

IEEE Standards Interpretation for IEEE Std 802.11™ -2007 IEEE Standard for Information technology- Telecommunications and information exchange between systems- Local and metropolitan area networks- Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications

Copyright © 2008 by the Institute of Electrical and Electronics Engineers, Inc. 3 Park Avenue New York, New York 10016-5997 USA All Rights Reserved.

This is an interpretation of IEEE Std 802.11-2007.

Interpretations are issued to explain and clarify the intent of a standard and do not constitute an alteration to the original standard. In addition, interpretations are not intended to supply consulting information. Permission is hereby granted to download and print one copy of this document. Individuals seeking permission to reproduce and/or distribute this document in its entirety or portions of this document must contact the IEEE Standards Department for the appropriate license. Use of the information contained in this document is at your own risk.

IEEE Standards Department Copyrights and Permissions 445 Hoes Lane, Piscataway, New Jersey 08855-1331, USA

November 2008

Interpretation Request #1

1-09/07 (TCLAS Elements) **Topics:** Usage of TCLAS Elements with (Classifier Elements, VLANs, TCP and UDP protocol) **Relevant Clauses:** 7.3.2.29 **Classification:** Ambiguous

Interpretation #11 that follow are requested on the following aspects of TCLAS elements, as specified in section 7.3.2.29 of [1]: Issues with Type 0 (Ethernet) TCLAS elements

1. Use of Type field for VLAN unclear

a. Can a Type value of 81-00 be used to match all VLAN-tagged frames, per Annex M, or does it only apply to the innermost Ethertype field in a frame?

Interpretation Response #1

IEEE Std. 802.11-2007 is unambiguous on this matter. The IEEE Std. 802.11-2007 does not apply special meaning to the type value 81-00. From the normative material in Clause 7 of IEEE Std. 802.11-2007, the type value of 81-00 shall match all Ethernet packets with type value 81-00 without further interpretation of the meaning inherent in that value.

Interpretation Request #2

b. Can matching on Type be used with singly-encapsulated VLAN frames, i.e. those start-

ing AA-AA-03-00-00-00-81-00 but not starting AA-AA-03-00-00-00-81-00-xx-yy-AA-AA, per Annex M (which is merely informative)?

Interpretation Response #2

IEEE Std. 802.11-2007 is unambiguous on this matter. Clause 7 defines the normative behaviour for TCLAS. Annex M contains informative information only and does not modify the normative behaviour defined in Clause 7.

Interpretation Request #3

2. Use with non-SNAP/non-RFC1042 frames unclear
 - a. Can matching on Type be used with non-RFC1042 SNAP frames, i.e. those starting AA-AA-03 but not starting AA-AA-03-00-00-00, per Annex M?
 - i. If so, does this mean that the first three octets of the SNAP header are simply ignored?
 - ii. If not, does this mean that AppleTalk (2), AppleTalk AARP (1) and IPX Ethernet II, per Table M.2, cannot be matched?
 - b. Can matching on Type be used with non-SNAP frames, e.g. those starting E0-E0-03 or FF-FF, per Annex M?
 - i. If so, how?

Interpretation Response #3

IEEE Std. 802.11-2007 specifies how to match the type field of an Ethernet packet without specifying any mapping from an Ethernet packet to a MAC-UNITDATA primitive. Whenever the integration function results in an Ethernet packet, a TCLAS classifier of Type 0 [Ethernet] may meaningfully be applied. Whenever an integration function does not result in an Ethernet packet, a TCLAS classifier of Type 0 cannot be applied.

Interpretation Request #4

Issues with Type 1 (TCP/UDP IP) TCLAS elements

1. Use of Version field unclear
 - a. Is the Version field part of the Classifier Mask, such that the LSB of the Classifier Mask refers to the Version, or does the LSB of the Classifier Mask refer to the Source IP Address?
 - b. Is the Version field required to be set to 4 for IPv4 or 6 for IPv6 (even if the answer to the previous question is that the LSB of the Classifier Mask refers to the Version and hence the Version may not be part of the matching), or is the IP version to which a Type 1 TCLAS element applies implied by the length of the TCLAS element?

