IEEE P802.11  
Wireless LANs

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | CR ESP | | | | | | Date: 2018-05-16 | | | | | | Author(s): | | | | | | Name | Affiliation | Address | Phone | email | | Matthew Fischer | Broadcom |  |  | [Matthew.fischer@broadcom.com](mailto:Matthew.fischer@broadcom.com) | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

Abstract

Comment resolution with proposed changes to TGmd D1.0 for CIDs from WG LB 232 that are related to Estimated Throughput.

Note that the original version of this document through version 19 were referenced to CIDs from the WG CC for TGmd D0.1 and beginning with version 20, the document proposes changes to TGmd Draft 1.0 based on comments from LB 232.

The CID list is:

1062, 1063, 1064, 1065, 1149, 1150, 1151, 1152, 1153, 1154, 1155, 1156, 1157, 1158, 1159, 1160, 1368, 1420, 1421, 1422, 1423, 1424, 1427, 1429

The proposed changes on this document are based on TGmd Draft 1.0.

**REVISION NOTES:**

**R0**:

Initial

Note that the original version of this document through version 19 were referenced to CIDs from the WG CC for TGmd D0.1 and beginning with version 20, the document proposes changes to TGmd Draft 1.0 based on comments from LB 232.

**R1**:

Add CID 212

Update resolution column DCN revision number

9.4.2.174 – slight modifications to the wording to address CID 212

ESTAirtimeFractionDir – slight modification to the wording to address CID212

**R2**:

6.3.103.2.2 change added

Update resolution column DCN revision number

**R3**:

6.3.103.2.2 Changes to inbound and outbound removed

9.4.2.174 – add ATF for outbound, requires identifying the last inbound field, which is per AC, using a bitmap for outbound airtime information present per AC

Update resolution column DCN revision number

**R4**:

Change references of TGax to TGmd (i.e. the editor)

Add a new note at the very end of R.7 for CID 213

**R5**:

Includes some comments from Mark Hamilton with some comment responses from Matthew Fischer, plus some changes, some of which were motivated by the comments from Mark Hamilton:

Various changes, mostly minor technical, except for:

expanded definition of new fields, old definitions were not sufficient

9.4.2.174 – Outbound Information field expanded – previously had only airtime fraction – now includes PPDU duration target field, so the field now expands from one octet per AC to two octets per AC

CID 215 – change from revise to reject based on a rereading that reveals that the equations are correct, as explained in the new rejection rationale for CID 215, also removed editing instructions that proposed to delete and modify the set of equations according to the suggestions given in CID 215

**R6**:

Backwards compatibility issue with ESP element resolved by creating a new separate element for the ESP Outbound

This means that changes to the ESP element are reverted in this version and a new element is defined

Update resolution column DCN revision number

**R7**:

Removed PPDU duration from outbound element

Update resolution column DCN revision number

**R8**:

CID 213 in the proposed changes for this CID which affected the equation for MPDU\_pA\_MPDU, added a term to account for padding (previous revisions had already added the term “+ 4” to account for the MPDU delimiter)

CID 214 changed from REJECT to REVISE and accompanying text changes to modify the A\_MSDU\_BTX and A\_MSDU\_BRX definitions to include the option of A-MSDU not active

CID 215 – change from REJECT to REVISE and modify the definition of DPDUR to include a reference to the Data PPDU Duration Target subfield of the ESP element for inbound estimated throughput calculation and a statement that the value is determined by the STA performing the calculation using a method outside of the scope of the standard for outbound estimated throughput calculation.

CID 216 changed the proposed change from fixing the equation reference to deleting the note which changes the resolution to ACCEPT.

Update resolution column DCN revision number

**R9**:

CID 213 in the proposed changes for this CID which affected the equation for MPDU\_pA\_MPDU, change the ceiling symbols to floor symbols, as this should be the highest full MPDU count for the AMPDU, i.e. floor will drop the fractional MPDU

Note that this same equation cannot include a correction factor for the fact that the last MPDU does not need padding to a 4 octet boundary because this equation is calculating the MPDU count and the adjustment for the lack of padding on the last MPDU needs the MPDU count as an input. Therefore, an iterative calculation would be required and the complexity of such a description is not worth the slight change in accuracy of the result that would follow such a complex operation.

**R10**:

Description of Outbound Airtime Fraction – added a sentence that indicates that the value in the element might be different from what is actually experienced because the sending STA might have a different view of the medium condition than the receiving STA.

**R11**:

Global change of Estimated Service Parameters element to Estimated Service Parameters Inbound element

Add ESP Outbound IE to Beacon frame format, probe request format, probe response format

9.4.2.216a Estimated service parameters outbound element – fix few field references

11.46 Estimated throughput – add paragraph for rules for inclusion of outbound element

R.7 DPDUR – mentioned a recommended value for DPDUR for outbound calculation

**R12**:

CID 251 – added – same as CID 213

Updated document references

**R13**:

Slight change to wording of correspondence of outbound airtime bitmaps to outbound airtime information fields

Changed the word “Airtime” in some field names to “Air Time” so that all such names use the two word version for consistency

Updated document references

**R14**:

Slight change to wording of correspondence of outbound airtime bitmaps to outbound airtime information fields – lowest numbered bits stuff

Qualifying some mesh STA references to “an ESP STA that is a mesh STA”

Updated document references

**R15**:

11.46 - Modification of mesh STA condition for the “may” requirements for carrying ESP elements in management frames.

Added more information in the resolution column for several CIDs to summarily describe the changes introduced as a result of the proposed resolution.

CID 259 – used this CID as justification for adding a new MIB variable for Outbound and added language throughout to modify behaviour according to which MIB is true, allowing that both can be true.

Updated document references

**R16**:

11.46 – added text that provides further assumptions about traffic and other conditions that are considered when creating airtime fraction estimation inbound and outbound values

Frame formats – made the inclusion of the outbound element OPTIONALLY present if dot11blah is true

Updated document references

**R17**:

11.46 – modified text that provides further assumptions about traffic and other conditions that are considered when creating airtime fraction estimation inbound and outbound values – by changing the “is” to a “should be”

Updated document references

**R18**:

11.46 – changed max length of PHY types to 5430 us

Updated document references

**R19**:

Beacon frame format – wrong MIB variable, needed to refere to the Outbound MIB, now fixed

Updated document references

**R20**:

Change from WG CC to WG LB232

* CID list updated, WG CC CID list remains for reference for now, but darkened to allow comparison in a single document – if there is another revision, the old CIDs will be removed in the next revision
* Note that the majority of the LB232 comments are nearly identical to the WG CC comments and that some of the new CIDs are identical to each other as well as to some old CIDs because it was not clear whether the original commenters from the WG CC would resubmit those comments that had not been addressed – in some cases, the original WG CC commenters did resubmit and in some cases they did not resubmit, but in most cases, the author of this document resubmitted those rejected comments form WG CC, hence within the LB232 CIDs, there are some comments that appear once, and some that appear twice, where the single appearance comments are a mix of resubmittals and new comments
* Modify CID tags in the proposed text changes to conform to the LB232 CID numbers
* Update baseline draft language used in the proposed change section from D0.4 to D1.0
* Update the abstract to reflect the LB and Draft changes

Definition – added a definition for Data PPDU

6.3.103.3.2 – semantics of the service primitive (ESP confirm) – the directionality stated in the table was backwards

11.46 estimated throughput – in the assumptions section, modified the wording to make it clear that SU is not required as the PPDU format, but only expected to be used to make the calculation and added assumptions about a static traffic load of OBSS STA activity and medium activity in general

R.7 – definition of P-adjust modified to add information

R.7 – add another note at the end which mentions that a STA can modify ESTAirtimeFractionDir based on knowledge about whether it is currently competing for airtime with the target BSS and would no longer be doing so if it joined the BSS.

