IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Location Related Comments | | | | |
| Date: 2014-01-20 | | | | |
| Author(s): | | | | |
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##### Baseline is 11mc D2.1. Changes indicated by a mixture of Word track-changes and instructions. For equation changes, Tex notation is sometimes used. E.g. a\_{xyz}^b denotes axyzb .

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2404 | 701.00 |  | 8.4.2.21.13 |  |  | Location civic report assumes the STA is configured with its civic location. A valid use case is when the feature is supported but the STA does not know its civic location. Add a sentence which describes how the STA indicates in the Location Civic Report that it does not know its civic location. | add a sentence to this extent: "when the country code in the civic location field (figure 8-194) is set to an invalid value (see ISO3166 for valid country codes), it indicates that the reporting STA does not know its civic location." same change for 8.4.4.13 AP Civic Location ANQP-element subclause. | Revised, see changes in 14/1509r<motionjedRev> that correct the parsing of the Civic field. When the Civic location is unknown, it is indicated by an empty subelement |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2403 | 692.00 |  | 8.4.2.21.10 |  |  | LCI report assumes that when the feature is supported, location is known. A valid scenario is when the STA supports the feature, but does not know its location. | add a sentence saying "The value of FFFF for longitude, latitude and altitude fields is reserved, a STA sets these fields to FFFF when it does not know its location." Same change to 8.4.4.12. | Revised, see changes in 14/1509r<motionjedRev> that correct the parsing of the LCI field. When a field is unknown, it is indicated by an empty subelement |

***Discussion 2404:***

1)

Parsibility of response is fragile – could become difficult to distinguish start of Civic Location type from another optional subelement. Issue also affects Public Identifier URI field in Location Identifier Report.

Proposed fix is to prefix these fields by Element ID and Length octets.

Examples of payloads

|  |
| --- |
| D 0 1 2 3  H 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1  C +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+  P | GEOCONF\_CIVIC | N | what | country |  V +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+  4 | code | civic address elements ...  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+  D 0 1 2 3  H 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1  C +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+  P | OPTION\_GEOCONF\_CIVIC | option-len |  V +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+  6 | what | country code | .  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+ .  . civic address elements .  . ... .  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+  GEOCONF\_CIVIC = 99; OPTION\_GEOCONF\_CIVIC = 36, presumably in network byte order (big endian) so 0x00-34. So if we defined a sub-element with Element ID = 0 or 99, parsing would be very difficult / impossible. Or if IETF prepared a new RFC (e.g. “DHCPv9”) with a new leading octet, parsing would also be much more difficult.  Basically we are creating an unnecessary coupling between layers. |

2)

The RFC is an IETF standard, with network coding (big-endian) ordering, unlike 802.11, so we need to be explicit if this is little-endian or big-endian. Propose little endian as per 8.2.2 (same as LCI)

3)

Then, when the Civic Location is unknown, then set the Length to 0. This aligns with a discussion with an IETF representative (Marc Linsner), who says “In the IETF, lack of data indicates I don't know.”

4)

Location Civic is also useful for FTM procedure. Add optional Civic request/response within FTM request/next FTM frame

5)

Location Civic is also useful within the Neighbor Report. Add optional Civic request/response within Neighbor Report Req/Resp exchange

6)

Fix up URI encoding

|  |
| --- |
| For the URI, consider <http://www.example.com>, [ftp.example.com](ftp://ftp.example.com), gopher:, mailto:, news:, telnet: etc etc. So if we defined a sub-element with Subelement ID = 104, 102, 103, 109, 110, 116, parsing would be very difficult / impossible. Or if a new URI prefix became popular (e.g. “!!!://”) with a new leading octet, parsing would also be much more difficult.  Basically we are creating an unnecessary coupling between layers. |

***Discussion 2403:***

7)

Presentation 14/32 to address CIDs 2402, 2492, 2491 and 2493 adopts the newer “uncertainty” fields over the older “resolution” fields and makes other changes.

Although it is possible to indicate an unknown location by 1) max-ing out the uncertainty and 2) including an invalid lat/long, this is long, clumsy and not really consistent with “In the IETF, lack of data indicates I don't know.” Therefore use the same solution as for Civic – turn this into a subelement, where a zero-length subelement indicates “I don’t know”.

8)

Related, the LCI figure includes an element ID and length but there is no text on how they are set, no element ID is assigned and in fact this figure is for the LCI field that is a suffix to the Measurement Report element where no element ID or length is needed. Clean this up by converting this element ID to a subelement ID (set to zero, so it is first).

3)

LCI lacks AP height above floor and floor number (Civic provides floor string but not floor number). Add suitable optional subelement.