Interpretation Response #4

1a) IEEE Std. 802.11-2007 is unambiguous on this matter. The version field is included in the list of classifier parameters [paragraph 4 page 137] and is therefore included in the classifier mask subfield as defined in [paragraph 1 page 137].

1b) IEEE Std. 802.11-2007 is unambiguous with respect to the fields included in the

Frame Classifier. IEEE Std. 802.11-2007 is ambiguous with respect to the value contained in those fields. Specification of those values is outside the scope of IEEE Std. 802.11-2007.

IEEE Std. 802.11-2007 is ambiguous on this issue. The issue will be forwarded to the 802.11 Working Group for consideration in a future revision of the standard.

Interpretation Request #5

2. Lack of Protocol field for IPv6

a. It is not possible to match based on the upper-layer protocol in IPv6 frames, unlike in IPv4 frames. Is this an oversight, or is it deliberate?

Interpretation Response #5

2a) IEEE Std. 802.11-2007 is unambiguous on this issue. The next header field is not included in the IPv6 Frame Classifier.

This issue will be forwarded to the 802.11 Working Group for consideration in a future revision of the standard.

3. Lack of DSCP field for IPv6

a. It is not possible to match based on the DSCP in IPv6 frames, unlike in IPv4 frames. Is this an oversight, or is this deliberate?

3a) IEEE Std. 802.11-2007 is unambiguous on this issue. The Traffic Class field is not included in the IPv6 Frame Classifier. This issue will be forwarded to the 802.11 Working Group for consideration in a future revision of the standard.

Interpretation Request #6

4. Setting of the 4 MSBs in Flow Label field for IPv6 unclear

a. It is not specified that the 4 MSBs in the Flow Label field for IPv6 are set to 0/ignored, unlike the 2 MSBs in the DSCP field for IPv4. Is this an oversight, or is this deliberate?

Interpretation Response #6

4a) IEEE Std. 802.11-2007 is ambiguous on this issue. The text does not describe how the 20-bit IPv6 Flow Label is aligned within the 24-bit Flow Label Field in figure 7-89. This issue will be forwarded to the 802.11 Working Group for consideration in a future revision of the standard.

Interpretation Request #7

5. Use of Source/Destination Port fields for protocols other than TCP and UDP unclear

a. The formatting of the specification suggests that in frames carrying protocols other than TCP or UDP, only the DSCP and Protocol (IPv4) or Flow Label (IPv6) fields are part of the matching. Is this unintended? [Will assume so!]

Interpretation Response #7

5a) IEEE Std. 802.11-2007 is unambiguous on this issue. The classifier mask allows the selection of version, source IP address, destination IP address, DSCP, and protocol. The text of IEEE Std. 802.11-2007 does not describe every possible combination of classifier mask settings.

Interpretation Request #8

b. Is it valid for a TCLAS element for IPv4 to have the Classifier Mask bit corresponding to the Protocol clear, but to have the bits corresponding to the Source and/or Destination Port set? [Will assume so, based on the inapplicability of this question to TCLAS elements for IPv6.]

Interpretation Response #8

5b) Yes this is valid. The text of IEEE Std. 802.11-2007 does not describe every possible combination of classifier mask settings.

Interpretation Request #9

- c. If the Classifier Mask bits corresponding to the Source and/or Destination Port are set (and for IPv4 the Protocol bit is clear):
- How are frames with protocols which do not have 16-bit source/destination ports handled? Do they never match, or do they match subject to the other fields selected in the Classifier Mask (and what if there are no other selected fields do they then always match?)?
 - How are frames with protocols other than TCP and UDP which do have 16-bit source/destination ports handled? Do they never match, or do they match subject to these and the other fields selected in the Classifier Mask, or do they match subject only to the other fields selected in the Classifier Mask? What if the classifying device does not know this protocol?

Interpretation Response #9

5c) (both i and ii) IEEE Std. 802.11-2007 is ambiguous on this issue. If the protocol is not TCP and not UDP then IEEE Std. 802.11-2007 does not state how source port and destination port classifier fields are used.

This issue will be forwarded to the 802.11 Working Group for consideration in a future revision of the standard.

Whether this condition is diagnosed it is up to the SME and is out of scope for the IEEE Std. 802.11-2007. The IEEE Std. 802.11-2007 is ambiguous regarding how the SME communicates invalid TCLAS parameters to the requesting STA.