New proposed changes for a few CIDs of LB232 that are not carry over CIDs from WG CC, and adding CID tags to some existing changes, including minor changes to:

* 11.44 for CID 1062, 1065
* 9.4.2.172 for CID 1063, 1064

Updated document references

**R21**:

11.44 – reword sentence regarding mesh STA, as non-AP STA covers the mesh STA case

CID 1062 resolution minor modification

CID 1420 – add overhead of backoff, SIFS, BA in equation (R-1)

11.44 – add a new sentence to indicate that ESP STA refers to both ESP Inbound STA and ESP Outbound STA

Updated document references

**END OF REVISION NOTES**

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. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGmd Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGmd Editor: Editing instructions preceded by “TGmd Editor” are instructions to the TGmd editor to modify existing material in the TGmd draft. As a result of adopting the changes, the TGmd editor will execute the instructions rather than copy them to the TGmd Draft.***

**CIDs**

The following are the LB232 CIDs

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1062 | Emily Qi | 2298.17 | 11.44 | "An ESP STA or a mesh STA" doesn't seem correct. It should be changed to "An ESP STA or a mesh ESP STA", or "An ESP STA that is non-AP STA or a mesh STA". | change cited text to "An ESP STA that is non-AP STA or a mesh STA" | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1062 which generally agree with the commenter but use slightly modified wording vs the suggested change. |
| 1063 | Emily Qi | 1272.01 | 9.4.2.172 | "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents the predicted percentage of time, linearly scaled with 255 representing 100%, that a new STA joining the BSS will be allocated for PPDUs that contain only MPDUs with the Type subfield equal to Data of the corresponding access category for that STA." Is the "predicted percentage of time" for "traffic to the STA", "traffic from the STA" or combination of both? It is not clear in regards to what would the AP be able to provide or the actual data that can be transmitted to the specific STA. | Commenter will bring a contribution. | Revise - TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1063. These changes clarify the meaning of the estimated air time fraction field as only applying to transmissions to the STA that is receiving the element with this field. The description of the field and the associated behavorial description indicate that there are restrictions on what is included in the air time fraction (i.e. data) and the overhead needed to transmit that data. Additional inserted text notes that the algorithm to determine this value is beyond the scope of the standard. |
| 1064 | Emily Qi | 1272.01 | 9.4.2.172 | "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents the predicted percentage of time...." . The Air time allocation by AP for a specific STA may include additional assumptions with regard to airtime fairness logic. This definition does not take this into account. Also, how to derive this "percentage of time" need to be specified. Otherwise, the estimated throughput service is meaningless and vendors may provide disinformation. | Specify how to derive "estimated air time" or remove Estimated Service Parameters. | Revise - TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1064. These changes note that the algorithm to determine this value is beyond the scope of the standard. The commenter is effectively asking for a limit on the accuracy of the delivered value, and the group is unwilling to supply such a requirement as it might place too much constraint on the possible algorithms from which to choose and might not be capable of ensuring a constant level of accuracy through different operating conditions. |
| 1065 | Emily Qi | 1272.07 | 9.4.2.172 | "The Data PPDU Duration Target field is 8 bits in length and is an unsigned integer that indicates the  expected target duration of PPDUs". How to derive "the expected target duration of PPDUs"? If it is not specified, how do we know the estimated throughput from different AP vendors are comparable? | Specify it. | Revise - TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1065. These changes note that the algorithm to determine this value is beyond the scope of the standard and explain that because the STA transmitting the value of the field is the same STA that would be transmitting the PPDUs, it would be expected that that STA could maintain the promised duration value by modifying transmission parameters as needed for that purpose. |
| 1149 | Matthew Fischer |  | 11.44 | "When an MLME-ESTIMATED-THROUGHPUT.request primitive is received at the MLME, the MLME  can use the parameters provided in the primitive plus the following information to create estimates of  throughput per access category to deliver to the SME in the EstimatedThroughputOutbound parameter of the  MLME-ESTIMATED-THROUGHPUT.confirm primitive:" -- OK, and how can the MLME determine the EstimatedThroughputInbound to deliver to the SME? CCCID259 | Add an equivalent para for EstimatedThroughputInbound | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1149. These changes effect the requested change and add a new MIB variable for Outbound and split the functionality of STAs, allowing them to support any combination of ESP Inbound, ESP Outbound. |
| 1150 | Matthew Fischer |  | 11.44 | This "Estimated Throughput" is intended to be useful for controlling traffic decisions. It does specify how a STA can inform another STA of traffic estimates but I am not convinced that this is of any use for what it supposed to address. By stating at L51 and L53 that these outside entities "need to know the current estimates" we are open to questions of accuracy and 'how to use'. I suggest that these statements are removed. CCCID56 | Delete "Entities outside the scope of this standard that might control the traffic steering decision of a device benefitby being able to predict the throughput that might be obtained through a link with a STA. Those same entities also need to know what the current estimate of throughput is for network selection purposes (by comparing an estimated throughout with existing throughout)." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1150 – slight modifications to the wording have been made to reduce the expressed level of certainty of the statements as opposed to the wholesale deletion proposed by the commenter, based on the fact that existing systems do use parameters similar to those listed to make the decisions described in the cited text. |
| 1151 | Matthew Fischer |  | 11.44 | Huge paragraph at P2049 L13 is in fact quite simple", but is repeated for each parameter and hence becomes diffivult to comprehend. If the MLME is incapable of determining a vale for EstimatedThroughput it simply returns a 0. If the AverageMSDU size in the MLME-ESTIMATED-THROUGHPUT.request primitive is -1, then the corresponding EstimatedThroughputin the MLME-ESTIMATED-THROUGHPUT.confirm primitive is 0. If the AverageMSDU size is 0, then the correspondoing EstimatedThroughput is calculated using any size but recommends 1500B. Can we try to write it simpler? CCCID55 | "If the MLME is incapable of determining a value for the EstimatedThroughputOutbound or EstimatedThroughputInbound parameter for any access category, then the MLME shall return a value of 0 for the value of that parameter for that access category in the MLME-ESTIMATEDTHROUGHPUT.confirm primitive. If the AverageMSDUSizeOutbound or AverageMSDUSizeInbound parameter for an access category is equal to -1 in the MLME-ESTIMATED-THROUGHPUT.request primitive, the STA shall include a value of 0 in the respective EstimatedThroughputOutbound or EstimatedThroughputInbound parameter for the corresponding access category in the MLME-ESTIMATED-THROUGHPUT.confirm primitive. If the AverageMSDUSizeOutbound or AverageMSDUSizeInbound parameter for an access category is equal to 0 in the MLME-ESTIMATED-THROUGHPUT.request primitive, the STA may use any value for the average MSDU size used in calculating the estimated throughput to be included in the corresponding access category in the respective EstimatedThroughputOutbound or EstimatedThroughputInbound parameter of the MLMEESTIMATED-THROUGHPUT.confirm primitive, but should use a value of 1500 octets. " | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1151. These changes break up the paragraph, but do not make the other changes suggested. |
| 1152 | Matthew Fischer |  | 11.44 | Where did this "Beacon RSSI" come from (shame on me for missing it) ? What is it used for? I see no dirrect reference to using it anywhere, unless it is P2049L1, and if so why a seperate clause??. Also +/-5dB is useless, differing MCS EVM requirements are much tighter than 5dB, it needs to be +/-1dB. We need to tighten up on all these RSSI measurements, there is no reason why we need to stick to +/- 5dB we should be making a target of 1dB. As many will know I have been advocating the DSC mechanism that uses the Beacon RSSI. As such an algorithm for determining the Beacon RSSI has been presented that accounts for a mobile STA, missed beacons etc. but uses the Beacon RSSI to adjust effective CCA thresheld. This is a good use for Beacon RSSI but even if DSC is adopted there is still no need to have this seperate Clause. CCCID54 | Either change 5dB to 1dB, or delete this clause and all references to dot11BeaconRssi | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1152, commenter to see 11.45 Beacon RSSI. Accuracy value was agreed upon by discussion among PHY experts. Again, this parameter is already successfully used today in existing systems and while the accuracy might not be as high as desired, experts did not agree that a more accurate value was possible and useful output is generated in real systems with an accuracy estimated to be about 5dB. Commenter can review equation R-2 of Annex R.7 P3801 to see where RSSI is used, noting that in the earliest implementations, a simple comparison of RSSI is often employed rather than a calculation such as is described in R.7. |