4)

LCI is also useful for FTM procedure. Add optional LCI request/response within FTM request/next FTM frame

5)

LCI is also useful within the Neighbor Report. Add optional LCI request/response within Neighbor Report Req/Resp exchange

***Change:***

**8.4.2.21.10 Location Configuration Information Report**

A known LCI (#1294)report includes Latitude, Longitude, Altitude, and optional Z and Azimuth information. An unknown LCI is indicated by a subelement Length of 0 and no following fields. The LCI report field format is shown in Figure 8-186.99 (Measurement Report field format for Location Configuration Information Report(#1692)).

|  |  |  |
| --- | --- | --- |
|  | LCI subelement | Optional Subelements |
| Octets | 2 or 18 | Variable |

Figure 8-186.99: Measurement Report field format for Location Configuration Information Report

***11mc editor: move Table 8-99 to here***

**Table 8-99—Subelement IDs for Location Configuration Information Report**

***11mc editor: Insert new rows and renumber reserved rows***

|  |  |  |
| --- | --- | --- |
| **Subelement ID** | **Name** | **Extensible** |
| 0 | LCI | No |
| 4 | Z | Subelements |

The LCI subelement is formatted according to Figure 8-187 (LCI subelement format).

***802.11m editor: Change “Element ID” to “Subelement ID” and mark following fields as optional (as per figure below)***

***802.11m editor: Presentation 14/32 also updates other fields in this figure; so the intent of the change indicated below is to keep all fields after “Length” marked as optional.***



Figure 8-187—LCI subelement format

***Note movement of text (not shown via Word track changes)***

The definition of fields within the LCI report subelement are as per Section 2.2 of IETF RFC 6225(#1692) (July 2011) or as defined herein. This structure and information fields are little-endian, per conventions defined in 8.2.2 (Conventions), and are based on the LCI format described in IETF RFC 6225(#1692).

NOTE—An example of fixed/fractional notation, using the longitude of the Sears Tower from

p. 28of IETF RFC6225(#1692) (July 2011):

Longitude 87.63602 °(#1491) West (or –87.63602 °(#1491)),

Using (#273)2s complement, 34 bit fixed point, 25 bit fraction,

Longitude = 0xf50ba5b97,

Longitude = 1101010000101110100101101110010111 (big-endian)

DSE registered location expression for a Longitude resolution of 34-bits:

Bits 56–61 Longitude resolution = (bit 56) 0 1 0 0 0 1 (bit 61)

Bits 62–86 Longitude fraction = (bit 62) 1 1 1 0 1 0 0 1 1 1 0 1 1 0 1 0 0 1 0 1 1 1 0 1 0 (bit 86)

Bits 87–95 Longitude integer = (bit 87) 0 0 0 1 0 1 0 1 1 (bit 95)

The octets in transmission order = E2 E5 96 2E D4.

The RegLoc Agreement field is set to 1 to report that the STA is operating within a national policy area or an

international agreement area near a national border (see 10.12.3 (Registered STA operation)); otherwise, it is

0.(#1692)

The RegLoc DSE field is set to 1 to report that the enabling STA is enabling the operation of STAs with

DSE; otherwise, it is 0.(#1692)

The Dependent STA field is set to 1 to report that the STA is operating with the enablement of the enabling

STA whose LCI is being reported; otherwise, it is 0.(#1692)

The Optional Subelements field comprises zero or more subelements with subelement ID greater than or equal to 1 as listed in Table 8-99 (Subelement IDs for Location Configuration Information Report(#1429)). A Yes in the Extensible column of a subelement listed in Table 8-99 (Subelement IDs for Location Configuration Information Report(#1429)) indicates that the (Ed)subelement might be extended in future revisions or amendments of this standard. When the Extensible column of an element is equal to Subelements, then the subelement might be extended in future revisions or amendments of this standard by defining additional subelements within the subelement. See 9.25.9 (Extensible subelement parsing).

***11mc editor: Insert at end of subclause***

The Z subelement is used to report the floor and location of the STA with respect to the floor level.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Sub-element ID | Length | STA Height Above Floor Integer | STA Height Above Floor Fraction | STA Height Above Floor Uncertainty | STA Floor Info |
| Octets | 1 | 1 | 1 | 1 | 1 | 2 |

Figure 8-188xxx – Z subelement format

The Subelement ID field is equal to the value for Z in Table 8-99.

The Length field is defined in 8.4.3.

