IEEE P802.11
Wireless LANs

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| Resolution for CIDs 1024 and 1113 |
| Date: 2022-06-02 |
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|  |  |  |  |  |

Abstract

This submission proposes resolution for CIDs 1024 and 1113 received in LB258 (REVme D1.0).

***TGm editor: The baseline for this document is REVme D1.2.***

**Revisions:**

* Rev 0: Initial version of the document.
* Rev 1: based on offline feedback from members

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 TGm Draft. This introduction is not part of the adopted material.

|  |  |  |  |  |  |  |  |
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| **CID** | **Commenter** | **Clause** | **Page** | **Line** | **Comment** | **Proposed Change** | **Resolution** |
| 1024 | Abhishek Patil | 9.6.7.36 | 1906 | 18 | Many upcoming device-to-device applications require lower latency and higher throughput. Add a signaling from the AP to assist more scalable direct link operation that can coexist with infra mode operation. | The commenter will provide a contribution | **Revised**Agree with the comment. Defined a new value for the Channel Usage Mode field that is carried in the Channel Usage element to signal dedicated peer-to-peer off-channel. In addition, extended the Channel Usage Request and Response frame to enhance the scalability of peer-to-peer operation on the off-channel.**TGm editor, please implement changes as shown in 528r1 tagged as 1024** |
| 1113 | George Cherian | 9.6.7.36 | 1906 | 34 | To cater to many emerging use cases involving device-to-device applications, 802.11 should provide better support and co-ex scheme for direct link applications (coex with infra). Add a signaling (e.g. beacon) from an AP recommending a channel for device-to-device (direct link) operations | The commenter will provide a contribution | **Revised**Agree with the comment. Same resolution as CID 1024.**TGm editor, please implement changes as shown in 528r1 tagged as 1024** |

Discussion:

Anticipate wide adoption of peer-to-peer (P2P) devices with increasing QoS requirements in Enterprise and Residential environments. The AP operating channel is not scalable with infrastructure and P2P transmissions; hence scalability is a key issue to address. In addition, the AP has a better view of network resources and can help to orthogonalize the P2P transmissions on the off-channel.

The goal is to enable the coexistence of large number of P2P devices with each other and with the infrastructure where the AP recommends service periods on a set of off-channels (AP does not operate on) to orthogonalize P2P transmissions. AP recommends one or more (channel, service period) tuples. AP will rely on existing signaling by extending the Channel Usage Request/Response frame

The existing Channel Usage Request/Response frame was designed to provide the necessary signaling to enable the AP to advise the non-AP STA on how to coexist with the infrastructure network. This contribution is a natural extension of the existing functionality to aid the P2P operation on the off-channel by adding a time component that can help to reduce collisions.





**9.4.2.85 Channel Usage element**

***TGm editor: Please update Table 9-265 in this subclause as shown below:***

Table 9-265—Usage Mode definitions [1024]

|  |  |
| --- | --- |
| **Value** | **Usage Mode** |
| 0 | Noninfrastructure IEEE 802.11 network |
| 1 | Off-channel TDLS direct link |
| 2 | Noninfrastructure IEEE 802.11 network in which none of the APs belonging to the same ESS operate infrastructure BSSs |
| 3-255 | Reserved |

**9.6.13.24 Channel Usage Request frame format**

***TGm editor: Please note that there is no change to the following paragraph, added for discussion only:***

The Channel Usage Request frame is sent by a non-AP STA to the AP to request the specified Channel

Usage information. The format of the Channel Usage Request frame Action field is defined in Figure 9-1174 (Channel Usage Request frame Action field format)

***TGm editor: Please update Figure 9-1174 in this subclause as shown below:***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|   | Category | WNMAction | Dialog Token | Channel Usage Elements | Supported Operating Classes Element | TWT Elements(optional) |
| **Octets:** | 1 | 1 | 1 | variable  | variable | variable |

Figure 9-1174 — Channel Usage Request frame Action field format[1024]

***TGm editor: Please add the following paragraphs and figure in this subclause as shown below after the paragraph starting “The Supported Operating Classes…”:***

[1024]The TWT Elements field includes zero or more TWT elements each containing only one individual TWT parameter set (see Figure 9-765 (Individual TWT Parameter Set field format)). The subfields values of the Individual TWT Parameter Set field are set as described in 11.21.15 (Channel usage procedures).

