



**IEEE Standard for
Information technology—
Telecommunications and information
exchange between systems—
Local and metropolitan area networks—
Specific requirements**

**Part 11: Wireless LAN Medium Access Control (MAC)
and Physical Layer (PHY) Specifications**

**Amendment 1: Radio Resource Measurement of
Wireless LANs**

IEEE Computer Society

Sponsored by the
LAN/MAN Standards Committee

IEEE
3 Park Avenue
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(Amendment to
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Approved 9 May 2008

IEEE SA-Standards Board

Abstract: This amendment specifies the extensions to IEEE Std 802.11 for Wireless LANs providing mechanisms for Radio Resource Measurement.

Keywords: local area network (LAN), measurement, network management, radio, radio resource

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Introduction

This introduction is not part of IEEE Std 802.11k-2008, IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications—Amendment 1: Radio Resource Measurement of Wireless LANs.

Radio Resource Measurement is a key enabler to the next generation of Wireless LANs (WLANs). Radio Resource Measurement addresses some of the existing issues in using unlicensed radio environments to meet the requirements of emerging technologies. In addition, Radio Resource Measurement provides knowledge about the radio environment to improve performance and reliability.

The existing WLAN measurements and information about them are inadequate to move ahead to the next generation of WLAN. The proposed Radio Resource Measurement approach is to add measurements that extend the capability, reliability, and maintainability of WLANs through measurements and provide that information to upper layers in the communications stack. In addition, there are new applications that require quantifiable radio environment measurements in order to attain the necessary performance. These applications include voice over Internet Protocol (VoIP), video over IP, location based applications, as well as applications requiring mitigation of harsh radio environments (multifamily dwellings, airplanes, factories, municipalities, etc.).

WLAN Radio Resource Measurement addresses the MAC, the SME, the MLME primitives, the MIB, and the interface to upper layers. The Radio Resource Measurement scope is to define Radio Measurements and to provide mechanisms to higher layers for radio and network measurements. This amendment provides these mechanisms using request/response queries and an Object Identifier (OID) interface to upper layers in the MIB.

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IEEE Standard for
Information technology—
Telecommunications and information
exchange between systems—
Local and metropolitan area networks—
Specific requirements

Part 11: Wireless LAN Medium Access Control (MAC)
and Physical Layer (PHY) Specifications

Amendment 1: Radio Resource Measurement of Wireless LANs

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NOTE—The editing instructions contained in this amendment define how to merge the material contained herein into the existing base standard to form the new comprehensive standard.

The editing instructions are shown in **bold italic**. Four editing instructions are used: change, delete, insert and replace. **Change** is used to make small corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed either by using ~~strike through~~ (to remove old material) or underscore (to add new material). **Delete** removes existing material. **Insert** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. **Replace** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editing instructions, change markings, and this NOTE will not be carried over into future editions because the changes will be incorporated into the base standard.

2. Normative references

Insert the following reference in alphanumeric order:

IETF RFC 3825, Dynamic Host Configuration Protocol Option for Coordinate-based Location Configuration Information, Polk, J., Schnizlein, J., Linsner, M., July 2004.

3. Definitions

Insert the following definitions in alphabetical order, renumbering as necessary:

3.173 access point (AP) reachability: An AP is reachable by a STA if pre-authentication messages can be exchanged between the STA and the target AP via the DS.

NOTE—As defined in 8.4.6.1.¹

¹ Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.

3.174 antenna connector: The measurement point of reference for RF measurements in a STA. The antenna connector is the point in the STA architecture representing the input of the receiver (output of the antenna) for radio reception and the input of the antenna (output of the transmitter) for radio transmission. In systems using multiple antennas or antenna arrays, the antenna connector is a virtual point representing the aggregate output of (or input to) the multiple antennas. In systems using active antenna arrays with processing, the antenna connector is the output of the active array, which includes any processing gain of the active antenna subsystem.