The STA Height Above Floor Integer and STA Height Above Floor Fraction fields indicate the height of the STA above the floor according to Table 8-99xxz:

Table 8-99xxz: Interpretation of STA Height Above Floor Integer and STA Height Above Floor Fraction fields

|  |  |  |
| --- | --- | --- |
| STA Height Above Floor Integer (signed, units of meters) | STA Height Above Floor Fraction (unsigned, units of 1/256 meters) | STA height above floor in meters |
| 127 | 255 | Unknown |
| 127 | 254 | >= 127 + 254/256 meters |
| -128 | 0 | <= -128 meters |
| All other combinations | | STA Height Above Floor Integer + STA Height Above Floor Fraction/256 meters |

An STA Height Above Floor Uncertainty value of 0 indicates an unknown STA height above floor uncertainty. Values of 19 or higher are reserved. A value between 1 and 18 inclusive indicates that the actual STA height above floor is bounded according to:

***Note to reader (not for inclusion in the 11mc draft): this somewhat unnatural encoding follows RFC6225’s encoding for latitude uncertainty, which in turn is due to attempting to align with the original RFC3825 “Resolution” encoding.***

STA height above floor in meters - 29 - STA Height Above Floor Uncertainty <= actual STA height above floor <= STA height above floor in meters + 29 - STA Height Above Floor Uncertainty

If the STA height above floor in meters is unknown (see Table 8-99xxz), the STA Height Above Floor Uncertainty field is set to 0.

The format of the STA Floor Info field is defined in Figure 8-188xxy

|  |  |  |  |
| --- | --- | --- | --- |
|  | STA Floor Number Integer | STA Floor Number Fraction | Reserved |
| Bits | B0 B9 | B10 B13 | B14 B15 |

Figure 8-188xxy-STA Floor Info field format

The STA Floor Number Integer field is a signed integer indicating the floor number, where a higher value indicates a higher floor, and the integer approximates the floor number labels used at the venue (e.g. in the stairwells and elevators, if present).

The STA Floor Number Fraction field is an unsigned integer indicating intermediate floors between integer-labelled floors, where a higher value indicates a higher intermediate floor.

NOTE: For example, a UK building with floors labelled as B1, G, M, 1, and 2 can have the floors identified by a pair of (STA Floor Number Integer,STA Floor Number Fraction) values set to (-1,0), (0,0), (0,8), (1,0), and (2,0) respectively.

**8.4.2.21.13 Location Civic Report**

The Location Civic Report includes the location information defined in Civic format for the location subject provided in the Location Civic measurement request, as shown in Figure 8-194 (Location Civic Report field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Civic Location Type | Location Civic subelement | Optional Subelements |  |
| Octets: | 1 | variable | variable |  |

**Figure 8-194—Location Civic Report field format**

The Civic Location Type field contains the format of location information in the Civic Location field, as

indicated in Table 8-84 (Civic Location Type).

**Table 8-84—Civic Location Type**

|  |  |
| --- | --- |
| **Civic Location Type value** | **Description** |
| 0 | IETF RFC4776-2006 starting at the country code field (i.e. excluding the GEOCONF\_CIVIC/ OPTION\_GEOCONF\_CIVIC, N/ option-len and what fields); includes all subsequent RFCs that define additional civic address Types. |

***11mc editor: move Table 8-104 to here***

**Table 8-104—Subelement IDs for Location Civic Report(#1429)**

|  |  |  |
| --- | --- | --- |
| **Subelement ID** | **Name** | **Extensible** |
| 0 | Location Civic | No |
| 1 | Originator Requesting STA MAC Address | No |
| 2 | Target MAC Address | No |
| 3 | Location Reference |  |
| 4 | Location Shape |  |
| 5 | Map Image |  |
| 6–220 | Reserved |  |
| 221 | Vendor Specific |  |
| 222–255 | Reserved |  |

The Location Civic subelement of the Location Civic Report (see Figure 8-194 (Location Civic Report field format)) is formatted according to Figure XXX1.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Subelement ID | Length | Location Civic |
| Octets | 1 | 1 | Variable |

Figure XXX1: Location Civic Report subelement format

The Subelement ID is equal to Location Civic as defined inTable 8-104.

The Location Civic field contains the location information in the format as indicated in the Civic Location Type field. When the Civic Location Type is IETF RFC4776-2006:

* Location Civic field is formatted according to IETF RFC4776-2006 but starting at the country code field (i.e. excluding the GEOCONF\_CIVIC/ OPTION\_GEOCONF\_CIVIC, N/ option-len and what fields)
* An unknown Civic Location is indicated by a subelement Length of 0 and an empty Location Civic field
* The Civic Location field follows the little-endian octet ordering

When the Civic Location Type is IETF RFC4776-2006, the Optional Subelements field optionally(#1677) includes the Location Reference, Location Shape, Map Image, and Vendor Specific subelements as defined in Table 8-104 (Subelement IDs for Location Civic Report(#1429)).

When the Civic Location Type value is Vendor Specific, a Vendor Specific subelement is included in the Optional Subelements field that identifies the Organization Identifier corresponding to the Civic Location Type.

The Optional Subelements field format contains zero or more subelements with subelement ID greater than or equal to 1, each consisting of a 1-octet Subelement ID field, a 1-octet Length field, and a variable-length Data field, as shown in Figure 8-504 (Subelement format). The optional subelements are ordered by nondecreasing subelement ID.

