCA SBA for video streams

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Video, Mbps** | **Pkts per SI** | **Min HCCA SBA** | **SBA, (1 sec)** | **HCCA SBA** |
| 1 | 1 | **2.000** | 1.221 | **2.000** |
| 2 | 3 | **1.333** | 1.189 | **1.333** |
| 3 | 4 | **1.250** | 1.179 | **1.250** |
| 4 | 6 | 1.167 | **1.168** | **1.168** |
| 5 | 7 | 1.143 | **1.164** | **1.164** |
| 6 | 9 | 1.111 | **1.160** | **1.160** |
| 7 | 10 | 1.100 | **1.156** | **1.156** |
| 8 | 12 | 1.083 | **1.154** | **1.154** |
| 9 | 13 | 1.077 | **1.151** | **1.151** |
| 10 | 15 | 1.067 | **1.151** | **1.151** |
| 20 | 30 | 1.033 | **1.139** | **1.139** |

In summary, the suggested value for SBA is derived as follows:

1. Calculate Packets per sec

PPS = Mean Data Rate / (Nominal MSDU x 8)  
*Note: Nominal MSDU = MDSU or A-MSDU*

1. Calculate SBA

SBA = -0.033 Ln (PPS) + 1.37

EDCA Admission Control TSPEC and Medium Time calculation uses SBA

For HCCA TSPEC:

* Calculate packets per SI, PPSI
  + PPSI = Mean Data Rate bps /(Nominal MSDU x 8) x SI (in secs)
* HCCA SBA = MAX [SBA, (PPSI + 1)/PPSI)]

HCCA Medium Time uses SBA in place of HCCA SBA, if different.

**N.4.2 Minimum and Maximum Service Interval**

**N.4.2.1 Scheduled traffic**

The HC uses the Maximum Service Interval for the calculation of the schedule.

The value of the Minimum Service Interval is an indication that the traffic is CBR or VBR.

For CBR traffic the minimum and maximum Service Intervals should be set to the same value. For example, most voice traffic requires a minimum and maximum service interval value of 20ms.

In the case of VBR traffic, such as video, Minimum Service Interval should be set to zero and the Maximum Service Interval set to the service interval required by the application, e.g. to correspond to the codec that is to be used For example, Maximum Service Interval is set to 16ms for many real time video applications.

**N.4.2.1 Use of Maximum Service Interval with Aggregation of Packets**

Aggregation of MPDUs or MSDUs introduces delay to the packets, but the use of aggregated packets is to be encouraged because of the increased efficiency. In the case of scheduled traffic, the aggregation of packets must be such that the number of MSDUs that are aggregated into a single packet (A-MSDU or A-MPDU) does not exceed the scheduling service interval. Consider the following example:

* Video packet = 1316B (7\*188 MPEG2-TS)
* Nom MSDU Size = 1364B
* Mean Data Rate = 4Mbps
* Maximum Service Interval = 16ms

Nominal MSDUs per SI = INT [(4 x 10^6 / (1364 x 8)] = 3

Hence, to comply with the 16ms SI, the limit for aggregation is 3, (an A-MSDU of 3 MSDUs, or an A-MPDU consisting of 3 MSDUs).

In the case of EDCA Admission Control, where regular scheduling is not used, the value of the Maximum Service Interval is used to indicate the limit of aggregation of nominal MSDUs and the acceptable latency between packets. Using aggregation reduces the Medium Time and Used Time required.

For example, assuming a minimum PHY Rate of 39Mbps for the example used above, the accurate Medium Time returned by the AP would be 13783µs. If the AP assumed that A-MPDUs were to be used, then the accurate Medium Time would be 11681µs, a 15% reduction. Hence, an AP could ‘force’ a STA to use aggregation, or alternatively could assume aggregation when it is considering the total traffic as part of its admittance policy.

The Nominal MSDU Size is the size of the MSDU or A-MSDU belonging to the TS.

Consider another example:

* Video packet = 1316B (7\*188 MPEG2-TS)
* Nom MSDU Size = 4137B (A-MSDU of 3 MSDUs)
* Mean Data Rate = 10Mbps
* Maximum Service Interval = 16ms

Nominal MSDUs per SI = INT [(10 x 10^6 / (4137 x 8)] = 4

Hence, further aggregation is possible and an A-MPDU consisting of 4 A-MSDUs could be sent and still comply with the latency or SI requirement.

