IEEE P802.11
Wireless LANs

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| Combined Text for Active Scanning |
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Abstract

The submission provides normative text for active scanning to implement the requirements of the SFD for active scanning. The active scanning text is also provided in documents 12-1018, 12-1019 and 12-1020.

The submission implements the Specification Framework document requirements under subsections 6.1.2, 6.2.1, 6.2.2, 6.2.3, 6.2.4, 6.2.5, 6.2.6, 6.2.7 and 6.2.9.

Instructions to Editor:

Target of the submission is to minimize the changes to existing description of the active scanning. Special attention is set to indicate the changed location of the text, but keeping the content of the text the same.

The submission includes the text of active scanning clause 10.1.4.3 of 802.11-2012:

* No changes to clause 10.1.4.3.1
* The clause 10.1.4.3.2 of 802.11-2012 is moved to clause 10.1.4.3.5 and the structure of the clause is changed, i.e. the third chapter is moved to be the first chapter. The last and the second last chapters of clause 10.1.4.3.2 of 802.11-2012 are moved to 10.1.4.3.7.
* The clause 10.1.4.3.3 of 802.11-2012 is moved to clause 10.1.4.3.2 and the proposed changes to the clause are shown.

**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,

 FILSRequestParameters,

 ReportingOption,

 VendorSpecificInfo

)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| FILSRequestParameters | As defined in 8.4.2.ai1 | As defined in 8.4.2.ai1 | The parameters define the responding STAs.  |
| ReportingOption | Enumeration | IMMEDIATE,CHANNEL\_SPECIFIC,AT\_END | Indicates the result reporting mode |

**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. |

**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 or an MLME-SCAN-STOP.request following an MLME-SCAN.request to ascertain the operating environment of the STA.The primitive is invoked to report on found BSS as indicated in ReportingOption MLME-parameter of the MLME-SCAN.request primitive.

**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.

**6.3.3.ai1 MLME-SCAN-STOP.request**

*Instructions to Editor: Add a new clause 6.3.3.ai1and subclausesas shown below:*

**6.3.3.ai1.1 Function**

This primitive terminates any ongoing scan.

**6.3.3.ai1.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-SCAN-STOP.request (

 )

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |

**6.3.3.ai1.3 when generated**

This primitive is generated by the SME as for a STA to stop any ongoing scan process.

**6.3.3.ai1.4 Effect of receipt**

This request terminates any ongoing scan procedures. The passive scanning is stopped immediately after the primitive is received; and active scanning is stopped after the max channel time of the currently scanned channel has elapsed. The confirmation of the scan termination is provided through MLME-SCAN.confirm primitive.

* + - 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 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). |

**8.3.3.10 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 | NeighborReport | The NeighborReport 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.*

The FILS Request Parameters element in Probe Request frame are used as criteria to response with Probe Response transmission as defined in 10.1.4.3.5(Criteria to respond to probe request). The FILS Request Parameters is defined in Figure 8-ai1.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Element Id | Length | Parameter Control Bitmap | FILS Criteria | Max Delay Limit | Minimum Data Rate | Received Signal Strength Limit | OUI Response Criteria |
| Octets: 1 | 1 | 1 | 0 or 1 | 0 or 1 | 0 or 3 | 0 or 1 | 0 or 2 |

**4 B5 B7e 8-ai2 CILS Cri refer to the same parameter defined in TSPEC.Figure 8-ai1—FILS Request Parameters element**

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 element and set to value between 1 and 9 depending on the values of Parameter Control Bitmap field.

The Parameter Control Bitmap field is 1 octet in length and illustrated in Figure 8-ai2. Bits 0 to 4 of the Parameter ControlBitmap field correspond to the Parameter fields present in the IE respectively.A value of 1 in a bit indicates the corresponding parameter is present, and the value of 0 indicates the corresponding parameter is not present.

 B0 B1 B2 B3 B4 B5 B7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| FILS Criteria | Max Delay Limit | Minimum Data Rate | Received Signal Strength Limit | OUI Response Criteria | Reserved |

**Bits: 1 1 1 1 1 3**

**4 B5 B7e 8-ai2 CILS Cri refer to the same parameter defined in TSPEC.Figure 8-ai2 — Parameter Control Bitmap field**

The FILS Criteria field is 1 octet in length and is illustrated in Table 8-ai2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Comprehensive Response | BSS Delay Criteria  | HT Support Criteria | VHT Support Criteria | Reserved |
| Bits:  | 1 | 3 | 1 | 1 | 2 |

**4 B5 B7e 8-ai2 CILS Cri refer to the same parameter defined in TSPEC.Figure 8-ai3 — FILS Criteria field**

The Comprehensive Response field is set to 1 to indicate that the information of other BSSs are requested to be included to the Probe Response frame that is transmitted as a response to the Probe Request. A Neighbor Report element is included to Probe Response frame for each BSS which information is included. Otherwise the field is set to 0.

The BSS Delay Criteria field values and the selection of the delay of the criteria to respond to the probe request as explained in 10.1.4.3.5 (Criteria to respond to probe request) is provided in Table 8-ai3(Mapping of BSS Delay Criteria field).

