IEEE P802.11
Wireless LANs

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| Normative text for active scanning meeting the requirements of the SFD |
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|  |  |  |  |  |

Abstract

The submission contains normative text for the requirements that are present in the 802.11ai specification framework document 11-12-151r8 [1]. The comments of the normative text refer to the requirement that the text implements.

Two requirements that are described 11-12-151r8 for active scnning are not implemented:

* 6.1.6 requirement that was accepted in 655r5
* 6.1.8

The numbering of the clauses is taken from 2012 revision of IEEE802.11 standard [2].

**6.3.3 Scan**

**6.3.3.2 MLME-SCAN.request**

**6.3.3.2.2 Semantics of the service primitive**

*Instructions to Editor: Change the clause as shown with track changes:*

The primitive parameters are as follows:

MLME-SCAN.request(

 BSSType,

 BSSID,

 SSID,

 ScanType,

 ProbeDelay,

 ChannelList,

 MinChannelTime,

 MaxChannelTime,

 RequestInformation,

 SSID List,

 ChannelUsage,

 AccessNetworkType,

 HESSID,

 MeshID,

 Inclusion Parameters,

 VendorSpecificInfo

)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Inclusion Parameters | As defined in 8.4.2.ai | As defined in 8.4.2.ai | The parameters define the responding STAs.  |

**6.3.3.3 MLME-SCAN.confirm**

**6.3.3.3.2 Semantics of the service primitive**

*Instructions to Editor: Modify the explanation of the ResultCode parameter of the MLME-SCAN.confirm primitive as follows:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| ResultCode | Enumeration | SUCCESS,INTERMEDIATE\_SCAN\_RESULT,NOT\_SUPPORTED | Indicates the result of the MLME- SCAN.confirm primitive.If SUCCESS, the MLME-SCAN.confirm contains information of all BSSs that has been received during the period from the point when the corresponding MLME-SCAN.request primitive was invoked to the point the scan process was ended.If INTERMEDIATE\_SCAN\_RESULT, the MLME-SCAN.confirm contains a BSS information that has been received. The The scan process is still onging.If NOT\_SUPPORTED, the requested active scanning is not allowed in the current regulatory domain. |

**6.3.3.3.3 When generated**

*Instructions to Editor: Change 6.3.3.3.3 as shown below:*

This primitive is generated by the MLME as a result of an MLME-SCAN.request primitive to ascertain the operating environment of the STA. The primitive is immediately invoked to report on every found BSS during the scan procedure.

**6.3.3.3.4 Effect of receipt**

*Instructions to Editor: Change 6.3.3.3.4 as shown below:*

As indicated by the ResultCode, the SME is notified of the intermediate or final results of the scan procedure.

**8.3.3.2 Beacon frame format**

*Instructions to Editor: Add new element to Table 8-20 as shown with track changes*

The frame body of a management frame of subtype Beacon contains the information shown in Table 8-20.

**Table 8-20—Beacon frame body**

|  |  |  |
| --- | --- | --- |
| Order | Information | Notes |
| 56 | FILS Response Parameters | The FILS Response Parameters are present if dot11FILSActivated is true. |
| Last | Vendor Specific | One or more vendor-specific (#1684)elements are optionally present(#29). These (#1684)elements follow all other (#1684)elements(#1221). |

* + - 1. Probe Request frame format

*Instructions to Editor: Add new element to Table 8-26 as shown with track changes.*

The frame body of a management frame of subtype Probe Request contains the information shown in Table 8–26 Probe Request frame body  (#33)

|  |
| --- |
| Table 8–26 Probe Request frame body   |
| Order | Information | Notes |
| 14 | FILS Request Parameters | The FILS Request Parameters are present if dot11FILSActivated is true. |
| 15 | Probe Response Reception Time | The Probe Response Reception Time is optionally present if the dot11FILSActivated is true. |
| Last | Vendor Specific | One or more vendor-specific (#1684)elements are optionally present(#29). These (#1684)elements follow all other (#1684)elements(#1221). |

* + - 1. **Probe Response frame format**

*Instructions to Editor: Add new element to Table 8-27 as shown with track changes.*

The frame body of a management frame of subtype Probe Response contains the information shown in Table 8-27. See additional details and procedures in 9.18.3 and 10.1.4, respectively.