The Subelement ID field values for the defined subelements are shown in Table 8-104 (Subelement IDs for Location Civic Report(#1429)). A Yes in the Extensible column of a subelement listed in Table 8-104 (Subelement IDs for Location Civic Report(#1429)) indicates that the length of the subelement might be extended in future revisions or amendments of this standard. When the Extensible column of an element is Subelement, then the subelement might be extended in future revisions or amendments of this standard by defining additional subelements within the subelement. See 9.25.9 (Extensible subelement parsing).

**8.4.2.21.14 Location Identifier Report**

The Location Identifier (#1294)report includes an indirect reference to the location information for the

location subject provided in the Location Identifier measurement request, as shown in Figure 8-207

(Location Identifier (#1294)report field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Expiration TSF | Public Identifier URI subelement | Optional Subelements |  |
| Octets: | 8 | variable | variable |  |

**Figure 8-207—Location Identifier (#1294)report field format**

The Expiration TSF field is the value of the TSF when the Public Identifier URI field value is no longer

valid. The Expiration TSF field set to 0 indicates the Public Identifier URI does not expire.

***11mc editor: move Table 8-107 to here***

**Table 8-107—Subelement IDs for Location Identifier report(#1294)(#1429)**

|  |  |  |
| --- | --- | --- |
| **Subelement ID** | **Name** | **Extensible** |
| **0** | **Public Identifier URI** | **No** |

The Public Identifier URI subelement of the Location Identifier Report (see Figure 8-207 (Location Identifier report field format)) is formatted according to Figure XXX2.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Subelement ID | Length | Public Identifier URI |
| Octets | 1 | 1 | Variable |

Figure XXX2: Public Identifier URI subelement format

The Subelement ID is equal to Public Identifier URI as defined inTable 8-107.

The Public Identifier URI field contains a value in URI format that points to a location object. It can be used to return the location value for the requesting STA. The format of the location value returned when the URI is dereferenced is dependent on the provider of the URI and is beyond the scope of this standard. The Public Identifier URI field confirms the validity of the location estimate to an external agent when a STA forwards a location estimate to that agent. The protocol used to query the infrastructure for a location report based on the Public Identifier URI field is beyond the scope of this standard.

The Optional Subelements field format contains zero or more subelements with subelement ID greater than or equal to 1, each consisting of a 1-octet

Subelement ID field, a 1-octet Length field and a variable-length Data field, as shown in Figure 8-516

(Subelement format). Any optional subelements are ordered by nondecreasing subelement ID.

The Subelement ID field values for the defined subelements are shown in Table 8-107 (

subelement IDs for Location Identifier report(#1294)(#1429)). A Yes in the Extensible column of a subelement listed in Table 8-107 (subelement IDs for Location Identifier report(#1294)(#1429))

indicates that the (Ed)subelement might be extended in future revisions or amendments of this standard.

When the Extensible column of an element is Subelement, then the subelement might be extended in future

revisions or amendments of this standard by defining additional subelements within the subelement. See

9.25.9 (Extensible subelement parsing).

The Originator Requesting STA MAC Address subelement contains the MAC address of the STA that

requested the Location Information and it is present whenever the location subject definition field in the

corresponding Location Identifier (#1294)request was set to 2. The format of the Originator Requesting

STA MAC Address subelement is shown in Figure 8-146 (Originator Requesting STA MAC Address

subelement format).

The Target MAC Address subelement contains the MAC address of the STA whose Location Information

was requested and it is present whenever the location subject definition field in the corresponding Location

Identifier (#1294)request was set to 2. The format of the Target MAC Address subelement is shown in

Figure 8-147 (Target MAC Address subelement format).

**8.4.2.36 Neighbor Report element**

***Note to reader, not for inclusion in draft: The FTM field as shown is a potential addition.***

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B1 | B2 | B3 | B4 B9 | B10 | B11 | B12 | B13 B31 |
|  | AP Reachability | Security | Key Scope | Capabilities | Mobility  Domain | High Throughput | FTM | Reserved |
| Bits | 2 | 1 | 1 | 6 | 1 | 1 | 1 | 19 |

**Figure 8-256—BSSID Information field**

The FTM field equal to 1 indicates that the AP represented by this BSSID is an AP that has set the Fine Timing Measurement field of the Extended Capabilities element to 1. If the FTM field is 0, it indicates either that the AP has not set the Fine Timing Measurement field of the Extended Capabilities element to 1 or that the value of the Fine Timing Measurement field of the AP is not available at this time.

Bits 13–31 are reserved.