3.175 average noise power indicator (ANPI): A MAC indication of the average noise plus interference power measured when the channel is idle as defined by three simultaneous conditions: 1) the Virtual CS mechanism indicates idle channel, 2) the STA is not transmitting a frame, and 3) the STA is not receiving a frame.

3.176 azimuth: The horizontal orientation of the front surface of a station or of a radio antenna system's main lobe measured clockwise from True North.

3.177 basic service set (BSS) transition: A STA movement from one BSS to another BSS in the same ESS.

3.178 extended service set (ESS) transition: A STA movement from one BSS in one ESS to another BSS in a different ESS.

3.179 idle power indicator (IPI): A PHY indication of the total channel power (noise and interference) as measured in the channel at the receiving antenna connector while the STA is idle, i.e., neither transmitting nor receiving a frame.

3.180 LCI subject local: The term used when the LCI request is for the location of the requesting STA, i.e., when the requesting STA asks "Where am I?".

3.181 LCI subject remote: The term used when the LCI request is for the location of the reporting STA, i.e., when the requesting STA asks "Where are you?".

3.182 location configuration information (LCI): As defined in IETF RFC 3825: includes latitude, longitude, and altitude, with resolution indicators for each.

NOTE—Information on references can be found in Clause 2.

3.183 neighbor AP: Any AP that is a potential service set transition candidate.

3.184 non-operating channel: A channel that is not the operating channel of the BSS or IBSS of which the STA is a member.

3.185 operating channel: The operating channel is the channel used by the serving AP of the BSS to transmit beacons. In an IBSS, the operating channel is the channel used by the IBSS DFS owner to transmit beacons.

3.186 received channel power indicator (RCPI): An indication of the total channel power (signal, noise, and interference) of a received IEEE 802.11™ frame measured on the channel and at the antenna connector used to receive the frame.

3.187 received signal to noise indicator (RSNI): An indication of the signal to noise plus interference ratio of a received IEEE 802.11 frame. RSNI is defined by the ratio of the received signal power (RCPI-ANPI) to the noise plus interference power (ANPI) as measured on the channel and at the antenna connector used to receive the frame.

NOTE—RCPI and ANPI might not be measured simultaneously; see 11.10.8.4 for details.

3.188 service set transition: A STA movement from one BSS to another BSS, i.e., either a BSS transition or an ESS transition.

3.189 serving AP: The AP to which the STA is associated.

3.190 validated AP: An AP that has either been explicitly configured as a Neighbor or learned through a mechanism like the Beacon Report.

3.191 wildcard BSSID: A special BSSID value (all binary 1s) used to represent all BSSIDs.

3.192 wildcard SSID: A special SSID value (null) used to represent all SSIDs.

4. Abbreviations and acronyms

Insert the following acronyms in alphabetical order:

ANPI average noise power indicator

IPI idle power indicator

LCI location configuration information

RCPI received channel power indicator

RFC request for comments

RSNI received signal to noise indicator

TMPTT target measurement pilot transmission time

VoIP voice over Internet Protocol (IP)

5. General description

5.2 Components of the IEEE 802.11 architecture

Insert the following subclauses after 5.2.6:

5.2.7 Wireless LAN Radio Measurements

Wireless LAN (WLAN) Radio Measurements enable STAs to understand the radio environment in which they exist. WLAN Radio Measurements enable STAs to observe and gather data on radio link performance and on the radio environment. A STA may choose to make measurements locally, request a measurement from another STA, or may be requested by another STA to make one or more measurements and return the results. Radio Measurement data is made available to STA management and upper protocol layers where it may be used for a range of applications. The measurements enable adjustment of STA operation to better suit the radio environment. The Radio Resource Measurement service includes measurements that extends the capability, reliability, and maintainability of WLANs by providing standard measurements across vendors, and provides the resulting measurement data to upper layers in the communications stack.

In addition to featuring standard measurements and delivering measurement information to upper layers, there are applications that require quantifiable radio environment measurements in order to attain the necessary performance levels. These applications include VoIP, video over IP, location based applications, as well as applications requiring mitigation of harsh radio environments (multifamily dwellings, airplanes, factories, municipalities, etc.). Radio Measurements address most of the existing issues in using unlicensed radio spectrum to meet the requirements of these emerging technologies.