**Table 8-27—Probe Response frame body**

|  |  |  |
| --- | --- | --- |
| Order | **Information** | **Notes** |
| 55 | FILS Response Parameters | The FILS Response Parameters are present if dot11FILSActivated is true. |
| 56 | NeighborList | The NeighborList is optionally present if dot11FILSActivated is true. |
| Last*–1* | Vendor Specific | One or more vendor-specific (#1684)elements are optionally present(#29). These (#1684)elements follow all other (#1684)elements(#1221), except the Requested (#1684)elements. |
| Last–*n* | Requested (#1684)elements | Elements requested by the Request (#1684)element of the Probe Request frame are present(#29) if dot11MultiDomainCapabilityActivated(#1005) is true. See 11.1.3.2.1 (Sending a probe response).(11k) |

**8.4.2.ai1 FILS Request Parameters element**

*Instructions to Editor: Add new element type to the element type list.*

**Table 8-ai1—FILS Request Parameters element**

|  |  |  |
| --- | --- | --- |
| Element Id | Length | FILS Criteria |
| Octets: 1 | 1 | 1 |

The Element Id is equal to the FILS Request Parameters element value in Table 8-ai.

The value of the Length field is the length of the FILS Criteria field and set to value 1.

**Table 8-ai2—FILS Criteria field**

|  |  |  |
| --- | --- | --- |
|  | Comprehensive Response | Reserved |
| Bits:  | 1 | 7 |

The Comprehensive Response field is set to 1 to indicate that the information of other BSSs are requested to be included to the response and otherwise the field is set to 0.

**8.4.2.ai2 FILS Response Parameters element**

*Instructions to Editor: Add new element type to the element type list.*

**Table 8-ai3—FILS Response Parameters element**

|  |  |  |
| --- | --- | --- |
| Element Id | Length | FILS Response Indication |
| Octets: 1 | 1 | 1 |

**Table 8-ai4—FILS Response Indication field**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Response to Multiple Requests | Beacon Replacing Probe Response  | Reserved |
| Bits:  | 1 | 1 | 6 |

The Response to Multiple Requests field is set to 1 to indicate that the frame is a response to two or more Probe Request frames and otherwise set to 0.

The Beacon Replacing Probe Response field is set to 1 in a Beacon frame to indicate that the Beacon frame replaces the transmission of Probe Response frame and otherwise the field is set to 0. The field is reserved in other than Beacon frames.

**8.4.2.ai3 Probe Response Reception Time element**

*Instructions to Editor: Add new element type to the element type list.*

|  |  |  |
| --- | --- | --- |
| Element Id | Length | Max Channel Time |
| Octets: 1 | 1 | 1 |

The Element Id is equal to the Probe Response Reception Time element value in Table 8-ai.

The value of the Length field is the length of the Probe Response Reception Time element and set to value 2.

The Max Channel Time field contains an unsigned integer of units of 64 microseconds. It presents the time that the transmitter will be available to receive the Probe Responses as shown in Figure 10-ai1 and Figure 10-3.

**10.1.4.3 Active scanning**

**10.1.4.3.1 Introduction**

*Instructions to Editor: Change the text as shown with track changes*

Active scanning involves the generation of Probe Request frames and the subsequent processing of received responses to Probe Request frames. The details of the active scanning procedures are as specified in the following subclauses.

**10.1.4.3.2 Active scanning procedure**

*Instructions to Editor: Delete the current clause 10.1.4.3.3 and move the text including the Figure and incorporate the identified changes to clause 10.1.4.3.2.*

Upon receipt of the MLME-SCAN.request primitive with ScanType indicating an active scan, a STA shall use the following procedure:

For each channel to be scanned:

a) Wait until the ProbeDelay time has expired or a PHYRxStart.indication primitive has been received.

b) Perform the Basic Access procedure as defined in 9.3.4.2.

c) Send a probe request to the broadcast destination address, with the SSID and BSSID from the MLME-SCAN.request primitive. When the SSID List is present in the MLME-SCAN.request primitive, send one or more Probe Request frames, each with an SSID indicated in the SSID List and the BSSID from the MLME-SCAN.request primitive.

d) Set a ProbeTimer to 0 and start the ProbeTimer.

e) If PHY-CCA.indication (busy) primitive has not been detected before the ProbeTimer reaches MinChannelTime, then set NAV to 0 and scan the next channel, else the MLME shall issue MLME-SCAN.received primitive with the BSSDescriptionSet containing information of the AP when Probe Response or Beacon frame is received from the AP for the first time. When ProbeTimer reaches MaxChannelTime set NAV to 0 and scan the next channel.

