IEEE P802.11
Wireless LANs

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| Resolution CID1160 - OBBS QLoad Reporting using 11k Beacon Reports |
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Abstract

CID1160 states:

*"""APs overlap situation"" addresses the low-hanging fruit but EDCA addresses this case very well already, so the changes may be inadequate for genuinely improving the video experience with hidden nodes etc*

*This is really about a) Aps that are out of range but clients are in range, b) BSSs whose PLCP headers and/or MAC Duration fields cannot be decoded but still raise the noise floor.*

*The previous response refers to 09/9341r1 which assumes a channel-rich environment (whereas with 11ac we are operating in a channel-poor environment) and the stray client case is just one aspect of the wider problem. Further, no sim evidence is presented."*

With a proposed resolution of:

*Improve proposal to deal with the BSS's overlap situation, since APs may be non-overlapping but clients are. E.g. make use of 11k beacon report and 11k frame rep; clients relaying information between APs, etc*

This document provides normative text for adding support for using RMM Beacon Reports to exchange QLoad Report elements. The changes shown in this document are based upon P802.11aa D2.0

# 5. General description

## 5.2 Components of the IEEE 802.11 architecture

### 5.2.aa12 Robust Audio Video Streaming

#### 5.2.aa12.3 OBSS Management

The objective of overlapping BSS (OBSS) management is to facilitate co-operative sharing of the medium between APs operating in the same channel that are able to receive frames fromeach other, including Beacon frames. These frames can be received directly, or via associated STAs that support the Beacon Request capability (see 5.2.7.1).

OBSS Management provides the means to:

* Provide additional information for channel selection
* Extend the admission control mechanism to a distributed environment
* Enable the coordination of scheduled TXOPs between overlapping BSSs

OBSS Management enables fixed and portable APs to provide to neighboring APs information for the purposes of selecting a channel and for the cooperative sharing of that channel. The main component of OBSS Management is the QLoad report that provides information to other APs as to an AP’s overlap situation and the QoS traffic load of that AP. It also includes information as to the total QoS traffic that exists in the directly overlapping APs that can be used to enable cooperative sharing to take place. To coordinate the TXOPs of overlapping HCCA APs, OBSS management provides means for the AP to advertise its TXOP allocations so another AP can schedule its TXOPs to avoid those already scheduled.

# 7. Frame formats

## 7.2 Format of individual frame types

### 7.2.3 Management frames

#### 7.2.3.9 Probe Response frame format

***Change Table 7-15 as follows:***

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| **Table 7-15—Probe Response frame body** |
| **Order** | **Information** | **Notes** |
| <ANA> | QLoad Report | The QLoad Report element is present if dot11QLoadReportActivated is true |

# 11.MLME

## 11.aa24 Procedures to Manage Overlapping BSS (OBSS)

The QLoad element and the HCCA TXOP Advertisement element are designed to mitigate the effects of overlapping APs and provide the means to:

* Provide additional information for channel selection
* Extend the admission control and scheduled mechanisms to a distributed environment
* Enable the coordination of scheduled TXOPs between overlapping BSSs

Overlapping APs are APs that are on the same channel and that are able to receive frames from each other, including Beacon frames. These frames can be recevied directly, or via associated STAs that support the Beacon Request capability (as indicated by the Beacon Passive Measurement capability enabled bit or the Beacon Active Measurement capability enabled bit being set in the RM Enabled Capabilities element in the (Re)Association frame).

NOTE⎯These OBSS procedures use unauthenticated Beacons and public action frames. Implementations may choose to use additional heuristics, (e.g. a history of collaboration and traffic monitoring) to determine the authenticity of this information

NOTE⎯These OBSS procedures are intended for fixed and mobile APs (see 4.2.4)

### 11.aa24.1 QLoad Report element

#### 11.aa24.1.1 Introduction

The QLoad Report element is contained in a public action frame that is provided by an AP and optionally, periodically in the Beacon. The QLoad Report public action frame is transmitted upon the receipt of a QLoad Request frame. Whenever there is a change in the contents of the QLoad element, an unsolicited QLoad Report Action frame should be transmitted. When dot11QLoadReportActivated is true, the QLoad Report element shall be included in the Beacon frame every dot11QLoadReportIntervalDTIM DTIMs. When dot11QLoadReportActivated is false the QLoad Report element shall not be included in Beacon frames.

11.aa24.1.2 Calculating field valuesThe values in the Potential Traffic Self Field shall be derived as follows:

* 1. A non-AP STA for which dot11MgmtOptionQoSTrafficCapabilityEnabled is true may include a QoS Traffic Capability element in its (Re)Association Request frames to indicate potential QoS loads from the non-AP STA that it wishes the AP to include in the Potential Traffic Self Field calculation.
	2. In addition to the above, the AP shall include in the Potential Traffic Self all accepted and not deleted TSPECs as they are sent by non-AP STAs. At the deletion of each such TSPEC, the AP shall remove the TSPEC from its QLoad Report.

An exemplary method of calculating the values, Mean and Standard Deviation, in the Potential Traffic Self Field, is given in Annex .