To address the mobility requirements of technologies, such as VoIP and video streaming, Radio Measurements, such as Channel Load request/report and the Neighbor request/report, may be used to collect pre-handoff information, which can drastically speed up handoffs between cells within the same ESS. By accessing and using this information, the STAs (either in the APs or in the individual devices) can make intelligent decisions about the most effective way to utilize the available spectrum, power, and bandwidth for its desired communications.

The request/report measurements are as follows:

- Beacon
- Frame
- Channel Load
- Noise Histogram
- STA Statistics
- Location Configuration Information (LCI)
- Neighbor Report
- Link Measurement
- Transmit Stream/Category Measurement

The request-only mechanism is:

- Measurement Pause

The report-only mechanism is:

- Measurement Pilot

These measurement mechanisms provide the capability for a STA to manage and query its radio environment, and to make appropriate assessments about its health and efficiency. It is the first step in making WLAN smart and capable of making appropriate decisions for fast transition, for mesh connectivity, and for managing the radio environment for all wireless devices.

5.2.7.1 Beacon

The Beacon request/report pair enables a STA to request from another STA a list of APs it can receive on a specified channel or channels. This measurement may be done by active mode (like active scan), passive mode (like passive scan), or beacon table modes. If the measurement request is accepted and is in passive mode, a duration timer is set and the measuring STA monitors the requested channel, measures beacon, probe response, and measurement pilot power levels (RCPI), and logs all beacons, probe responses, and measurement pilots received within the measurement duration. If the measurement request is in active mode, the measuring STA sends a probe request on the requested channel at the beginning of the measurement duration, then monitors the requested channel, measures beacon, probe response, and measurement pilot power levels (RCPI), and logs all beacons, probe responses, and measurement pilots received within the measurement duration. If the request is beacon table mode, then the measuring STA returns a Beacon Report containing the current contents of any stored beacon information for any supported channel with the requested SSID and BSSID without performing additional measurements.

5.2.7.2 Measurement Pilot

The Measurement Pilot frame is a compact Action frame transmitted periodically by an AP at a small interval relative to a Beacon Interval. The Measurement Pilot frame provides a subset of the information provided in a Beacon frame, is smaller than a Beacon, and is transmitted more often than a Beacon. The purpose of the Measurement Pilot frame is to assist a STA with scanning.

5.2.7.3 Frame

The frame request/report pair returns a picture of all the channel traffic and a count of all the frames received at the measuring STA. For each unique Transmitter Address, the STA reports the Transmitter Address, number of frames received from this transmitter, average power level (RCPI) for these frames, and BSSID of the transmitter.

5.2.7.4 Channel load

The channel load request/report pair returns the channel utilization measurement as observed by the measuring STA.

5.2.7.5 Noise histogram

The noise histogram request/report pair returns a power histogram measurement of non-IEEE 802.11 noise power by sampling the channel when virtual carrier sense indicates idle and the STA is neither transmitting nor receiving a frame.

5.2.7.6 STA statistics

The STA statistics request/report pair returns groups of values for STA counters and for BSS Average Access Delay. The STA counter group values include: transmitted fragment counts, multicast transmitted frame counts, failed counts, retry counts, multiple retry counts, frame duplicate counts, Request to Send (RTS) success counts, RTS failure counts, Acknowledgement (ACK) failure counts, received fragment counts, multicast received frame counts, FCS error counts, and transmitted frame counts. BSS Average Access Delay group values include: AP average access delay, average access delay for each access category, associated STA count, and channel utilization

5.2.7.7 Location

The Location request/report pair returns a requested location in terms of latitude, longitude, and altitude. It includes types of altitude such as floors and permits various reporting resolutions. The requested location may be the location of the requestor (e.g., Where am I?) or the location of the reporting STA (e.g., Where are you?)