See Figures 10-ai1 and 10-3.



**Figure 10-ai1—Example of active scanning process when Probe Request frame is addressed to individual address.**



**Figure 10-3—Example of active scanning process when Probe Request frame is addressed to broadcast address.**

When all channels in the ChannelList have been scanned, the MLME shall issue an MLME-SCAN.confirm primitive with the BSSDescriptionSet containing all of the information gathered during the scan.

**10.1.4.3.3 Sending a probe request**

*Instructions to Editor: Add the new Clause 10.1.4.3.3*

STAs may transmit Probe Request frames to a broadcast or to individual addresses.

A Probe Request frame transmitted to an individual address shall be acknowledged by the receiver.

The Probe Request frame addressed to a broadcast address should limit with SSID, SSID List, HESSID and Inclusion Parameter fields the amount of Probe Response frames that are transmitted as a response to the Probe Request frame.

When an MLME receives an MLME-SCAN.request primitive with ScanType indicating an active scan, a STA may not transmit a Probe Request frame to a channel at which the STA has received:

* A broadcast addressed Probe Request frame containing request of at least the same information as indicated in the received MLME-SCAN.request.
* A broadcast addressed Probe Response or a Beacon frame containing at least the same information as indicated in the received MLME-SCAN.request.

When the dot11FILSActivated equal true, the FILS Request Parameters element shall be included to Probe Request frame and the FILS Supported field of the FILS Request Parameters shall be set true.

The Comprehensive Response field of the FILS Request Parameters element of the Probe Request frame may be set to 1 to allow the information of other BSSs to be included to the responses.

The Max Channel Time field of the Probe Response Reception Time element is set to the Max Channel Time of the MLME-SCAN.request.

The SSID List element shall not be included in a Probe Request frame in an IBSS.

**10.1.4.3.4 Selecting the response frame to probe request**

*Instructions to Editor: Add the new Clause 10.1.4.3.4*

STAs receiving Probe Request frames shall respond, if the criteria to response to probe request as described in 10.1.4.3.5(Criteria to respond to probe request), are met.The STA shall response:

* with a Probe Response or a Beacon frame when dot11FILSActivated equal to true. More details on selecting the Probe Response or Beacon frame are described in 10.1.4.3.7(Probe response collision avoidance).
* with Probe Response frame when dot11FILSActivated equal to false

**10.1.4.3.5 Criteria to respond to probe request**

*Instructions to Editor: Add the new Clause 10.1.4.3.5*

Only APs and STAs in an IBSS or in an MBSS respond to probe requests. A result of the procedures defined in this subclause is that in each infrastructure BSS and IBSS there is at least one STA that is awake at any given time to receive and respond to probe requests. In an MBSS, STAs might not be awake at any given time to respond to probe requests. In an infrastructure BSS or in an IBSS, a STA that sent a Beacon frame shall remain in the Awake state and shall respond to probe requests, subject to criteria in the next paragraph, until a Beacon frame with the current BSSID is received. If the STA is contained within an AP, it shall remain in the Awake state and respond to probe requests, subject to criteria in the next paragraphs. There may be more than one STA in an IBSS that responds to any given probe request, particularly in cases where more than one STA transmitted a Beacon frame following the most recent TBTT, either due to not receiving successfully a previous Beacon frame or due to collisions between beacon transmissions.

STAs receiving Probe Request frames shall respond only if the criteria below are met:

a) The Address 1 field in the probe request is the broadcast address or the specific MAC address of the STA, and either item b) or item c) below.

b) The STA is a mesh STA and

1) The Mesh ID in the probe request is the wildcard Mesh ID or the specific Mesh ID of the STA.

c) The STA is not a mesh STA and

1) The SSID in the probe request is the wildcard SSID, or the SSID in the probe request is the specific SSID of the STA, or the specific SSID of the STA is included in the SSID List element, and

2) The Address 3 field in the probe request is the wildcard BSSID or the BSSID of the STA.

Additionally, STAs with dot11InterworkingServiceActivated equal to true receiving Probe Request frames containing an Interworking field in the Extended Capabilities element set to 1 shall examine the Interworking element in the received Probe Request frame and respond with a probe response only if

d) The Access Network Type field in the Interworking element is the wildcard Access Network Type or the Access Network Type of the STA.