**Table 8-131—Optional subelement IDs for neighbor report**

***11mc editor: Insert new row and renumber reserved rows***

|  |  |  |
| --- | --- | --- |
| **Subelement ID** | **Name** | **Extensible** |
| 39 | Measurement Report | Subelements |

***11mc editor: Insert at the end of this subclause***

A Measurement Report subelement with Measurement Type equal to LCI report (see Table 8-90) is optionally present. If present, the subelement has the same format as the Measurement Report element with Measurement Type equal to LCI report.The subelement indicates the LCI of the neighbour STA and further includes the Z subelement, or the subelement indicates an unknown LCI (see 10.24.6.2). The Late, Incapable and Refused bits in the Measurement Report Mode field are equal to 0.

A Measurement Report subelement with Measurement Type equal to Location Civic report (see Table 8-90) is optionally present. If present, the subelement has the same format as the Measurement Report element with Measurement Type equal to Location Civic report, and the subelement indicates the Civic address of the transmitting STA or an unknown Civic address (see 10.24.6.2). The Late, Incapable and Refused bits in the Measurement Report Mode field are equal to 0.

**8.6.7.6 Neighbor Report Request frame format**

***11mc editor: Replace subelement by element throughout the baseline clause.***

**Table 8-256—Optional element IDs for Neighbor Report Request frame**

***11mc editor: Insert new row and renumber reserved rows***

|  |  |  |
| --- | --- | --- |
| **Element ID** | **Name** | **Extensible** |
| 38 | Measurement Request | Subelements |

***11mc editor: Insert at the end of this subclause***

A Measurement Request element with Measurement Type equal to LCI request (see Table 8-66) is optionally present. If present, the element indicates a request for a Measurement Report subelement with Measurement Type equal to LCI report for each Neighbor Report element (see 10.11.10.2). The Enable bit in the Measurement Request Mode field in the Measurement Request element is equal to 0. The Location Subject field in the Measurement Request field of the Measurement Request element is equal to Location Subject Remote (see Table 8-78). The Request, Report and Duration Mandatory bits within the Measurement Request Mode field in the Measurement Request element are reserved (see 8.4.2.20.1)

A Measurement Request element with Measurement Type equal to Location Civic request (see Table 8-66) is optionally present. If present, the element indicates a request for a Measurement Report subelement with Measurement Type equal to Location Civic report for each Neighbor Report element (see 10.11.10.2). The Enable bit in the Measurement Request Mode field within the Measurement Request element is equal to 0. The Location Subject field in the Measurement Request field of the Measurement Request element is equal to Location Subject Remote (see Table 8-78). The Location Service Interval Units field in the Measurement Request field of the Measurement Request element is equal to 0. The Request, Report and Duration Mandatory bits in the Measurement Request Mode field in the Measurement Request element are reserved (see 8.4.2.20.1)

**8.6.8.25 Fine Timing Measurement Request frame format**

***11mc editor: Append the two elements shown to fixed-length fields in the frame***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  | 0 or 1 | 0 or 1 |
|  | Category | Action | Trigger | Measurement Request element with Measurement Type equal to LCI request | Measurement Request element with Measurement Type equal to Location Civic request |
| Octets: | 1 | 1 | 1 | Variable | Variable |

***11mc editor: Insert at the end of this subclause***

A Measurement Request element with Measurement Type equal to LCI request (see Table 8-66) is optionally present. If present, the element indicates a request for a Measurement Report element with Measurement Type equal to LCI (see 10.24.6.2). The Enable bit in the Measurement Request Mode field in the Measurement Request element is equal to 0. The Location Subject field in the Measurement Request field of the Measurement Request element is equal to Location Subject Remote (see Table 8-78). The Request, Report and Duration Mandatory bits in the Measurement Request Mode field in the Measurement Request element are reserved (see 8.4.2.20.1)

A Measurement Request element with Measurement Type equal to Location Civic request (see Table 8-66) is optionally present. If present, the element indicates a request for a Measurement Report element with Measurement Type equal to Location Civic report (see 10.24.6.2). The Enable bit in the Measurement Request Mode field in the Measurement Request element is equal to 0. The Location Subject field in the Measurement Request field of the Measurement Request element is equal to Location Subject Remote (see Table 8-78). The Location Service Interval Units field in the Measurement Request field of the Measurement Request element is equal to 0. The Request, Report and Duration Mandatory bits in the Measurement Request Mode field within the Measurement Request element are reserved (see 8.4.2.20.1)

**8.6.8.26 Fine Timing Measurement frame format**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  | 0 or 1 | 0 or 1 |
|  | Category | Action | Dialog Token | Follow Up Dialog Token | TOD | TOA | Max TOD Error | Max TOA Error | Measurement Report element with Measurement Type equal to LCI report | Measurement Report element with Measurement Type equal to Location Civic report |
| Octets: | 1 | 1 | 1 | 1 | 6 | 6 | 2 | 2 | Variable | Variable |

Figure 8-589—Fine Timing Measurement frame format

***11mc editor: Insert at the end of this subclause***

A Measurement Report element with Measurement Type equal to LCI report (see Table 8-90) is optionally present. If present, the element either indicates the LCI of the transmitting STA and includes the Z subelement or the element indicates an unknown LCI (see 10.24.6.2). The Late, Incapable and Refused bits in the Measurement Report Mode field are equal to 0.