The number of AC\_VI and AC\_VO streams shall also be provided in the Potential Traffic Self field. For each potential admission control TSPEC, the AP calculates a Medium time, as described in Annex K.2.2. This Medium time, however, does not include the medium access overhead that, in turn, is related to the number of streams. This access overhead is further discussed in Annex aa.2.6 and a recommendation is given for its value.

EDITORIAL NOTE: Annex K.2.2 is defined in IEEE P802.11-2007 and moves to clause L.2.2 in IEEE P802.11REVmb D6.0

The Potential Traffic Self represents the potential QoS traffic of this AP and therefore shall always be equal to or greater than the values represented by the Allocated Traffic Self field.

The Allocated Traffic Self field contains the mean and standard deviation value of the composite stream that the AP has allocated at any one time, and the number of AC\_VI and AC\_VO streams. As each stream is added or deleted, the AP shall calculate the new value of the composite traffic, and the new number of AC\_VI and AC\_VO streams and provide the results in the Allocated Traffic Self field. A recommended method for calculating the Allocated Traffic Self mean and standard deviation values is given in Annex

The Allocated Traffic Shared field contains the sum of Allocated Traffic Self values for all APs which overlap with the AP performing the calculation, plus the Allocated Traffic Self value of the AP performing the calculation. A recommended method for summing the Allocated Traffic Self values is given in Annex .

The Access Factor is the total traffic bandwidth requirement for all the overlapping APs expressed as a fraction that may be greater than 1. An implementation might calculate the Access Factor from the summation of the Potential Traffic Self fields of all the APs that are overlapping, as follows:

Sum all the Potential Traffic Self values for all overlapping APs, including self, in order to calculate the peak traffic requirement in multiples of 32µs per second. As the Potential Traffic Self is expressed in terms of mean and standard deviations, it is possible to sum the Potential Traffic Self values as a composite stream. A suggested method for this summation is given in Annex .

Sum the AC\_VO and AC\_VI streams reported in its own QLoad Report and all the QLoad Reports of overlapping APs. Based upon the number of EDCA streams an EDCA Overhead factor can be estimated to account for the medium access time requirements. EDCA Overhead Factor is further discussed in Annex and a recommendation is given for its value.

Multiply together the peak traffic and the EDCA Overhead Factor to obtain a value that represents the total peak bandwidth requirement for the overlapping APs. This value is in multiples of 32µs per second.

Convert the total peak bandwidth requirement to a fraction that is rounded down to 1/64 (8 bits). An example for this conversion is given in Annex aa.2.4.

HCCA Peak is the summation of the all the HCCA TXOP times over a one second period for all the HCCA TSPECs included in the QLoad field. The TXOP time, scheduled by the HC, multiplied by the reciprocal of its Service Interval (SI), is termed HCCA Medium Time. The HCCA Peak value is the summation of the HCCA Medium Times that the HC has scheduled, in multiples of 32µs per second.

HCCA Access Factor is the total HCCA TXOP Medium Time requirement for all the overlapping APs expressed as a fraction that may be greater than 1. An implementation might calculate the HCCA Access Factor from the summation of the HCCA Peak values of all the APs that are overlapping, as follows:

1. Sum all the HCCA Peak values for all overlapping APs.
2. Convert this summation to a fraction that is rounded down to 1/64 (8 bits). An example for this conversion is given in Annex aa.2.5

#### 11.aa24.1.3 Requesting QLoad Reports using Radio Measurement Requests

If an AP has associated STAs that support passive or active Beacon Measurement (as indicated by the Beacon Passive Measurement capability enabled bit or the Beacon Active Measurement capability enabled bit being set in the RM Enabled Capabilities element), it may use the Neighbour Report capability of these associated STAs to attempt to retrieve QLoad Report elements from APs that the AP is unable to directly exchange frames.

The AP sends a Radio Measurement Request frame that contains a Measurement Request element to an associated STA that supports neighbor reporting and beacon reporting. This Measurement Request element has the Measurement Type field set to “Beacon Request” as defined in Table 7-29, and the BSSID field of the Beacon Request Measurement Request field format (as described in 7-62e) set to the wildcard BSSID. There shall be a Request subelement in the Beacon Request Measurement Request field that contains the Element ID of the QLoad Report Element (as defined in Table-7-26) and may contain other element IDs. The SSID subelement shall not be included in the Request subelement of the Beacon Request Measurement Request field.

Depending upon the signaled enabled radio measurement capabilities of the associated STA, the AP may use either the passive or active Measurement Mode. The Operating Class field shall be set the operating class that is currently being used by the AP. The Channel Number field should be set to the primary channel number that is currently being used by the AP, but may be set to other values if off-channel Beacon Measurement is supported by the STA to which the measurement request is to be sent.

If the measurement request is accepted, the requested STA will perform the measurement request (as described in 11.10). The Radio Measurement Report frame will contain Beacon Reports for successful measurements. These Beacon Reports might contain QLoad Report elements inside a Reported Frame Body subelement, if the reporting STA received QLoad Report elements from the Beacon or Probe Response frames that it received from neighbouring APs. The contents of these QLoad Report elements can then be used in calculating Allocated Traffic Shared, Access Factor and HCCA Access Factor fields as described in 11.aa24.1.2.

**References:**