5.2.7.8 Measurement pause

The measurement pause request is defined, but no report comes back from this request. The measurement pause permits the inclusion of a quantified delay between the execution of individual measurements that are provided in a series within a measurement request frame. The measurement pause used as the last measurement in a frame provides control of the measurement period when measurement request frames are to be repeated.

5.2.7.9 Neighbor report

The neighbor report request is sent to an AP, which returns a neighbor report containing information about known neighbor APs that are candidates for a service set transition. Neighbor reports contain information

from the table dot11RRMNeighborReportTable in the MIB concerning neighbor APs. This request/report pair enables a STA to gain information about the neighbors of the associated AP to be used as potential roaming candidates.

5.2.7.10 Link measurement

The link measurement request/report exchange provides measurements of the RF characteristics of a STA to STA link. This measurement indicates the instantaneous quality of a link.

5.2.7.11 Transmit stream/category measurement

The Transmit Stream/Category measurement is a request/report pair that enables a QoS STA to inquire of a peer QoS STA the condition of an ongoing traffic stream link between them. The Transmit Stream/Category Measurement Report provides the transmit-side performance metrics for the measured traffic stream. Trigger conditions included in the Transmit Stream/Category Measurement Request may initiate triggered Transmit Stream/Category Measurement Reports upon detection of the trigger condition.

5.3 Logical service interfaces

Change the list of architectural services in 5.3 as follows:

- a) Authentication
- b) Association
- c) Deauthentication
- d) Disassociation
- e) Distribution
- f) Integration
- g) Data confidentiality
- h) Reassociation
- i) MSDU delivery
- j) DFS
- k) TPC
- l) Higher layer timer synchronization (QoS facility only)
- m) QoS traffic scheduling (QoS facility only)
- n) Radio measurement

5.3.1 Station service (SS)

Change the list of station services (SSs) in 5.3.1 as follows:

- a) Authentication
- b) Deauthentication
- c) Data confidentiality
- d) MSDU delivery
- e) DFS
- f) TPC
- g) Higher layer timer synchronization (QoS facility only)
- h) QoS traffic scheduling (QoS facility only)
- i) Radio measurement

5.4 Overview of the services

Change the first paragraph as follows:

There are many services specified by IEEE Std 802.11. Six of the services are used to support medium access control (MAC) service data unit (MSDU) delivery between STAs. Three of the services are used to control IEEE 802.11 LAN access and confidentiality. Two of the services are used to provide spectrum management. One of the services provides support for LAN applications with QoS requirements. Another of the services provides support for higher layer timer synchronization. One of the services is used for radio measurement.

Insert the following subclause after 5.4.6:

5.4.7 Radio measurement service

The Radio Measurement Service provides the following:

- The ability to request and report radio measurements in supported channels.
- The ability to perform radio measurements in supported channels.
- An interface for upper layer applications to retrieve radio measurements using MLME primitives and/or MIB access.
- Information about neighbor APs.

7. Frame formats

7.2 Format of individual frame types

7.2.3 Management frames

7.2.3.1 Beacon frame format

Change the first paragraph and Table 7-8 as follows:

The frame body of a management frame of subtype Beacon contains the information shown in Table 7-8. ~~If the dot11MultiDomainCapabilityEnabled attribute is true, a STA shall include a Country information element in the transmission of Beacon frames. Optionally, the Beacon frame format may also include the information described in either or both of FH Parameters and FH Pattern Table elements. If both FH Parameters and FH Pattern Table elements are sent, they shall describe the same hopping pattern. Note that the information described in FH Parameters and FH Pattern Table elements also may be contained in the Probe Response frame~~