**9.6.13.25 Channel Usage Response frame format**

***TGm editor: Please note that there is no change to the following paragraph, added for discussion only:***

The Channel Usage Response frame is sent by an AP in response to a Channel Usage Request frame, or autonomously. The format of the Channel Usage Response frame Action field is shown in Figure 9-1175 (Channel Usage Response frame Action field format).

***TGm editor: Please update Figure 9-1175 in this subclause as shown below:***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|   | Category | WNMAction | Channel Usage Elements | Country String | Power Constraint Element (optional) | EDCA Parameter Set Element (optional) |
| **Octets:** | 1 | 1 | variable  | 3 | 0 or 3 | variable |
|  |  |  |  |  |  |  |
|  | Transmit Power Envelope Element (optional) | TWT Elements(optional) | Timeout Interval Element(optional) |
| **Octets:** | variable | variable | 0 or 7 |  |  |  |

Figure 9-1175—Channel Usage Response frame Action field format [1024]

***TGm editor: Please add the following paragraphs and figure in this subclause as shown below after the paragraph starting “The Transmit Power Envelope element …”:***

[1024] The TWT Elements field includes zero or more TWT elements each containing only one individual TWT parameter set (see Figure 9-765 (Individual TWT Parameter Set field format)). The subfields values of the Individual TWT Parameter Set field are set as described in 11.21.15 (Channel usage procedures).

The Timeout Interval Element field is present when the TWT Elements field contains at least one TWT element. Otherwise, the Timeout Interval Element field is not carried in this frame. The subfields values of the Timeout Interval Element field are set as described in 11.21.15 (Channel usage procedures).

**9.4.2.48 Timeout Interval element (TIE)**

***TGm editor: Please update Table 9-219 in this subclause as shown below:***

**Table 9-219 – Timeout Interval Type field value** [1024]

|  |  |  |
| --- | --- | --- |
| **Timeout Interval Type** | **Meaning** | **Units** |
| 0 | Reserved |  |
| 1 | Reassociation deadline interval | Time Units (TUs) |
| 2 | Key lifetime interval | Seconds |
| 3 | Association Comeback time | Time Units (TUs) |
| 4 | Time-to-Start (see 11.31.3.1 (General)) | Time Units (TUs) |
| 5 | Off-channel TWT agreement lifetime | Time Units (TUs) |
| 6-255 | Reserved |  |

**9.4.2.26 Extended Capabilities element**

***TGm editor: Please update Table 9-190 in this subclause as shown below:***

**Table 9-190—Extended Capabilities field** [1024]

|  |  |  |
| --- | --- | --- |
| **Bit** | **Information** | **Notes** |
| <Last assigned +1> | Off-channel TWT Scheduling Support | Set to 1 to indicate support for reception of a Channel Usage Request frame that includes TWT element(s) |
| <Last assigned + 2> - *n* | Reserved |  |

**11.21.15 Channel usage procedures**

***TGm editor: Please update this subclause as shown below:***

Channel Usage information is a set of channels provided by an AP to non-AP STAs for operation of a noninfrastructure network or an off-channel TDLS direct link. The Channel Usage information provided by the AP to the non-AP STA is to advise the STA on how to coexist with the infrastructure network.

Implementation of Channel Usage is optional for a WNM STA. A STA that implements Channel Usage has dot11ChannelUsageImplemented equal to true. When dot11ChannelUsageImplemented is true, dot11WirelessManagementImplemented shall be true, or the STA shall support (#546) acting as an S-AP within a CCSS. A STA with dot11ChannelUsageActivated equal to true shall support channel usage and shall set to 1 the Channel Usage field of the Extended Capabilities elements that it transmits.

[1024] A TWT agreement that is negotiated for a channel that is outside the operating bandwidth of AP’s BSS, by exchanging Channel Usage Request and Response frames, is reffered to as an off-channel TWT agreement and the corresponding TWT schedules are referred to as off-channel TWT schedules. An HE AP, that has dot11ChannelUsageActivated equal to true and supports providing an off-channel TWT schedule to a requesting non-AP STA to establish a non-infrastructure network or an off-channel TDLS direct link shall set to 1 the Off-channel Scheduling TWT Support field of the Extended Capabilities elements that it transmits.