| 1153 | Matthew Fischer |  | 9.4.2.172 | "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents the predicted percentage of time, linearly scaled with 255 representing 100%, that a new STA joining the BSS will be allocated for PPDUs that contain only MPDUs with the Type subfield equal to Data of the corresponding access category for that STA." "Allocated"? So the STA is using HCCA, or EDCA Admission Control? What scheme is in use here that we have allocation of BW to specific STAs, and traffic? In addition, what is %, the fraction of all traffic or fraction of just that AC traffic? This is unclear, but why have this for every AC and how is this to be interpreted? Also unclear how an AP would even measure this. I am generally unhappy with this, I might make a presentation. CCCID31 | Replace cited with "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents the predicted percentage of time, linearly scaled with 255 representing 100%, not used by PPDUs that contain only MPDUs with the Type subfield equal to Data, of the corresponding access category." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1153. These changes improve the wording, similar to the requested changes. |
| 1154 | Matthew Fischer |  | 9.4.2.172 | "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents    the predicted percentage of time, linearly scaled with 255 representing 100%, that a new STA joining the    BSS will be allocated for PPDUs carrying Data of the corresponding AC for that STA." -- if you look at R.7 it turns out that this is exactly the time for the PPDUs, not including any contention/IFS time. This is a very subtle point (and differs from e.g. admission control) CCCID212 | Change the cited text to "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents    the predicted percentage of air time (so not including interframe space), linearly scaled with 255 representing 100%, that a new STA joining the    BSS will be allocated for PPDUs carrying Data of the corresponding AC for that STA (so not including any Management or Control frames)." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1154. These changes add a "beyond the scope of this standard" language that says the computation should include efficiency scaling. |
| 1155 | Matthew Fischer |  | R.7 | The equation for PPDU\_Dur extremely pedantically accounts for symbol rounding ... and then completely fails to account for A-MPDU delimiters. It also includes the PHY header but not the PHY trailer (e.g. signal extension) CCCID213 | At the end of the referenced subclause add a "NOTE---The equations above do not account for e.g. A-MPDU delimiters and signal extension." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1155, which adds a minimum delimiter count of 4 octets to the PPDUDur equation, and adds a note that indicates that signal extension is not accounted for. |
| 1156 | Matthew Fischer |  | R.7 | The equation for PPDU\_Dur assumes A-MSDUs can be included in A-MPDUs, but this will only happen if both sides support it CCCID214 | At the end of the referenced subclause add a "NOTE---The equations above assume that A-MSDUs are included in A-MPDUs." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1156, which qualifies the definitions of A\_MSDU\_BTX and A\_MSDU\_BRX to account for the case of no A-MSDU aggregation. |
| 1157 | Matthew Fischer |  | R.7 | PPDU\_Dur "is the expected duration of a single PPDU, in seconds". DPDUR "is the Data PPDU duration target of the transmitter of the PPDUs containing MPDUs with the Type subfield equal to Data, in seconds". Given the equation, PPDU\_Dur is also only for PPDUs with Data MPDUs. So PPDU\_Dur is the same thing as DPDUR CCCID215 | Delete the definition of PPDU\_Dur and then change PPDU\_Dur to DPDUR throughout the referenced subclause | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1157 which makes a reference to the Data PPDU Duration Target subfield of the ESP element, while noting that the two terms cited by the commenter, PPDU\_Dur and DPDUR are not the same thing. DPDUR is the target duration, but PPDU\_Dur is the actual duration which can be limited at high data rates by aggregation limits, for example. |
| 1158 | Matthew Fischer |  | R.7 | "Note that some of the parameters of Equation (R-2) have values that are AC dependent." -- er, which? None of them have any dependency on the AC CCCID216 | Delete the cited sentence | Accept |
| 1159 | Matthew Fischer |  | R.7 | It is claimed that one can determine "EstimatedThroughputInbound and EstimatedThroughputOutbound for each AC of a current or potential link to another STA using Equation (R-1)", but Equation (R-1) refers to EST\_AirtimeFraction, which is defined as " the estimated portion of airtime that is available for outbound transmissions", so does not work for inbound traffic CCCID217 | Delete "EstimatedThroughputInbound and" in R.7. At the end of R.7 add a para "The mechanism by which ESP STAs determine  values for EstimatedThroughputInbound is outside the scope of the standard." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1159, which generally agree with the nature of the comment, but resolve it by adding language for Inbound describing a method for estimating the inbound traffic. |
| 1160 | Matthew Fischer |  | R.7 | The equation for PPDU\_Dur extremely pedantically accounts for symbol rounding ... and then completely fails to account for A-MPDU delimiters. It also includes the PHY header but not the PHY trailer (e.g. signal extension) CCCID251 | Add the overhead (delimiter and rounding) for MPDUs in an A-MPDU. Also add a term for the PHY trailer | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1160, which adds a minimum delimiter count of 4 octets to the PPDUDur equation, and adds a note that indicates that signal extension is not accounted for. |
| 1368 | Mark RISON | 4203.15 | R.7 | "Note that some of the parameters of Equation (R-2) have values that are AC dependent." -- none of them do | Delete the cited text in the referenced location | Accept |
| 1420 | Mark RISON | 1272.01 | 9.4.2.172 | "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents the predicted percentage of time, linearly scaled with 255 representing 100%, that a new STA joining the BSS will be allocated for PPDUs that contain only MPDUs with the Type subfield equal to Data of the corresponding access category for that STA." -- if you look at R.7 it turns out that this is exactly the time for the PPDUs, not including any contention/IFS time. This is a very subtle point (and differs from e.g. admission control) | Change the cited text to "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents the predicted percentage of air time (so not including interframe space), linearly scaled with 255 representing 100%, that a new STA joining the BSS will be allocated for PPDUs that contain only MPDUs with the Type subfield equal to Data of the corresponding access category for that STA (so not including any Management or Control frames)." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1420. These changes add a "beyond the scope of this standard" language that says the computation should include efficiency scaling. |
| 1421 | Mark RISON |  | R.7 | The equation for PPDU\_Dur extremely pedantically accounts for symbol rounding ... and then completely fails to account for A-MPDU delimiters. It also includes the PHY header but not the PHY trailer (e.g. signal extension) | At the end of the referenced subclause add a "NOTE---The equations above do not account for e.g. A-MPDU delimiters and signal extension." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1421, which adds a minimum delimiter count of 4 octets to the PPDUDur equation, and adds a note that indicates that signal extension is not accounted for. |
| 1422 | Mark RISON |  | R.7 | The equation for PPDU\_Dur assumes A-MSDUs can be included in A-MPDUs, but this will only happen if both sides support it | At the end of the referenced subclause add a "NOTE---The equations above assume that A-MSDUs are included in A-MPDUs." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1422, which qualifies the definitions of A\_MSDU\_BTX and A\_MSDU\_BRX to account for the case of no A-MSDU aggregation. |
| 1423 | Mark RISON |  | R.7 | PPDU\_Dur "is the expected duration of a single PPDU, in seconds". DPDUR "is the Data PPDU duration target of the transmitter of the PPDUs containing MPDUs with the Type subfield equal to Data, in seconds". Given the equation, PPDU\_Dur is also only for PPDUs with Data MPDUs. So PPDU\_Dur is the same thing as DPDUR | Delete the definition of PPDU\_Dur and then change PPDU\_Dur to DPDUR throughout the referenced subclause | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1423 which makes a reference to the Data PPDU Duration Target subfield of the ESP element, while noting that the two terms cited by the commenter, PPDU\_Dur and DPDUR are not the same thing. DPDUR is the target duration, but PPDU\_Dur is the actual duration which can be limited at high data rates by aggregation limits, for example. |
| 1424 | Mark RISON |  | R.7 | It is claimed that one can determine "EstimatedThroughputInbound and EstimatedThroughputOutbound for each AC of a current or potential link to another STA using Equation (R-1)", but Equation (R-1) refers to EST\_AirtimeFraction, which is defined as " the estimated portion of airtime that is available for outbound transmissions", so does not work for inbound traffic | Delete "EstimatedThroughputInbound and" in R.7. At the end of R.7 add a para "The mechanism by which ESP STAs determine  values for EstimatedThroughputInbound is outside the scope of the standard." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1424, which generally agree with the nature of the comment, but resolve it by adding language for Inbound describing a method for estimating the inbound traffic. |
| 1427 | Mark RISON |  | R.7 | The equation for PPDU\_Dur extremely pedantically accounts for symbol rounding ... and then completely fails to account for A-MPDU delimiters. It also includes the PHY header but not the PHY trailer (e.g. signal extension) | Add the overhead (delimiter and rounding) for MPDUs in an A-MPDU. Also add a term for the PHY trailer | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1427, which adds a minimum delimiter count of 4 octets to the PPDUDur equation, and adds a note that indicates that signal extension is not accounted for. |
| 1429 | Mark RISON |  | R.7 | "When an MLME-ESTIMATED-THROUGHPUT.request primitive is received at the MLME, the MLME  can use the parameters provided in the primitive plus the following information to create estimates of  throughput per access category to deliver to the SME in the EstimatedThroughputOutbound parameter of the  MLME-ESTIMATED-THROUGHPUT.confirm primitive:" -- OK, and how can the MLME determine the EstimatedThroughputInbound to deliver to the SME? | Add an equivalent para for EstimatedThroughputInbound | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 1429. These changes effect the requested change and add a new MIB variable for Outbound and split the functionality of STAs, allowing them to support any combination of ESP Inbound, ESP Outbound. |