STAs with dot11RadioMeasurementActivated equal to true receiving a Probe Request frame with a DSSS Parameter Set element containing a Current Channel field value that different from the value of dot11CurrentChannel shall not respond to Probe Request frame.

**10.1.4.3.6 Probe response collision avoidance**

*Instructions to Editor: Add the new Clause 10.1.4.3.7*

STAs with dot11FILSActivated equal to true should respond to a Probe Request frame with a Beacon frame if the criteria below are met:

* The requesting STA has received a Probe Response or a Beacon frame containing information of the BSS of the responding AP.
* The next TBTT of the responding STA is within dot11BeaconResponseDuration.
* The responder considers the medium congested. The criterion to consider medium congested is implementation dependent.

A Beacon frame transmitted by STA with dot11FILSActivated equal to true shall contain FILS Response Parameters. When a Beacon frame is transmitted as a response to Probe Request frame, the Beacon Replacing Probe Response field of the FILS Response Parameters element of the Beacon frame shall be set to 1. Otherwise the field shall be set to 0.

If a STA with dot11FILSActivated equal to true receives two or more Probe Request frames that meet the criteria to respond as specified in 10.1.4.3.5(Criteria to respond to probe request) and the STA has dot11OmitReplicateProbeResponses true, the responding STA may respond by a single Beacon or Probe Response frame with the Response to Multiple Requests field of the FILS Response Parameters element set to 1. The Beacon or the Probe Response frame shall contain all the information requested by the responded Probe Request frames.

When a Probe Response frame contains a response to multiple Probe Request frames, the Probe Response frame shall be transmitted to address of any transmitter of the multiple Probe Request frames or to broadcast address. The selection of the address of the Probe Response frame is implementation dependent.

**10.1.4.3.7 Sending a response to probe request**

*Instructions to Editor: Add the new Clause 10.1.4.3.8*

Probe Response frames shall be transmitted as directed frames to the address of the STA that generated the probe request, or to the broadcast address.

Requested Element IDs in the Request element shall be included in the Probe Response frame if the responding STA supports it. In an improperly formed Request element, a STA may ignore the first element requested that is not ordered properly and all subsequent elements requested. In the Probe Response frame, the STA shall return the requested elements in the same order as requested in the Request element.

If dot11RadioMeasurementActivated is true and if the Request element of the Probe Request frame includes the RCPI element ID, the STA shall include in the Probe Response frame an RCPI element containing the measured RCPI value of the received Probe Request frame. If no measurement result is available, the RCPI value shall be set to indicate that a measurement is not available.

If the Comprehensive Response field of the FILS Request Parameters element of the Probe Request, the Probe Response or Beacon frame may include information of other BSSs. The other BSSs information is carried in Neighbor List element of the Probe Response or Beacon frame, if the criteria as defined in 10.1.4.3.5.(Criteria to respond to probe request) are met for the included BSSs.The BSSs which information is included may have different primary channel as the responding STA. When information of other BSSs is included, the Probe Response or Beacon frame shall include NeighborList element.

**Annex C**

(normative)

*Instructions to Editor: Add new MIB variable as shown below*

dot11FILSActivated OBJECT-TYPE

SYNTAX Boolean

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 station implementation is capable of supporting fast initial link setup. The capability is disabled, otherwise."

DEFVAL { false }

dot11BeaconResponseDuration OBJECT-TYPE

SYNTAX Unsigned32(0..65535)

MAX-ACCESS Read-Only

STATUS Current

Description

"This is a control variable.

It is written by an external management entity.

Changes take effect as soon as practical in the implementation.

This attribute indicates the duration in units of 32 microseconds. If the duration from the reception of the Probe Request frame to the TBTT is less than the value, the STA transmits a Beacon frame as response to the Probe Request frame."

DEFVAL { 100 }

dot11OmitReplicateProbeResponses OBJECT-TYPE

SYNTAX Boolean

MAX-ACCESS Read-Only

STATUS Current

Description

"This is a control variable.

It is written by an external management entity.

Changes take effect as soon as practical in the implementation.

This attribute, when true, indicates that the AP may cancel the transmission of the pending responses. The capability is disabled otherwise.”

DEFVAL { false }

**References:**

[1] 11-12-151-07-00ai-Proposed-Specification-Framework-Document.docx

[2] IEEE Std 802.11tm – 2012