NOTE – An HE AP has dot11TWTOptionImplemented equal to true and has the TWT Responder Support subfield set to 1 in the Extended Capabilities element and the HE Capabilities element.

A non-AP STA that supports Channel Usage and is not associated to an AP prior to using a Noninfrastructure network or an off channel TDLS direct link may transmit a Probe Request frame including both Supported Operating Classes and Channel Usage elements. A non-AP STA supporting Channel Usage may send a Channel Usage Request frame at any time after association to the AP that supports the use of Channel Usage to request the Channel Usage information for supported operating classes. [1024]A non-AP STA that transmits a Channel Usage Request frame shall set the Usage Mode field of the Channel Usage element to 2 if it requests assistance to setup a Noninfrastructure network on an off-channel that does not have infrastructure BSS(s) operated by any AP that belongs to the ESS of its associated AP. Otherwise, the non-AP STA may set the Usage Mode field of the Channel Usage element to 1 or 0.

A non-AP STA that supports Channel Usage and has the TWT Requester Support subfield set to 1 in the HE Capabilities element, that it transmits, may negotiate an off-channel TWT schedule with its associated AP, for setting up a Noninfrastructure network on an off-channel, by transmitting a Channel Usage Request frame that includes TWT Elements field if the AP has the Off-channel TWT Scheduling Support bit set to 1 in the Extended Capabilities element. Each TWT element carried in the TWT Elements field includes a single Individual TWT Parameter Set field whose subfields shall be set as described in 26.8.2 (Individual TWT agreements) except that the Responder PM Mode subfield, Trigger subfield, Flow type subfield, and the TWT Channel subfield shall be set to zero. Each TWT element in the TWT Elements field applies to all the Channel Entry subfields of the Channel Usage Elements field.

A non-AP STA that has successfully set up an off-channel TWT schedule with its associated AP, shall use the off-channel TWT SPs for non-infrastruture network communication that does not involve its associated AP. A non-AP STA shall transmit a QoS Data frame or QoS Null frame to its associated AP, on the channel where the AP is operating its BSS, during the time that overlaps with the off-channel TWT SP for initiating a communication with the AP.

Upon receipt of a Channel Usage element in the Probe Request frame, the AP supporting Channel Usage shall send a Probe Response frame including one or more Channel Usage elements. Upon receiving a Channel Usage Request frame [1024] with the Usage Mode field set to 0 or 1, the AP supporting Channel Usage shall send a Channel Usage Response frame including one or more Channel Usage elements. Channel Usage elements shall include channels that are valid for the regulatory domain in which the AP transmitting the element is operating and consistent with the Country element in the Beacon or Probe Response frame; the Channel Usage elements shall not include any other channels. [1024]Upon receiving a Channel Usage Request frame with the Usage Mode field set to 2 in a Channel Usage element, an AP that supports Channel Usage shall send a Channel Usage Response frame with the Usage Mode field in the Channel Usage element set to 2 if the AP can determine that none of the APs belonging to the same ESS operate infrastructure BSSs on the channels indicated by the Channel Entry field in the same Channel Usage element.

NOTE – The determination of which APs belonging to the same ESS operate infrastructure BSSs on a particular channel is implementation dependent and beyond the scope of this standard.

Upon receiving a Channel Usage Request frame with a TWT element, an AP that supports Off-channel TWT Scheduling shall send a Channel Usage Response frame including a TWT Elements field and a Timeout Interval Element field. Each TWT element carried in the TWT Elements field includes a single Individual TWT Parameter Set field whose subfields shall be set as described in 26.8.2 (Individual TWT agreements) except that the Responder PM Mode subfield, Trigger subfield, Flow type subfield, and the TWT Channel subfield shall be set to zero. Each TWT element in the TWT Elements field applies to all the Channel Entry subfields of the Channel Usage Elements field.

An AP that successfully sets up an off-channel TWT agreement with a non-AP STA shall indicate the lifetime of the off-channel TWT agreement for the corresponding TWT Element(s) in the Timeout Interval Value field of the Timeout Interval Element that it includes in the Channel Usage Response frame and shall set the corresponding Timeout Interval Type field value to 5. An AP that successfully sets up an off-channel TWT agreement with a non-AP STA shall not transmit frames to the non-AP STA during the time that overlaps with an off-channel TWT SP unless the AP receives a QoS Data frame or QoS Null frame from the non-AP STA.