**The following are WG CC CIDs, not a part of the proposed changes and not intended to be resolved by this submission, but present simply for reference**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 259 | Mark RISON |  | 11.46 | "When an MLME-ESTIMATED-THROUGHPUT.request primitive is received at the MLME, the MLME can use the parameters provided in the primitive plus the following information to create estimates of throughput per access category to deliver to the SME in the EstimatedThroughputOutbound parameter of the MLME-ESTIMATED-THROUGHPUT.confirm primitive:" -- OK, and how can the MLME determine the EstimatedThroughputInbound to deliver to the SME? | Add an equivalent para for EstimatedThroughputInbound | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 259. These changes effect the requested change and add a new MIB variable for Outbound and split the functionality of STAs, allowing them to support any combination of ESP Inbound, ESP Outbound. |
| 56 | Graham Smith | 2048.00 | 11.46 | This "Estimated Throughput" is intended to be useful for controlling traffic decisions. It does specify how a STA can inform another STA of traffic estimates but I am not convinced that this is of any use for what it supposed to address. By stating at L51 and L53 that these outside entities "need to know the current estimates" we are open to questions of accuracy and 'how to use'. I suggest that these statements are removed. | Delete "Entities outside the scope of this standard that might control the traffic steering decision of a device benefitby being able to predict the throughput that might be obtained through a link with a STA. Those same entities also need to know what the current estimate of throughput is for network selection purposes (by comparing an estimated throughout with existing throughout)." The commenter intends to bring a related presentation. | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 56 – slight modifications to the wording have been made to reduce the expressed level of certainty of the statements as opposed to the wholesale deletion proposed by the commenter, based on the fact that existing systems do use parameters similar to those listed to make the decisions described in the cited text. |
| 55 | Graham Smith | 2049.00 | 11.46 | Huge paragraph at P2049 L13 is in fact quite simple", but is repeated for each parameter and hence becomes diffivult to comprehend. If the MLME is incapable of determining a vale for EstimatedThroughput it simply returns a 0. If the AverageMSDU size in the MLME-ESTIMATED-THROUGHPUT.request primitive is -1, then the corresponding EstimatedThroughputin the MLME-ESTIMATED-THROUGHPUT.confirm primitive is 0. If the AverageMSDU size is 0, then the correspondoing EstimatedThroughput is calculated using any size but recommends 1500B. Can we try to write it simpler? | "If the MLME is incapable of determining a value for the EstimatedThroughputOutbound or EstimatedThroughputInbound parameter for any access category, then the MLME shall return a value of 0 for the value of that parameter for that access category in the MLME-ESTIMATEDTHROUGHPUT.confirm primitive. If the AverageMSDUSizeOutbound or AverageMSDUSizeInbound parameter for an access category is equal to -1 in the MLME-ESTIMATED-THROUGHPUT.request primitive, the STA shall include a value of 0 in the respective EstimatedThroughputOutbound or EstimatedThroughputInbound parameter for the corresponding access category in the MLME-ESTIMATED-THROUGHPUT.confirm primitive. If the AverageMSDUSizeOutbound or AverageMSDUSizeInbound parameter for an access category is equal to 0 in the MLME-ESTIMATED-THROUGHPUT.request primitive, the STA may use any value for the average MSDU size used in calculating the estimated throughput to be included in the corresponding access category in the respective EstimatedThroughputOutbound or EstimatedThroughputInbound parameter of the MLMEESTIMATED-THROUGHPUT.confirm primitive, but should use a value of 1500 octets. " | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 55. These changes break up the paragraph, but do not make the other changes suggested. |
| 54 | Graham Smith | 2048.00 | 11.45 | Where did this "Beacon RSSI" come from (shame on me for missing it) ? What is it used for? I see no dirrect reference to using it anywhere, unless it is P2049L1, and if so why a seperate clause??. Also +/-5dB is useless, differing MCS EVM requirements are much tighter than 5dB, it needs to be +/-1dB. We need to tighten up on all these RSSI measurements, there is no reason why we need to stick to +/- 5dB we should be making a target of 1dB. As many will know I have been advocating the DSC mechanism that uses the Beacon RSSI. As such an algorithm for determining the Beacon RSSI has been presented that accounts for a mobile STA, missed beacons etc. but uses the Beacon RSSI to adjust effective CCA thresheld. This is a good use for Beacon RSSI but even if DSC is adopted there is still no need to have this seperate Clause. | Either change 5dB to 1dB, or delete this clause and all references to dot11BeaconRssi | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 54, commenter to see 11.45 Beacon RSSI. Accuracy value was agreed upon by discussion among PHY experts. Again, this parameter is already successfully used today in existing systems and while the accuracy might not be as high as desired, experts did not agree that a more accurate value was possible and useful output is generated in real systems with an accuracy estimated to be about 5dB. Commenter can review equation R-2 of Annex R.7 P3801 to see where RSSI is used, noting that in the earliest implementations, a simple comparison of RSSI is often employed rather than a calculation such as is described in R.7. |