Note that the TSPEC is invalid if the Nominal MSDUs per Maximum Service Interval is less than 1.

**N.4.3 Minimum, Mean and Peak Data Rate**

For an HCCA TSPEC, for CBR traffic the Minimum, Mean and Maximum Data Rate fields should contain the same value but it is allowable to just specify the Mean Data Rate noting that the Minimum and Maximum Service Intervals are the same.

For an EDCA TSPEC, for CBR traffic the Minimum, Mean and Maximum Data Rate fields should contain the same value but it is allowable to just specify the Mean Data Rate.

For VBR traffic it is desirable to populate the Minimum, Mean and Peak data rate fields.

If a TSPEChas the Minimum Data Rate (MIN) and Peak Data Rate (MAX) fields populated, then the standard deviation of that stream, σ, can be estimated as:

σ = 0.25(MAX – MIN)

If a TSPEChas the Mean Data Rate (MEAN) and Peak Data Rate fields populated, then the standard deviation of that stream, σ, can be estimated as:

σ = 0.5(MAX – MEAN)

If there are n streams, it is recommended that the values of the mean *μ* and standard deviation *σ*, of the total stream traffic be calculated using:

*μ* =

σtot = sqrt∑σn2

This is of particular use to EDCA admission control policy. It should also be noted that when summing streams for EDCA Admission Control, the EDCA Overhead Factor needs to be taken into account,see X.2.7

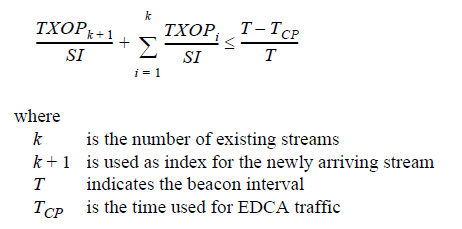
N.3.3 is changed to N.5.3

N.3.3.1 is changed to N.5.3.1 Text is unchanged

**N.5.3.2 Admission control unit**

This subclause describes a reference design for an admission control unit (ACU) that administers admission of TS. The ACU uses the same set of parameters that the scheduler uses in N.5.3.1 (Sample scheduler).

When a new stream requests admission, the admission control process is done in three steps. First, the ACU calculates the number of MSDUs that arrive at the mean data rate during the scheduled SI. The scheduled SI (*SI*) is the one that the scheduler calculates for the stream as specified in N.5.3.1 (Sample scheduler). For the calculation of the number of MSDUs, the ACU uses the equation for *Ni* shown in N.5.3.1 (Sample scheduler). Second, the ACU calculates the TXOP duration that needs to be allocated for the stream. The ACU uses the equation for *TXOPi* shown in N.5.3.1 (Sample scheduler). Finally, the ACU determines that the stream can be admitted when the following inequality is satisfied:



The ACU needs to ensure that it complies with the dot11CAPlimit, i.e., the scheduler does not allocate TXOPs that exceed dot11CAPlimit. The ACU might also consider additional time to allow for retransmissions. The ACU ensures that all admitted streams have guaranteed access to the channel. Any modification can be implemented for the design of the ACU. For example, UP-based ACU is possible by examining the UP field in TSPEC to decide whether to admit, retain, or drop a stream. If the UP is not specified, a default value of 0 is used. If a higher UP stream needs to be serviced, an ACU might drop lower UP streams.

Edit Clause 8.4.2.32 TSPEC element (11mc D0.5 P639 L5) as follows:

The Maximum Service Interval field is 4 octets long and contains an unsigned integer that, when the TSPEC is for the admitting of HCCA streams, specifies the maximum interval, in microseconds, between the start of two successive SPs. If the TSPEC element is intended for EDCA Admission Control, the Maximum Service Interval field specifies the latency limit in the case that aggregated packets are used (see Annex N.4.2.1). The Maximum Service Interval field is greater than or equal to the Minimum Service Interval field. If the TSPEC element is included within a GCR Request subelement that has the GCR delivery method equal to GCR-SP, a Maximum Service Interval field value of 0 indicates that the continuous SP used by the GCR-A delivery method is requested.