Table 7-8—Beacon frame body

Order	Information	Notes
11	Country	The Country element ~~is shall be~~ present if ~~when~~ dot11MultiDomainCapabilityEnabled is true or dot11SpectrumManagementRequired is true; ~~or~~ <u>dot11RadioMeasurementEnabled is true.</u>
14	Power Constraint	The Power Constraint element ~~is shall be~~ present if dot11SpectrumManagementRequired is true; ~~and can be present if~~ <u>dot11RadioMeasurementEnabled is true.</u>
16	Quiet	The Quiet element ~~can may~~ be present if dot11SpectrumManagementRequired is true; ~~or~~ <u>dot11RadioMeasurementEnabled is true.</u>
18	TPC Report	The TPC Report element ~~is shall be~~ present if dot11SpectrumManagementRequired is true; ~~or~~ <u>dot11RadioMeasurementEnabled is true.</u>
<u>25</u>	<u>AP Channel Report</u>	If dot11RRMAPChannelReportEnabled is true, one AP Channel Report element is present for each regulatory class that has at least 1 channel to report.
<u>26</u>	<u>BSS Average Access Delay</u>	The BSS Average Access Delay element is present if <u>dot11RRMBSSAverageAccessDelayEnabled is true and the value of the AP Average Access Delay field is not equal to 255 (measurement not available); otherwise, the BSS Average Access Delay element can be present if</u> <u>dot11RRMBSSAverageAccessDelayEnabled is true.</u>
<u>27</u>	<u>Antenna Information</u>	The Antenna Information element is present if <u>dot11RRMAntennaInformationEnabled is true and the value of the Antenna ID field is not equal to 0 (unknown antenna); otherwise, the Antenna Information element can be present if</u> <u>dot11RRMAntennaInformationEnabled is true.</u>
<u>28</u>	<u>BSS Available Admission Capacity</u>	The BSS Available Admission Capacity element is present if <u>dot11RRMBSSAvailableAdmissionCapacityEnabled is true with the following exceptions: 1) when Available Admission Capacity Bitmask equals 0 (Available Admission Capacity List contains no entries), or 2) when the BSS Load element is present and the Available Capacity Bitmask equals 256 (Available Admission Capacity List contains only the AC VO entry).</u>
<u>29</u>	<u>BSS AC Access Delay</u>	The BSS AC Access Delay element is present if <u>dot11RRMBSSAverageAccessDelayEnabled is true and at least one field of the element is not equal to 255 (measurement not available); otherwise, the BSS AC Access Delay element can be present if</u> <u>dot11RRMBSSAverageAccessDelayEnabled is true.</u>
<u>30</u>	<u>Measurement Pilot Transmission Information</u>	The Measurement Pilot Transmission Information is present if <u>dot11RRMMeasurementPilotCapability is set to a value between 2 and 7.</u>

Table 7-8—Beacon frame body (continued)

Order	Information	Notes
<u>31</u>	<u>Multiple BSSID</u>	The Multiple BSSID element is present if <u>dot11RRMMeasurementPilotCapability</u> is set to a value between 2 and 7 and the AP is a member of a Multiple BSSID Set (see 11.10.1) with two or more members.
<u>32</u>	<u>RRM Enabled Capabilities</u>	RRM Enabled Capabilities element is present if <u>dot11RadioMeasurementEnabled</u> is true.

7.2.3.4 Association Request frame format

Change order 6 and insert order 10 in Table 7-10 as follows:

Table 7-10—Association Request frame body

Order	Information	Notes
6	Power Capability	The Power Capability element ~~is shall be~~ present if <u>dot11SpectrumManagementRequired</u> is true ~~or~~ <u>dot11RadioMeasurementEnabled</u> is true.
<u>10</u>	<u>RRM Enabled Capabilities</u>	<u>RRM Enabled Capabilities element is present if dot11RadioMeasurementEnabled is true.</u>

7.2.3.5 Association Response frame format

Insert orders 7–9 into Table 7-11 as follows:

Table 7-11—Association Response frame body

Order	Information	Notes
7	RCPI	The RCPI information element is present if <u>dot11RRMRCPIMeasurementEnabled</u> is true.
8	RSNI	The RSNI information element is present if <u>dot11RRMRSNIMeasurementEnabled</u> is true.
9	RRM Enabled Capabilities	RRM Enabled Capabilities element is present if <u>dot11RadioMeasurementEnabled</u> is true.