A Measurement Report element with Measurement Type equal to Location Civic report (see Table 8-90) is optionally present. If present, the element either indicates the Civic address of the transmitting STA or an unknown Civic address (see 10.24.6.2). The Late, Incapable and Refused bits in the Measurement Report Mode field are equal to 0.

**10.11.10.2 Requesting a neighbor report**

A STA requesting a neighbor report from an AP shall send a Neighbor Report Request frame to its associated AP.

The requesting STA, to request the LCI of neighboring APs of its associated AP that advertises Fine Timing Measurement capability (see 8.4.2.26) within the Neighbor Report procedure, shall include a Measurement Request element with Measurement Type equal to LCI request within the Neighbor Report Request frame.

The requesting STA, to request the Location Civic of neighboring APs of its associated AP that advertises Fine Timing Measurement capability (see 8.4.2.26) within the Fine Timing Measurement procedure, shall include a Measurement Request element with Measurement Type equal to Location Civic request within the Neighbor Report Request frame.

**10.11.10.3 Receiving a neighbor report**

If dot11RMNeighborReportActivated is true, an AP receiving a neighbor report request shall respond with a

Neighbor Report Response frame containing zero or more Neighbor Report elements. If an SSID element is

specified in the corresponding Neighbor Report Request frame, the Neighbor Report element(s) shall

contain information only concerning neighbor APs that are members of the current ESS identified by the

SSID element contained within the neighbor report request. If the SSID element is omitted, the Neighbor

Report element(s) shall contain information concerning neighbor APs that belong to the same ESS as the

requesting STA. If the wildcard SSID element is specified in the corresponding Neighbor Request frame, the

Neighbor Report element(s) shall contain information concerning all neighbor APs. If there are no neighbor

APs available, the AP shall send a Neighbor Report Response frame with no Neighbor Report elements.

If dot11RMNeighborReportActivated is false in an AP receiving a neighbor report request, it shall ignore

the request and return a Neighbor Report frame with the Incapable bit in the Measurement Report Mode

field set to 1.

A STA receiving a neighbor report element with an unknown subelement identifier shall ignore the

unknown subelement and continue to process remaining subelements. A STA receiving a neighbor report

element containing a Vendor Specific subelement with an unknown Organization Identifier should ignore

this vendor-specific subelement and shall continue to process any remaining Vendor Specific subelements.

A serving AP shall include a TSF (#136)subelement in the Neighbor Report element if it is able to guarantee

an accumulated error of 1.5 TU or better on the TSF Offset subfield. Otherwise, the AP shall not include a

TSF (#136)subelement in the Neighbor Report element.

When an AP that has dot11FineTimingMsmtActivated equal to true receives a Measurement Request element with Measurement Type equal to LCI request within a Neighbor Report Request frame, the AP shall include a Measurement Report subelement with Measurement Type equal to LCI report in each Neighbor Report element in the Neighbor Report response frame. If the LCI information of the neighbor is unknown, the AP shall indicate an unknown LCI for the neighbor following the format defined in 8.4.2.21.10.

When an AP that has dot11FineTimingMsmtActivated equal to true receives a Measurement Request element with Measurement Type equal to Location Civic request within a Neighbor Report Request frame, the AP shall include a Measurement Report subelement with Measurement Type equal to Location Civic report in each Neighbor Report element in the Neighbor Report response frame. If the Location Civic information of the neighbor is unknown, the AP shall indicate an unknown Civic address following the format defined in 8.4.2.21.13.

Each Measurement Report subelement returned shall have the same Measurement Token as in the corresponding Measurement Request element.

***11mc editor: demote contents of 10.24.6 to 10.24.6.1 with new title shown below***

**10.24.6 Fine timing measurement procedure**

**10.24.6.1 Fine timing measurement**

**…**

**10.24.6.2 LCI and Location Civic retrieval using Fine timing measurement procedure**

Within the Fine Timing Measurement procedure, a STA, to request the LCI of an AP that advertises Fine Timing Measurement capability (see 8.4.2.26), shall include a Measurement Request element with Measurement Type equal to LCI request within the Fine Timing Measurement Request frame.

Within the Fine Timing Measurement procedure, a STA, to request the Location Civic of an AP that advertises Fine Timing Measurement capability (see 8.4.2.26), shall include a Measurement Request element with Measurement Type equal to Location Civic request within the Fine Timing Measurement Request frame.

When an AP that has dot11FineTimingMsmtActivated equal to true receives a Measurement Request element with Measurement Type equal to LCI request within a Fine Timing Measurement Request frame, the AP shall include a Measurement Report element with Measurement Type equal to LCI report in the following Fine Timing Measurement frame. If the LCI information is unknown, the AP shall indicate an unknown LCI following the format defined in 8.4.2.21.10.