| 31 | Graham Smith | 1189.00 | 9.4.2.174 | "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents the predicted percentage of time, linearly scaled with 255 representing 100%, that a new STA joining the BSS will be allocated for PPDUs that contain only MPDUs with the Type subfield equal to Data of the corresponding access category for that STA." "Allocated"? So the STA is using HCCA, or EDCA Admission Control? What scheme is in use here that we have allocation of BW to specific STAs, and traffic? In addition, what is %, the fraction of all traffic or fraction of just that AC traffic? This is unclear, but why have this for every AC and how is this to be interpreted? Also unclear how an AP would even measure this. I am generally unhappy with this, I might make a presentation. | Replace cited with "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents the predicted percentage of time, linearly scaled with 255 representing 100%, not used by PPDUs that contain only MPDUs with the Type subfield equal to Data, of the corresponding access category." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 31. These changes improve the wording, similar to the requested changes. |
| 30 | Graham Smith | 1189.00 | 9.4.2.174 | "A-MPDU aggregation is expected to be performed for MPDUs with the Type subfield equal to Data for the corresponding AC, but A-MSDU aggregation is not expected to be performed for MSDUs for the corresponding AC". Seems to be missing something. | Change cited text after the comma to "but A-MSDU aggregation is not expected to be performed for MSDUs with the Type subfield not equal to Data for the corresponding AC ." | Reject – nothing is missing. MPDUs are aggregated into AMPDUs, and MPDUs have a MAC header with a type and subtype and TID. A-MSDUs are built from MSDUs which do not have a MAC header and therefore do not have type or subtype but by definition will eventually be placed into an MPDU of some sort with a type of DATA and any of various subtypes. |
| 212 | Mark RISON |  | *9.4.2.174* | "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents  the predicted percentage of time, linearly scaled with 255 representing 100%, that a new STA joining the  BSS will be allocated for PPDUs carrying Data of the corresponding AC for that STA." -- if you look at R.7 it turns out that this is exactly the time for the PPDUs, not including any contention/IFS time. This is a very subtle point (and differs from e.g. admission control) | Change the cited text to "The Estimated Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents  the predicted percentage of air time (so not including interframe space), linearly scaled with 255 representing 100%, that a new STA joining the  BSS will be allocated for PPDUs carrying Data of the corresponding AC for that STA (so not including any Management or Control frames)." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 212. These changes add a "beyond the scope of this standard" language that says the computation should include efficiency scaling. |
| 213 | Mark RISON |  | R.7 | The equation for PPDU\_Dur extremely pedantically accounts for symbol rounding ... and then completely fails to account for A-MPDU delimiters. It also includes the PHY header but not the PHY trailer (e.g. signal extension) | At the end of the referenced subclause add a "NOTE---The equations above do not account for e.g. A-MPDU delimiters and signal extension." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 213, which adds a minimum delimiter count of 4 octets to the PPDUDur equation, and adds a note that indicates that signal extension is not accounted for. |
| 214 | Mark RISON |  | R.7 | The equation for PPDU\_Dur assumes A-MSDUs can be included in A-MPDUs, but this will only happen if both sides support it | At the end of the referenced subclause add a "NOTE---The equations above assume that A-MSDUs are included in A-MPDUs." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 214, which qualifies the definitions of A\_MSDU\_BTX and A\_MSDU\_BRX to account for the case of no A-MSDU aggregation. |
| 215 | Mark RISON |  | R.7 | PPDU\_Dur "is the expected duration of a single PPDU, in seconds". DPDUR "is the Data PPDU duration target of the transmitter of the PPDUs containing MPDUs with the Type subfield equal to Data, in seconds". Given the equation, PPDU\_Dur is also only for PPDUs with Data MPDUs. So PPDU\_Dur is the same thing as DPDUR | Delete the definition of PPDU\_Dur and then change PPDU\_Dur to DPDUR throughout the referenced subclause | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 215, which makes a reference to the Data PPDU Duration Target subfield of the ESP element, while noting that the two terms cited by the commenter, PPDU\_Dur and DPDUR are not the same thing. DPDUR is the target duration, but PPDU\_Dur is the actual duration which can be limited at high data rates by aggregation limits, for example. |
| 216 | Mark RISON |  | R.7 | "Note that some of the parameters of Equation (R-2) have values that are AC dependent." -- er, which? None of them have any dependency on the AC | Delete the cited sentence | Accept. |
| 217 | Mark Rison |  | R.7 | It is claimed that one can determine "EstimatedThroughputInbound and EstimatedThroughputOutbound for each AC of a current or potential link to another STA using Equation (R-1)", but Equation (R-1) refers to EST\_AirtimeFraction, which is defined as " the estimated portion of airtime that is available for outbound transmissions", so does not work for inbound traffic | Delete "EstimatedThroughputInbound and" in R.7. At the end of R.7 add a para "The mechanism by which ESP STAs determine values for EstimatedThroughputInbound is outside the scope of the standard." | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 217, which generally agree with the nature of the comment, but resolve it by adding language for Inbound describing a method for estimating the inbound traffic. |
| 251 | Mark Rison |  | R.7 | The equation for PPDU\_Dur extremely pedantically accounts for symbol rounding ... and then completely fails to account for A-MPDU delimiters. It also includes the PHY header but not the PHY trailer (e.g. signal extension) | Add the overhead (delimiter and rounding) for MPDUs in an A-MPDU. Also add a term for the PHY trailer | Revise – TGmd editor to make changes as shown in 11-17/1192r21 that are marked with CID 251, which adds a minimum delimiter count of 4 octets to the PPDUDur equation, and adds a note that indicates that signal extension is not accounted for. These changes add delimiters, and explicitly state that signal extension is not included. |