Interpretation Request #10

- d. Is it valid for a TCLAS element for IPv4 to have the bits corresponding to the Protocol and to the Source and/or Destination Port set, where the Protocol is not TCP or UDP?
- If it isn't, is the classifying device required to diagnose the condition, and if so what

Status Code should it use?

ii. If it is:

1. What if the classifying device does not know this protocol? Is it required to diagnose the condition, and if so what Status Code should it use?
2. If the classifying device does know this protocol, what if it does not have d16-bit source/destination ports? Is the classifying device required to diagnose the condition, and if so what Status Code should it use?

Interpretation Response #10

5d) (both i and ii) IEEE Std. 802.11-2007 is ambiguous on this issue. If the protocol is not TCP and not UDP then IEEE Std. 802.11-2007 does not state how source port and destination port classifier fields are used.

This issue will be forwarded to the 802.11 Working Group for consideration in a future revision of the standard.

Whether this condition is diagnosed it is up to the SME and is out of scope for the IEEE Std. 802.11-2007. The IEEE Std. 802.11-2007 is ambiguous regarding how the SME communicates invalid TCLAS parameters to the requesting STA.

Interpretation Request #11

Issues with Type 2 (IEEE 802.1D/Q) TCLAS elements

1. Number of fields unclear

- a. The text implies that the 802.1D priority and the 802.1Q VLAN ID can be matched independently, but the figure implies that the classifier uses a single combined field (including the CFI bit). Which is the correct interpretation?

Interpretation Response #11

IEEE Std. 802.11-2007 is ambiguous on this issue. This issue will be forwarded to the 802.11 Working Group for consideration in a future revision of the standard.

Interpretation Request #12

Topic: Multiple SSID usage **Relevant Clauses:** not specified **Relevant Figures:** not specified **Classification:** Ambiguous/Non-Ambiguous not specified by WG

Service Providers use Multi-SSID many ways:

- extra SSID for particular use-case, device-class, WEP...
- very important for non-enterprise (hotspots, homes)

But There are interop issues

-Beacon timing

Some devices cannot cope with a variable or very-short beacon interval

- no problems if 50mSec apart,

- BUT t=SIF gives problems with some devices!

Needs defining for multi-SSIDs

- All clients need to cope with such timing
- Spacing beacons by just SIFS/DIFS

If an AP device is generating multiple BSSID signals what is the proper spacing between those SSIDs?

Interpretation Response #12

Std. IEEE 802.11-2007 only defines one MAC/PHY pair as a STA. When a product virtualizes multiple STAs within the same physical device, the interaction of the virtual STAs are currently outside the scope of the standard, however the use of multiple BSSID/SSID functionality is currently being defined. The commenter (and others interested) is invited to come and participate with the 802.11 WG.

Interpretation Request #13

Topic: Max SP Length subfield Relevant Clauses: 7.1.1, 7.3.1.17 Relevant Figures: not specified Classification: Ambiguous/non-Ambiguous not specified by WG

Section 7.3.1.17 of Std. IEEE 802.11-2007 says that the Max SP Length subfield of the QoS Info field is reserved when all four U-APSD flags are set to 0. Section 7.1.1 of Std. IEEE 802.11-2007 says that reserved fields and subfields are set to 0 upon transmission and are ignored upon reception.

If a non-AP STA sets all four U-APSD flags to 0 in the QoS Info field in the QoS Capability IE in the Association Request, and then uses an ADDTS Request to set up a delivered-enabled TS (and also sets up a trigger-enabled TS -- perhaps the same TS), how many buffered MSDUs and MMPDUs may the AP deliver to this non-AP STA during an SP triggered by this non-AP STA?

Interpretation Response #13

Std. IEEE 802.11-2007 does not specify when the bits are set to 0, a maximum limit of how many MSDU or MMPDUs are buffered by an AP. Therefore the maximum number would be AP implementation dependent value and would be dependent on the amount of traffic buffered at the AP (See table 7-25 bit 5-6). A limit is prescribed only when Bit 5 and/or 6 are set to 1.