When an AP that has dot11FineTimingMsmtActivated equal to true receives a Measurement Request element with Measurement Type equal to Location Civic request within a Fine Timing Measurement Request frame, the AP shall include a Measurement Report element with Measurement Type equal to Location Civic report in the following Fine Timing Measurement frame. If the Location Civic information is unknown, the AP shall indicate an unknown Civic address following the format defined in 8.4.2.21.13.

***Note to the modern reader, not for inclusion in the draft. This “without undue delay” language is merely following the precedent in 10.11.6 (Requesting and reporting of measurements)***

Each Measurement Report element returned shall have the same Measurement Token as in the corresponding Measurement Request element. The Fine Timing Measurement frame containing the Measurement Report element(s) should be returned without undue delay to the STA.

***The following is largely new content in r1***

***Insert new row and renumber***

**Table 8-66—Measurement Type definitions for measurement requests**

|  |  |  |
| --- | --- | --- |
| Name | Measurement Type | Measurement Use |
| Fine Timing Measurement range request | <ANA> | Radio Measurement, Spectrum Management,  and WNM |
| Reserved | <ANA+1>-254 | N/A |

8.4.2.20.18a Fine Timing Measurement range request

The Measurement Request field corresponding to a Fine Timing Measurement range request is shown in Figure 8-163a.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Randomization Interval | Minimum AP Count | Neighbor Report subelements | Optional subelements |
| Octets: | 2 | 1 | Variable | Variable |

Figure 8-163a: Measurement Request field for a Fine Timing Measurement range request

Randomization Interval specifies the upper bound of the random delay to be used prior to making the

measurement, expressed in units of TUs. See 10.11.3 (Measurement start time).

Minimum AP Count is the minimum number of Fine Timing Measurement ranges between the requested STA and the APs listed in the Neighbor Report subelements field that are requested. The value of 0 is reserved.

The Neighbor Report subelements field is a concatenation of at least Minimum AP Count Neighbor Report subelements. Each Neighbor Report subelement has the same format as the Neighbor Report element. See 8.4.2.36. The Neighbor Report subelements field specifies a superset of nearby APs with which the requested STA is requested to perform the Fine Timing Measurement procedure (see 10.11.9.10a Fine Timing Measurement range report).

The Optional Subelements field format contains zero or more subelements, each consisting of a 1-octet

Subelement ID field, a 1-octet Length field, and a variable-length Data field, as shown in Figure 8-516

(Subelement format). Any optional subelements are ordered by nondecreasing Subelement ID.

Table 8-90—Measurement Type definitions for measurement reports

|  |  |  |
| --- | --- | --- |
| Name | Measurement Type | Measurement Use |
| Fine Timing Measurement range report | <ANA> | Radio Measurement, Spectrum Management,  and WNM |
| Reserved | <ANA+1>-255 | N/A |

8.4.2.21.17a Fine Timing Measurement range report

The format of the Measurement Report field corresponding to a Fine Timing Measurement range report is shown in Figure 8-173a.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | M x 16 |  | N x 11 |  |
|  | Range Entry Count | Range Entry | Error Entry Count | Error Entry | Optional subelements |
| Octets: | 1 |  |  |  | Variable |

Figure 8-173a – Measurement Report field format for a Fine Timing Measurement range report

The Range Entry Count field indicates the number of Range Entry fields (i.e. M in Figure 8-173a).

The Range Entry field indicates parameters relating to a range measurement with a single AP, and is formatted according to Figure 8-173b.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Measurement Start Time | BSSID | Range | Max Range Error | Reserved |
| Octets: | 4 | 6 | 3 | 2 | 1 |

Figure 8-173b: Range Entry field format

The Measurement Start Time is the lower 4 octets of the TSF (synchronized with the associated AP) at the time (+-32us) at which the first Fine Timing Measurement frame was transmitted where the timestamps of both the frame and response frame were successfully measured.

The BSSID field contains the BSSID of the AP whose range is being reported.

The Range field indicates the estimated range between the requested STA and the AP using the Fine Timing Measurement procedure, in units of 1/256 meters. A value of 224-1 indicates a range of (224-1)/256 meters or higher. See 10.11.9.10a (Fine Timing Measurement range report).

The Max Range Error field contains an upper bound for the error in the value specified in the Range field, in units of 1/256 meters. A value of zero indicates an unknown error. A value of 216-1 indicates a maximum range error of (216-1)/256 meters or higher. For instance, a value of 512 in the Max Range Error field indicates that the value in the Range field has a maximum error of ± 2 m.

The Error Entry Count field indicates the number of Error Entry fields (i.e. N in Figure 8-173a).