**Discussion:**

See comments within the proposed resolutions.

**Proposed Changes to Draft Text of TGmd D1.0:**

**CID 1062, 1063, 1064, 1065, 1149, 1150, 1151, 1152, 1153, 1154, 1155, 1156, 1157, 1158, 1159, 1160, 1368, 1420, 1421, 1422, 1423, 1424, 1427, 1429:**

**3.2 Definitions specific to IEEE Std 802.11**

***TGmd editor: add the following definition:***

**Data PPDU:** a PPDU containing at least one MSDU or fragment of an MSDU

**6.3.102.2.2 Semantics of the service primitive**

***TGmd editor: within the table in subclause 6.3.102.2.2 Semantics of the service primitive, modify the text as described herein:***

Change “to the wireless medium” to “over the wireless medium” in two locations in the table.

**6.3.102.3.2 Semantics of the service primitive**

***TGmd editor: within the table in subclause 6.3.102.3.2 Semantics of the service primitive, modify the text as described herein:***

Change “from the STA corresponding to the PeerMACAddress to this STA” to “from this STA to the STA corresponding to the PeerMACAddress” and vice versa.

**9.3.3.3 Beacon frame format**

***TGmd editor: within Table 9-31 – Beacon frame body in subclause 9.3.3.3 Beacon frame format, add the following row, noting that the header row is shown for convience only:***

|  |  |  |
| --- | --- | --- |
| Order | Information | Notes |
| <ANA> | Estimated Services Parameters Outbound | The Estimated Service Parameters Outbound element is optionally present if dot11EstimatedServiceParametersOutboundOptionImplemented is true. |

**9.3.3.10 Probe Request frame format**

***TGmd editor: within Table 9-37 – Probe Request frame body in subclause 9.3.3.10 Probe Request frame format, add the following row, noting that the header row is shown for convience only:***

|  |  |  |
| --- | --- | --- |
| Order | Information | Notes |
| <ANA> | Estimated Services Parameters Outbound | The Estimated Service Parameters Outbound element is optionally present if dot11EstimatedServiceParametersOutboundOptionImplemented is true. |

**9.3.3.11 Probe Response frame format**

***TGmd editor: within Table 9-38 – Probe Response frame body in subclause 9.3.3.11 Probe Response frame format, add the following row, noting that the header row is shown for convience only:***

|  |  |  |
| --- | --- | --- |
| Order | Information | Notes |
| <ANA> | Estimated Services Parameters Outbound | The Estimated Service Parameters Outbound element is optionally present if dot11EstimatedServiceParametersOutboundOptionImplemented is true. |

**9.4.2.1 General**

***TGmd editor: add a new element to Table 9-87 Element IDs as shown, noting that the column headings are shown for convenience and are not to be added:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Element ID** | **Element ID Extension** | **Extensible** | **Fragmentable** |
| Estimated Service Parameters Outbound (see 9.4.2.216a (Estimated Service Parameters Outbound element)) | 255 | <ANA> | Yes | No |

**9.4.2.172 Estimated service parameters element**

***TGmd editor: modify the first paragraph as shown:***

The Estimated Service Parameters element is used by a STA to provide information to another STA which can then use the information as input to an algorithm to generate an estimate of inbound throughput between the two STAs.

***TGmd editor: modify Figure 9-618 – ESP Information field format as follows:***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 B1 | B2 | B3 B4 | B5 B7 | B8 B15 | B16 B23 |
|  | Access Category | Reserved | Data Format | BA Window Size | Estimated Inbound Air Time Fraction | Data PPDU Duration Target |
| Bits: | 2 | 1 | 2 | 3 | 8 | 8 |

**Figure 9-618 – ESP Information field format**

***TGmd editor: modify the following text as shown:***

The Estimated Inbound Air Time Fraction subfield is 8 bits in length and contains an unsigned integer that represents the predicted percentage of time, linearly scaled with 255 representing 100% and 0 representing 0% , that a new STA joining the BSS can expect to be available for the transmission of PPDUs to that STA, including overhead, where such PPDUs contain MPDUs with the Type subfield equal to Data that belong to the access category indicated in the Access Category subfield of the corresponding ESP Information field and any other MPDUs in the PPDU are considered to be overhead.**(#1153) (#1154)(#1420) (#1424)(#1159) (#1063)(#1064)**

The Data PPDU Duration Target field is 8 bits in length and is an unsigned integer that indicates the expected target duration of PPDUs transmitted to the STA that contain MPDUs with the Type subfield equal to Data that belong to the access category indicated in the Access Category subfield of the corresponding ESP Information field for the corresponding access category in units of 50 μs. This value is determined using a method that is beyond the scope of this standard. **(#1423)(#1157)**

***TGmd editor: insert a new subclause 9.4.2.216a Estimated service parameters outbound element to appear after subclause 9.4.2.216 Max Channel Switch Time element (M40) as shown:* (#1424)(#1159)**

**9.4.2.216a Estimated service parameters outbound element**

The Estimated Service Parameters Outbound element is used by a STA to provide information to another STA which can then use the information as input to an algorithm to generate an estimate of outbound throughput between the two STAs.

The format of the Estimated Service Parameters outbound element is shown in Figure 9-708a (Estimated Service Parameters Outbound element format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | Outbound AirTime Bitmap | Outbound Air Time List |
| Octets: | 1 | 1 | 1 | 1 | 0, 1, 2, 3 or 4 |

**Figure 9-708a – Estimated Service Parameters Outbound element format**

The Element ID, Length, and Element ID Extension fields are defined in 9.4.2.1 (General).

The Outbound Air Time Bitmap field contains a bitmap indicating the presence or absence of an Outbound Air Time Information field for each of the four EDCA Access Categories. The format of the Outbound Air Time Bitmap field is shown in Figure 9-708b Outbound Air Time Bitmap field format.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 B7 |
|  | AC\_BK Outbound Information Present | AC\_BE Outbound Information Present | AC\_VI Outbound Information Present | AC\_VO Outbound Information Present | Reserved |
| Bits: | 1 | 1 | 1 | 1 | 4 |

**Figure 9-708b – Outbound Air Time Bitmap field format**

The Outbound Air Time List field contains from 0 to 4 Outbound Air Time Information fields, each corresponding to an access category for which estimated air time information for outbound traffic is provided. The Outbound Air Time Information field with the lowest numbered bits of the Outbound Air Time List field contains the outbound information corresponding to the AC of the lowest numbered bit of the Outbound Air Time Bitmap field that has a value of 1. The next Outbound Air Time Information field, if present, corresponds to the next higher numbered Outbound Air Time Bitmap field bit that has a value of 1, and so forth. If no Outbound Air Time Bitmap field bit has the value of 1, then no Outbound Air Time Information field is present. The format of the Outbound Air Time Information field is shown in Figure 9-708c Outbound Air Time Information field format.

|  |  |
| --- | --- |
|  | B0 B7 |
|  | Estimated Outbound Air Time Fraction |
| Octets: | 1 |

**Figure 9-708c – Outbound Air Time Information field format**

The Estimated Outbound Air Time Fraction subfield of the Outbound Air Time Information field is 8 bits in length and contains an unsigned integer that represents the predicted percentage of time, linearly scaled with 255 representing 100% and 0 representing 0%, that a new STA joining the BSS can expect to be available for the transmission of PPDUs by that STA, including overhead, where such PPDUs contain MPDUs with the Type subfield equal to Data that belong to the access category corresponding to the position of the Outbound Air Time Information field in the Outbound Air Time Bitmap field and any other MPDUs in the PPDU are considered to be overhead. A new STA joining the BSS might have a different view of the medium than the STA transmitting the Estimated Outbound Air Time Fraction, e.g. due to hidden nodes. In such cases, the new STA might experience a different actual outbound airtime fraction than that advertised in the element.

***TGmd editor: modify the following text as shown:***

**11.43 Beacon RSSI**

Upon receiving a Beacon frame, a STA measures the received signal strength of the Beacon frame and may store the result in dot11BeaconRssi. If the Beacon frame is received using multiple receive chains, the Beacon RSSI is averaged in linear domain over all active receive chains. The Beacon RSSI is reported in dBm. When operating in frequency bands below 6 GHz, the Beacon RSSI has an accuracy of ± 5 dB (95% confidence interval) within the specified dynamic range of the receiver. Beacon RSSI may be averaged over time using a vendor specific smoothing function.**(#1152)**

**11.44 Estimated throughput**

A STA that has a value of true for dot11EstimatedServiceParametersOptionImplemented is an estimated service parameters ESP Inbound STA. A STA that has a value of true for dot11EstimatedServiceParametersOutboundOptionImplemented is an estimated service parameters ESP Outbound STA. The term ESP STA refers to both ESP Inbound STAs and ESP Outbound STAs. **(#1149)(#1429)**

Entities outside the scope of this standard that control the traffic steering decision of a device might benefit by being able to predict the throughput that might be obtained through a link with a STA. Those same entities might also benefit from having the current estimate of throughput for network selection purposes (e.g. to allow comparison of an estimated throughout with existing throughout). The MLME-ESTIMATEDTHROUGHPUT.request and MLME-ESTIMATED-THROUGHPUT.confirm primitives together provide an interface to allow such entities, operating through the SME, to obtain estimates of throughput for MSDUs sent between the STA that corresponds to the PeerMACAddress indicated in the parameter list of the MLME-ESTIMATED-THROUGHPUT.request primitive and this STA.**(#1150)**