Interpretation Request #14

Topic: Minimum PHY Rate definition **Relevant Clauses:** 7.3.2.30 Relevant Figures: not specified **Classification:** Ambiguous/non-Ambiguous was not specified by WG

Section 7.3.2.20 {note: the TSPEC element subclause is 7.3.2.30} of IEEE Std. 802.11-2007 says that the Minimum PHY Rate field of the TSPEC IE is the desired minimum PHY rate to use for this TS, in bits per second, that is required for transport of the MSDUs

belonging to the TS in this TSPEC.

What are the exact semantics of this field?

Does this need to correspond to an operational rate of the AP which the non-AP STA can transmit at, for a TS with an uplink component (vice-versa for a TS with a downlink component)? [*]

If not, must it be a rate supported by the PHY being used (though perhaps not a rate supported by the non-AP STA and/or AP)?

If not, must it be less than or equal to the highest rate supported by the PHY being used? Or the highest rate supported by the non-AP STA and AP? And if the answer to question marked with [*] is no, then how is K.2.2 to be used?

An example may help. Say we're using 802.11a, the AP supports 6, 12, 24 and 48 Mbps, and the STA supports 6, 9, 12 and 24 Mbps (here "supports" means both tx and rx). Which of the following values would be valid values in the Minimum PHY Rate field for an uplink TSPEC, and for those values, what value would be used for to compute the MPDU-ExchangeTime in section K.2.2 of [1]?

1. 24 000 000 (supported by both STAs)
2. 9 000 000 (not supported by AP)
3. 48 000 000 (not supported by non-AP STA)
4. 18 000 000 (valid .a rate, but not supported by either STA)
5. 36 000 000 (valid .a rate, but not supported by either STA and higher than non-AP STA's highest rate)
6. 27 000 000 (valid .a rate, but only in "half-clocked" operation)
7. 54 000 000 (highest rate on .a; not supported by either STA)
8. 1 111 111 111 (not a valid rate for any PHY; higher than highest rate on any PHY)
9. 111 111 111 (not a valid rate for any PHY; higher than highest rate on .a)
10. 11 111 111 (not a valid rate for any PHY, but in .a rate range)
11. 1 111 111 (not a valid rate for any PHY; lower than lowest rate on .a)
12. 111 111 (not a valid rate for any PHY; lower than lowest rate on any PHY)
13. 11 000 000 (not a valid .a rate, but valid .b rate and in .a rate range)
14. 1 000 000 (not a valid .a rate and not in .a rate range, but valid .b rate)

Interpretation Response #14

In clause 7.3.2.30, the Minimum PHY Rate field definition:

- The Minimum PHY Rate field is 4 octets long and contains an unsigned integer that specifies the desired minimum PHY rate to use for this TS, in bits per second, that is required for transport of the MSDUs belonging to the TS in this TSPEC21.
- Footnote 21: This rate information is intended to ensure that the TSPEC parameter values resulting from an admission control negotiation are sufficient to provide the

required throughput for the TS. In a typical implementation, a TS is admitted only if the defined traffic volume can be accommodated at the specified rate within an amount of WM occupancy time that the admissions control entity is willing to allocate to this TS.

The standard does not require the use any of the Operational Rates for the value of the Minimum PHY Rate.

K2.2 is part of an Informative Annex, and is provided to assist implementers, but it does not specify required functionality.

Interpretation Request #15

An AES-CCM protocol has been implemented but there is a problem in constructing AAD. AAD part is consisted of {FC, A1, A2, A3, SC} as is shown in IEEE 802.11i standard 2007. In page 1136 of IEEE Std 802.11-2007, a test vector is depicted. In this test vector Muted Header equals to AAD, NONCE and PLAIN TEXT values are also considered, but in the implementation MICU value is not equal to MICU value in test vector. It is thought that our Design does not have problem because it generates the true result for RFC3610 test vectors. RFC3610 is the document for CCM protocol 2003.

Interpretation Response #15

IEEE Std 802.11-2007 is unambiguous on this issue. Clause 8.3.3.3 defines the CCMP cryptographic encapsulation protocol; Clause 8.3.3.3.2 defines the Additional Authentication Data (AAD) construction. The test vector shown in H.6.4 includes example MPDU header fields and the encrypted MPDU result, and is consistent with the description in 8.3.3.3.