The Error Entry field indicates parameters relating to a failed range measurement with a single AP, and is formatted according to Figure 8-173c.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Measurement Start Time | BSSID | Error Code |
| Octets: | 4 | 6 | 1 |

Figure 8-173c: Error Entry field format

The Measurement Start Time is the lower 4 octets of the TSF (synchronized with the associated AP) at the time (+-32us) at which the Fine Toming Measurement failure was first detected.

The BSSID field contains the BSSID of the AP whose range was attempted to be measured

The Error Code field is defined in Table 8-173d.

Table 8-173d

|  |  |
| --- | --- |
| Error Code | Meaning |
| 0-2 | Reserved |
| 3 | AP reported “Request incapable” |
| 4 | AP reported “Request failed. Do not send new request for a specified period” |
| 5-7 | Reserved |
| 8 | Unable to detect AP |
| 9-255 | Reserved |

The Optional Subelements field format contains zero or more subelements, each consisting of a 1-octet

Subelement ID field, a 1-octet Length field, and a variable-length Data field, as shown in Figure 8-516

(Subelement format). Any optional subelements are ordered by nondecreasing Subelement ID.

10.11.9.10a Fine Timing Measurement range report

The Fine Timing Measurement range report provides a means for a requesting STA to request a non-AP STA that has dot11FineTimingMsmtActivated equal to true to measure and report the ranges between the non-AP STA and other nearby APs where the ranges are determined using the Fine Timing Measurement procedure (see 10.24.6 (Fine timing measurement procedure)).

If a non-AP STA that has dot11FineTimingMsmtActivated equal to true accepts a Fine Timing Measurement range request, the non-AP STA shall wait a random delay up to Randomization Interval in the Measurement Request element (see 10.11.3 (Measurement start time)) then initiate the Fine Timing Measurement procedure with at least Minimum AP Count APs listed in the Neighbor Report subelements field in the Measurement Request field. The non-AP STA should continue to initiate the Fine Timing Measurement procedure with listed APs until either the non-AP STA has successfully measured the range between the non-AP STA and at least Minimum AP Count APs or has attempted the Fine Timing Measurement procedure with all listed APs. The non-AP STA shall also record error entries for each failed Fine Timing Measurement procedure with an AP.

For procedures related to listed APs that operate on non-operating channels, see 10.11.2 (Measurement on operating and nonoperating channels).

The non-AP STA shall transform the measurements obtained from each Fine Timing Measurement procedure with an AP into a range and a maximum error between itself and the AP, while accounting for any clock offsets between the non-AP STA and the AP.

At the completion of all the Fine timing measurement procedures and transformations, the non-AP STA shall send the all computed range information between itself and other APs, and all error entries, to the requesting STA using a Measurement Report element with Measurement Type equal to Fine Timing Measurement range in a Measurement Report frame.

A requesting STA may request a single set of range measurements by setting the Number of Repetitions field to 0 in the Measurement Request frame, or request a regular sequence of range measurements by

* setting the Number of Repetitions field greater than 0 in the Measurement Request frame, and
* including a Measurement Request element with Measurement Type equal to Fine Timing Measurement range request and a Measurement Request element with Measurement Type equal to Measurement pause request (see 10.11.9.7 (Measurement pause)).

B.4.19 WNM extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | Protocol capability | References | Status | Support |
| WNM23 (#46)  WNM23.1  WNM23.2  WNM23.3  WNM23.4  WNM23.5  WNM23.6 | Fine Timing Measurement  Fine Timing Measurement Request  (including LCI and/or Location Civic request)  Fine Timing Measurement (including LCI and/or Location Civic report)  Request neighbor LCI and/or Civic locations within Neighbor Report Request  Report neighbor LCI and/or Civic locations within Neighbor Report Reponse  Initiator of Measurement request/report with type equal to Fine Timing Measurement range request/report  Responder of Measurement request/report with type equal to Fine Timing Measurement range request/report | 10.24.6 (Fine  timing  measurement  procedure(#46  ))  8.6.8.25 (Fine  Timing  Measurement  Request frame  format(#46))  8.6.8.26 (Fine  Timing  Measurement  frame  format(#46))  10.11.10.2 (Requesting a neighbor report)  10.11.10.2 (Requesting a neighbor report)  10.24.6.2 (LCI and Location Civic retrieval using Fine timing measurement procedure)  10.24.6.2 (LCI and Location Civic retrieval using Fine timing measurement procedure) | CF19:O  WNM23:M  WNM23:M  (CF2 OR CF21) AND WNM23:M  CF1 AND WNM23:M  WNM23:M  (CF2 OR CF21) AND WNM23:M | Yes □ No □ N/A □  Yes □ No □ N/A □  Yes □ No □ N/A □  Yes □ No □ N/A □  Yes □ No □ N/A □  Yes □ No □ N/A □  Yes □ No □ N/A □ |