When an MLME-ESTIMATED-THROUGHPUT.request primitive is received at the MLME, the MLME can use the parameters provided in the primitive plus the following information to create estimates of throughput per access category to deliver to the SME in the EstimatedThroughputOutbound and EstimatedThroughputInbound parameters of the MLME-ESTIMATED-THROUGHPUT.confirm primitive:**(#1149)(#1429)**

— RSSI measured during reception of Beacon or Probe Response frames transmitted by the STA that corresponds to the MAC entity with the MAC address equal to the PeerMACAddress in the MLMEESTIMATED-THROUGHPUT.request primitive to this STA

— Number of spatial streams that is expected to be supported on the link between this STA and the STA

— Channel bandwidth

— Estimated air time fraction

— Block ack window size

The Estimated Inbound Air Time Fraction subfield value should be determined using the following assumptions:

* There is sufficient inbound data traffic, destinated to the new STA joining the BSS and of the corresponding access category, available to fill the indicated air time
* The new STA joining the BSS does not generate outbound data traffic
* The Data PPDUs transmitted to the new STA joining the BSS are SU PPDUs, even though they might be transmitted as MU PPDUs
* The Data PPDUs transmitted to the new STA joining the BSS are transmitted in EDCA TXOPs of length equal to the duration indicated by dot11QAPEDCATableTXOPLimit for the corresponding access category or, if dot11QAPEDCATableTXOPLimit is 0, equal to the duration indicated by the Data PPDU Duration Target field
* The traffic load of OBSS STAs does not change if the new STA joins the BSS
* The characteristics of non-EDCA transmissions on the medium (e.g. interferers) do not change if the new STA joins the BSS

The Estimated Outbound Air Time Fraction subfield value should be determined using the following assumptions:

* There is sufficient outbound data traffic, originating from the new STA joining the BSS and of the corresponding access category, available to fill the indicated air time
* No inbound data traffic to the new STA joining the BSS is generated
* The Data PPDUs transmitted by the new STA joining the BSS are SU PPDUs, even though they might be transmitted as MU PPDUs
* The Data PPDUs transmitted by the new STA joining the BSS are transmitted in EDCA TXOPs of length equal to the duration indicated by dot11EDCATableTXOPLimit for the corresponding access category or, if dot11EDCATableTXOPLimit is 0, equal to 5430 us.
* The traffic load of OBSS STAs does not change if the new STA joins the BSS
* The characteristics of non-EDCA transmissions on the medium (e.g. interferers) do not change if the new STA joins the BSS

If the MLME is incapable of determining a value for the EstimatedThroughputOutbound or EstimatedThroughputInbound parameter for any access category, then the MLME shall return a value of 0 for the value of that parameter for that access category in the MLME-ESTIMATEDTHROUGHPUT.confirm primitive.

If the AverageMSDUSizeOutbound parameter for an access category is equal to 0 in the MLME-ESTIMATED-THROUGHPUT.request primitive, the STA shall include a value of 0 in the EstimatedThroughputOutbound parameter for the corresponding access category in the MLMEESTIMATED-THROUGHPUT.confirm primitive.

If the AverageMSDUSizeOutbound parameter for an access category is equal to -1in the MLME-ESTIMATED-THROUGHPUT.request primitive, the STA may use any value for the average MSDU size used in calculating the estimated throughput to be included in the corresponding access category in the EstimatedThroughputOutbound parameter of the MLMEESTIMATED-THROUGHPUT.confirm primitive, but should use a value of 1500 octets.

If the AverageMSDUSizeInbound parameter for an access category is equal to 0 in the MLME-ESTIMATEDTHROUGHPUT.request primitive, the STA shall include a value of 0 in the EstimatedThroughputInbound parameter for the corresponding access category in the MLME-ESTIMATED-THROUGHPUT.confirm primitive.

If the AverageMSDUSizeInbound parameter for an access category is equal to -1 in the MLMEESTIMATED-THROUGHPUT.request primitive, the STA may use any value for the average MSDU size used in calculating the estimated throughput to be included in the corresponding access category in the EstimatedThroughputInbound parameter of the MLME-ESTIMATED-THROUGHPUT.confirm primitive, but should use a value of 1500 octets.**(#1151)**

An ESP Outbound STA should determine a value for EstimatedThroughputOutbound for each AC of a current or potential link with a STA using the equation found in R.7.**(#1149)(#1429)**

An ESP Inbound STA that is a non-AP STA**(#1062)** may include a Request element that includes the element IDs of the Estimated Service Parameters Inbound element in transmitted Probe Requests. An ESP Outbound STA or a mesh STA may include a Request element that includes the element IDs of the Estimated Service Parameters Outbound element in transmitted Probe Requests. **(#1149)(#1429)**

An ESP Inbound STA that is an AP or an ESP Inbound STA that is a mesh STA shall include the Estimated Service Parameters element within Probe Response frames transmitted in response to a Probe Request frame that included a Request element that includes the element ID of the Estimated Service Parameters element. An ESP Inbound STA that is neither an AP nor a mesh STA may include the Estimated Service Parameters element within Probe Response frames transmitted in response to a Probe Request frame that included a Request element that includes the element ID of the Estimated Service Parameters element. An ESP Inbound STA may include the Estimated Service Parameters element within Probe Response frames transmitted in response to a Probe Request frame that did not include a Request element, or included a Request element that did not include the element ID of the Estimated Service Parameters element. **(#1149)(#1429)**

An ESP Outbound STA that is an AP or an ESP Outbound STA that is a mesh STA shall include the Estimated Service Parameters Outbound element within Probe Response frames transmitted in response to a Probe Request frame that included a Request element that includes the element ID of the Estimated Service Parameters Outbound element. An ESP Outbound STA that is neither an AP nor a mesh STA may include the Estimated Service Parameters Outbound element within Probe Response frames transmitted in response to a Probe Request frame that included a Request element that includes the element ID of the Estimated Service Parameters Outbound element. An ESP Outbound STA may include the Estimated Service Parameters Outbound element within Probe Response frames transmitted in response to a Probe Request frame that did not include a Request element, or included a Request element that did not include the element ID of the Estimated Service Parameters Outbound element. **(#1149)(#1429)**

An ESP Inbound STA that is an AP or an ESP Inbound STA that is a mesh STA shall include the Estimated Service Parameters Inbound element within Beacon frames. An ESP Inbound STA that is not an AP may include the Estimated Service Parameters Inbound element within Beacon frames.

An ESP Outbound STA that is an AP or an ESP Outbound STA that is a mesh STA shall include the Estimated Service Parameters Outbound element within Beacon frames. An ESP Outbound STA that is not an AP may include the Estimated Service Parameters Outbound element within Beacon frames. **(#1149)(#1429)**

An ESP STA that transmits an Estimated Throughput element determines the value of the Data PPDU Duration Target field in a manner that is beyond the scope of this standard, but should use a value of 5430 us. Because the STA transmitting the element is the STA that would be transmitting the PPDUs, that STA should know what parameters it would be likelyl to use for those transmissions, although variations in this estimate are possible due to the varying capabilities of the STAs receiving the PPDUs and due to dynamic channel conditions. The transmitting STA can adjust multiple transmission parameters to attempt to maintain the targeted duration despite the variations in the receiving STA and operating condition parameters.**(#1065)**

**R.7 Calculating Estimated Throughput**

***TGmd editor: in equation (R-1), modify the first term of the RHS “ESTAirtimeFraction” by changing it to “ESTAirtimeFractionDir”* (#1424)(#1159)**

***TGmd editor: in equation (R-1), modify the denominator to appear as follows:* (#1420)**

((CWmin/2 + AIFSN[AC])\*aSlotTime + SIFS + PPDUDur + BA\_PPDUDur)