**Table 8-ai3 —BSS Delay Criteria field**

|  |  |
| --- | --- |
| Value  | Explanation |
| 0 | The delay criteria is set to average access delay of the AC\_BK |
| 1 | The delay criteria is set to average access delay of the AC\_BE |
| 2 | The delay criteria is set to average access delay of the AC\_VI |
| 3 | The delay criteria is set to average access delay of the AC\_VO |
| 4 | The delay criteria is set to average access delay of all ACs |
| 5 – 6  | Reserved |
| 7 | Delay criteria is not in use |

The HT Support Criteria field is set to 1 to indicate that responding STA must be HT capable and otherwise set to 0.

The VHT Support Criteria field is set to 1 to indicate that responding STA must be VHT capable and otherwise set to 0.

The Max Delay Limit field is an unsigned integer in units of 200µs to calculate the value of the maximum access delay for delay criteria as indicated by the BSS Delay Criteria field of the FILS Criteria of the FILS Request Parameters element. Value 0 is reserved. The use of the maximum access delay and the delay criteria are explained in 10.1.4.3.5 (Criteria to respond to probe request).

The Minimum Data Rate field is 3 octets long and contains an unsigned integer in units of kilobits per second that specifies the lowest total data rate specified at the MAC\_SAP for transport of MSDUs or A-MSDUs that the STA is going to transmit. The minimum MAC\_SAP data rate does not include the MAC and PHY overheads incurred in transferring the MSDUs or A-MSDUs.

The Received Signal Strength Limit (RSSL) field is an unsigned integer. The receiver of Probe Request frame is obliged to respond, if the reception power of the frame is equal or higher than -90dBm + (RSSL value \* 0.5dBm). Value 255 indicates that receiver is obliged to respond regardless of the reception power of the Probe Request frame.

OUI Response Criteria field is a bitmap, in which the bits corresponds to the Vendor Specific elements of the Probe Request frame in order of presence, bit0 corresponds to the first Vendor Specific element, bit1 corresponds the second and so on. A bit in the OUI Response Criteria field is set to 1 to indicate that the receiver must know the Organization Identifier field of the corresponding Vendor Specific element in order to be obliged to respond to the request and otherwise set to 0. If the number of the Vendor Specific elements of the Probe Request frame is less than the number of bits of the OUI Response Criteria field, the remaining bits of the OUI Response Criteria field are set to 0.

**8.4.2.ai2 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 |

**Figure 8-ai6 — Probe Response Reception Time element**

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 1.

The Max Channel Time field contains an unsigned integer of units of 200 microseconds. It presents the time that the transmitter will be available after the transmission of the Probe Request to receive the Probe Responses as shown in Figure 10-ai1 and Figure 10-3.

**10.1.4.2 Passive scanning**

*Instructions to Editor: Append the following text to the as the last paragraph of the clause.*

If the ScanType parameter indicates a passive scan, the STA shall listen to each channel scanned for no longer than a maximum duration defined by the MaxChannelTime parameter.

If the MLME receives an MLME-SCAN-STOP.request primitive, the STA shall immediately stop the ongoing passive scanning process at the scanned channel, and shall not initiate scanning at any new channel. The MLME shall issue an MLME-SCAN.confirm primitive with the BSSDescriptionSet containing the gathered information since the previous issue of MLME-SCAN.comfirm primitive, or if the primitive has not been issued since the beginning of the scan, having the ResultCode set to SCAN\_SUCCESS.

**10.1.4.3.2 Active scanning procedure of the scanning STA**

*Instructions to Editor: Move the subclause of 10.1.4.3.2 of 802.11-2012 to the new subclause 10.1.4.3.5.*

*Move the subclause 10.1.4.3.3 of 802.11-2012 to the new subclause 10.1.4.3.2; and make the changes as marked below.*

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 ~~when ProbeTimer reaches~~

~~MaxChannelTime, process all received probe responses.~~ process the received probe responses or Beacon, and when ReportingOption is set to IMMEDIATE and new AP or new information of the AP is detected, issue MLME-SCAN.confirm primitive with the ResultCode equal to INTERMEDIATE\_SCAN\_RESULT and the BSSDescriptionSet containing information of the AP.

f)set NAV to 0 and scan the next channel.If the Reportingoption is set to ChannelSpecific an MLME-SCAN Confirm primitive is issued with all information of all APs that were discovered from the scanned channel.

See Figures10-ai1 and 10-3.



**Figure 10-ai8—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 Resultcode set to SCAN\_SUCCESSand the BSSDescriptionSet containing all of the information gathered during the scan.

If the MLME receives an MLME-SCAN-STOP.request primitive, the STA shall complete the ongoing active scanning process at the scanned channel, and shall not initiate scanning at any new channel. The MLME shall issue an MLME-SCAN.confirm primitive with the ResultCode set to SCAN\_SUCCESS and BSSDescriptionSet containing all of the information gathered during the scan.