***TGmd editor: in the definition for EstimatedThroughput , change the description as follows:***

***EstimatedThrougput*** is in bits/second and is calculated separately for inbound and outbound transmissions for this link**(#1420)**

***TGmd editor: in the definition for ESTAirtimeFraction, change the description as follows:***

***ESTAirtimeFractionDir*** is dimensionless. It is the estimated portion of air time that is available for inbound or outbound transmissions for this link when calculating EstimatedThroughput for inbound and outbound directions, respectively. The value of this parameter is based on the value of the Estimated Inbound Air Time Fraction or Estimated Outbound Air Time Fraction subfield, respectively, of the Estimated Service Parameters Inbound element or Estimated Service Parameters Outbound element, respectively, received from the STA with the MAC address that matches the PeerMacAddress in the MLME-ESTIMATED-THROUGHPUT.request primitive, using a method that is beyond the scope of this standard but that should include some efficiency scaling.**(# 1424)(#1159)(# 1154)(#1420)**

AIFSN[AC] is calculated according to 10.23.2.4 (Obtaining an EDCA TXOP) where the AC value corresponds to the AC of the Data frames

BA\_PPDUDur is the expected duration of a PPDU containing a BA using the rate indicated for a BA response to an MPDU using the rate of DataRate as determined according to 10.6.6 (Rate selection for Control frames) **(#1420)**

***TGmd editor: add an equation number to the equation for MPDU\_pA\_MPDU, swap the order of the definition of MPDU\_pA\_MPDU and the equation and modify the definition of MPDU\_pA\_MPDU as shown, with an appropriate replacement of the dummy equation number “R-xx” with a valid equation number corresponding to the number assigned to the equation for MPDU\_pA\_MPDU:***

*MPDU\_pA\_MPDU* is dimensionless, and is calculated as shown in equation (R-xx)

***TGmd editor: modify the definition of DPDUR as shown:***

*DPDUR* is the Data PPDU duration target of the transmitter of the PPDUs containing MPDUs with the Type subfield equal to Data, in seconds. For calculations of inbound Estimated Throughput, the value of this variable is equal to the time indicated in the Data PPDU Duration Target subfield of the Estimated Service Parameters element (see 9.4.2.172 (Estimated Service Parameters element)). For calculations of outbound Estimated Throughput, the value of this variable is determined by the STA performing the calculation using a method that is beyond the scope of this standard. A value of 5430 us is recommended for such calculations. **(#1423)(#1157)(#1065)**

***TGmd editor: modify the definitions shown:*(#1156)(#1422)**

*A\_MSDU\_BTX* is a number of octets which is equal to the maximum A-MSDU size of the transmitter of the PPDUs containing MPDUs with the Type subfield equal to Data if the MPDUs are expected to contain A-MSDUs. If the MPDUs are not expected to contain A-MSDUs, then the value is a number of octets equal to the AverageMSDUSizeInbound or AverageMSDUSizeOutbound, respectively, depending on whether the EstimatedThroughput being calculated is inbound or outbound.

*A\_MSDU\_BRX* is a number of octets which is equal to the maximum A-MSDU size of the receiver of the PPDUs containing MPDUs with the Type subfield equal to Data if the MPDUs are expected to contain A-MSDUs. If the MPDUs are not expected to contain A-MSDUs, then the value is a number of octets equal to the AverageMSDUSizeInbound or AverageMSDUSizeOutbound, respectively, depending on whether the EstimatedThroughput being calculated is inbound or outbound

***TGmd editor: within the equation for MPDU\_pA\_MPDU modify the term that is shown, as shown:***

***(MACHdr + A\_MSDU\_B + 4 + (4 – (MACHdr + A\_MSDU\_B) modulo 4))* (#1421)(#1155)(#1160)(#1427)**

***TGmd editor: within the equation for MPDU\_pA\_MPDU change both of the ceiling symbols to floor symbols* (#1421)(#1155)(#1160)(#1427)**

***TGmd editor: within the definition for P\_adjust, modify the text as shown:* (#1421)(#1155)(#1160)(#1427)**

P\_adjust is the implementation specific power adjustment parameter used to convert RSSI into SNR, as well as take into account potential transmit power differences between Beacon/Probe Response frames to Data frames and between the STAs for which the estimation is being performed, in dBm.

***TGmd editor: delete the last sentence of the subclauase R.7 Calculating Estimated Throughput as shown:***

**(# 1158)(#1368)**

***TGmd editor: add the following text at the end of the subclause:***

NOTE – The equations above do not account for signal extension. **(#1421)(#1155)(#1160)(#1427)**

NOTE - The STA can adjust the value of ESTAirtimeFractionDir based on knowledge about whether it is currently competing for airtime with the targeted BSS and would no longer do so if the STA joins that BSS. **(#1424)(#1159)(#1154)(#1420)**

NOTE - When determining the value of ESTAirtimeFractionDir, the total upper layer offered load (i.e. above the MAC) of all competing STAs is assumed to contain an adequate amount of bursty and flow-controlled loads such that changes in available airtime are met with offsetting changes in the total offered load as measured at the medium interface. **(#1424)(#1159) (#1154)(#1420)**

**C.3 MIB detail**

***TGmd editor: modify the following text:***

Dot11StationConfigEntry ::= SEQUENCE

{

dot11StationID MacAddress,

dot11MediumOccupancyLimit Unsigned32,

dot11CFPollable TruthValue,

dot11CFPPeriod Unsigned32,

dot11CFPMaxDuration

…

dot11GDDEnablementValidityTimer Unsigned32,

dot11MaxMSDULength INTEGER,

dot11ExtendedSpectrumManagementImplemented TruthValue,

dot11EstimatedServiceParametersOptionImplemented TruthValue,

dot11EstimatedServiceParametersOutboundOptionImplemented TruthValue,

dot11VHTExtendedNSSBWCapable TruthValue,

dot11FutureChannelGuidanceActivated TruthValue,

dot11FILSActivated(11ai) TruthValue(11ai),

dot11S1GOptionImplemented(11ah) TruthValue(11ah)

}

dot11StationID OBJECT-TYPE

dot11EstimatedServiceParametersOptionImplemented OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute, when true, indicates that the IEEE 802.11 Estimated

Service Parameters Inbound option is implemented."

::= { dot11StationConfigEntry 163 }

dot11EstimatedServiceParametersOutboundOptionImplemented OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute, when true, indicates that the IEEE 802.11 Estimated

Service Parameters Outbound option is implemented."

::= { dot11StationConfigEntry <ANA> }

dot11SMTbase13 OBJECT-GROUP

OBJECTS {

dot11MediumOccupancyLimit,

dot11CFPollable,

dot11CFPPeriod,

dot11CFPMaxDuration,

dot11PrivacyOptionImplemented,

dot11PowerManagementMode,

dot11DesiredSSID,

dot11DesiredBSSType,

dot11OperationalRateSet,

dot11BeaconPeriod,

dot11DTIMPeriod,

…

dot11MaxMSDULength,

dot11ExtendedSpectrumManagementImplemented,

dot11EstimatedServiceParametersOptionImplemented,

dot11EstimatedServiceParametersOutboundOptionImplemented,

dot11FutureChannelGuidanceActivated

}

***TGmd editor: after effecting all of the previously indicated edits, then, throughout TGmd D0.4, change “dot11EstimatedServiceParametersOptionImplemented” to “dot11EstimatedServiceParametersInboundOptionImplemented”***

***TGmd editor: after effecting all of the previously indicated edits, then, throughout TGmd D0.4, change “Estimated Service Parameters element” to “Estimated Service Parameters Inbound element”***

**End of proposed changes.**