**10.1.4.3.3 Sending a probe request**

*Instructions to Editor: Add the text to the new Clause 10.1.4.3.3*

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 to which the clause 10.1.4.3.5(Criteria to respond to probe request) allows at least the same responses as the information indicated in the received MLME-SCAN.request primitive.
* A broadcast addressed Probe Response or a Beacon frame containing at least the same information as indicated in the received MLME-SCAN.request primitive.

A Probe Request frame may contain Probe Response Reception Time element. When present, the Max Channel Time field of the Probe Response Reception Time element of the Probe Request frame 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 10.1.4.3.6(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: Move the subclause of 10.1.4.3.2 of 802.11-2012 to the new subclause 10.1.4.3.5.*

*Change the third section of 802.11-2012 to be the first section of the text.*

*Move the last and the second last subclauses to clause 10.1.4.3.7.*

*The text which location within the subclause is being changed, but the content remains the same is written in black. The modifications of the text are shown in red strikeout and new additions are showin in blue underlined text.*

*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.

~~In an infrastructure BSS or in an IBSS, STAs receiving Probe Request frames shall respond with a probe response when the SSID in the probe request is the wildcard SSID or matches the specific SSID of the STA or when the specific SSID of the STA is included in the SSID List element.~~ ~~Furthermore, a STA with dot11RadioMeasurementActivated true receiving a probe request with a DSSS Parameter Set element containing a Current Channel field value that is not the same as the value of dot11CurrentChannel shall not respond with a probe response. An AP shall respond to all probe requests meeting the above criteria. In an IBSS a STA that transmitted a Beacon frame since the last TBTT shall respond to group addressed Probe Request frames.~~ A STA in an IBSS shall respond to Probe Request frames sent to the individual address of the STA.

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:

— The HESSID field, if present in the Interworking element, is the wildcard HESSID or the HESSID of the STA, and

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

~~An associated mesh~~ 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.

STAs with dot11FILSActivated equal to true receiving a Probe Request frame with FILS Request Parameters element shall respond to Probe Request frame only if all the criteria below that are present in the corresponding Probe Request frame are met:

1. The access delay as indicated by the BSS Delay Criteria field of the FILS Criteria field of the FILS Request Parameters element is less than the value as specified in the Max Delay Limit field of the FILS Criteria field of the FILS Request Parameters element as explained in 8.4.2.ai1(FILS Request Parameters element)
2. The HT Support Criteria of the FILS Criteria field of the FILS Request Parameters element is set to 1 and the responding STA is HT STA.
3. The VHT Support Criteria of the FILS Criteria field of the FILS Request Parameters element is set to 1 and the responding STA is VHT STA.
4. The Minimum Data Rate field of the FILS Request Parameters element indicates lower data rate that can be provided over the MAC\_SAP.
5. The Received Signal Strength field of the FILS Request Parameters element indicates lower reception power limit than the reception power of the Probe Request frame as explained in 8.4.2.ai1(FILS Request Parameters element).
6. The STA knows the OUIs as specified by the OUI Response Criteria of the FILS Request Parameters element as explained in 8.4.2.ai1(FILS Request Parameters element).

~~Probe Response frames shall be sent as directed frames to the address of the STA that generated the probe request. The SSID List element shall not be included in a Probe Request frame in an IBSS.~~

**10.1.4.3.6 Probe response collision avoidance**

*Instructions to Editor: Add the new Clause 10.1.4.3.6*

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 frameaddressed to broadcast address. The Beacon or the broadcasted Probe Response frame shall contain all the information requested by the responded Probe Request frames. More details on selecting the Probe Response or Beacon frame are described below.

STAs with dot11FILSActivated equal to true should respond to one or more Probe Request frames addressed to broadcast address with a Beacon frame if the criteria below are met:

* The responding STA that is about to transmit a probe response receives an acknowledged Probe Response addressed to the requesting STA containing information of the BSS of the responding STA.
* The next TBTT of the responding STA is within dot11BeaconResponseDuration and is no later than any deadline of Probe Response Reception Time, if the Probe Response Reception Time element is present in any Probe Request frame.

**10.1.4.3.7 Sending a response to probe request**

*Instructions to Editor: Add the new Clause 10.1.4.3.7*

*The text which is moved from 10.1.4.3.2 or 802.11-2012 is written as black underlined text. The modifications of the text are shown in red strikeout and new additions are showin in blue underlined text.*

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 includes the RCPI element ID, the STA shall include in the Probe Response 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 Probe Response Reception Time element is present in the Probe Request frame, the responder with dot11FILSActivated true shall discard the pending untransmitted Probe Response frame to the Probe Request frame when the elapsed time equals to the value of the Max Channel Time field of the Probe Response Reception Time element of the Probe Request frame has been exceeded.

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, if the criteria as defined in 10.1.4.3.5.(Criteria to respond to probe request) are met for the included BSS.The BSSs which information is included may have different primary channel as the responding STA. When information of other BSSs is included, one Neighbor Report element is added to Probe Response or Beacon frame per one reported BSS.

**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 }