7.2.3.6 Reassociation Request frame format

Change order 7 and insert order 11 into Table 7-12 as follows:

Table 7-12—Reassociation Request frame body

Order	Information	Notes
7	Power Capability	The Power Capability element ~~is shall be~~ present if dot11SpectrumManagementRequired is true; <u>or dot11RadioMeasurementEnabled is true.</u>
<u>11</u>	<u>RRM Enabled Capabilities</u>	<u>RRM Enabled Capabilities element is present if dot11RadioMeasurementEnabled is true.</u>

7.2.3.7 Reassociation Response frame format

Insert orders 7–9 into Table 7-13 as follows:

Table 7-13—Reassociation Response frame body

Order	Information	Notes
7	RCPI	The RCPI information element is present if dot11RRMRCPIMeasurementEnabled is true.
8	RSNI	The RSNI information element is present if dot11RRMRSNIMeasurementEnabled is true.
9	RRM Enabled Capabilities	RRM Enabled Capabilities element is present if dot11RadioMeasurementEnabled is true.

7.2.3.8 Probe Request frame format

Insert order 5 in Table 7-14 as follows:

Table 7-14—Probe Request frame body

Order	Information	Notes
5	DS Parameter Set	The DS Parameter Set information element is present within Probe Request frames generated by STAs using Clause 15, Clause 18, or Clause 19 PHYs if dot11RadioMeasurementEnabled is true. The DS Parameter Set information element can be present within Probe Request frames generated by STAs using Clause 15, Clause 18, or Clause 19 PHYs if dot11RadioMeasurementEnabled is false.

7.2.3.9 Probe Response frame format

Change the first paragraph and delete the second paragraph as follows:

The frame body of a management frame of subtype Probe Response contains the information shown in Table 7-15. ~~If the dot11MultiDomainCapabilityEnabled attribute is true, the Probe Response frame contains a Country information element and all information elements identified by the Requested Element IDs of a Request information element. Note that the information returned as a result of a Probe Request frame with a Request information element may include the FH parameters and/or the FH Pattern Table possibly replicating optional elements identified by orders 12 and 13. See additional details and procedures in 9.8.2.1 and 11.1.3, respectively.~~

~~A STA shall return only the information elements that it supports. In an improperly formed Request information element, a STA may ignore the first information element requested that is not ordered properly and all subsequent information elements requested. In the probe response frame, the STA shall return the requested information elements in the same order as requested in the Request information element.~~

Change orders 10, 13, 15, 17, and Last-n, and insert orders 23–30 in Table 7-15 as follows:

Table 7-15—Probe Response frame body

Order	Information	Notes
10	Country	Included if dot11MultiDomainCapabilityEnabled <u>is true</u> or dot11SpectrumManagementRequired <u>is true</u> ; <u>or</u> dot11RadioMeasurementEnabled <u>is true</u> .
13	Power Constraint	~~Shall be included~~ Included if dot11SpectrumManagementRequired <u>is true</u> ; <u>and can be included if dot11RadioMeasurementEnabled is true.</u>
15	Quiet	~~May~~ Can be included if dot11SpectrumManagementRequired <u>is true</u> ; <u>or if dot11RadioMeasurementEnabled is true.</u>
17	TPC Report	~~Shall be included~~ Included if dot11SpectrumManagementRequired <u>is true</u> ; <u>or dot11RadioMeasurementEnabled is true.</u>
<u>23</u>	<u>Measurement Pilot Transmission Information</u>	Included if dot11RRMMeasurementPilotCapability <u>is set to a value between 2 and 7.</u>
<u>24</u>	<u>Multiple BSSID</u>	Included if dot11RRMMeasurementPilotCapability <u>is set to a value between 2 and 7 and the AP is a member of a Multiple BSSID Set (see 11.10.11) with two or more members.</u>
<u>25</u>	<u>RRM Enabled Capabilities</u>	RRM Enabled Capabilities element <u>is present if dot11RadioMeasurementEnabled is true.</u>
<u>26</u>	<u>AP Channel Report</u>	If dot11RRMAPChannelReportEnabled <u>is true, one AP Channel Report element can be present for each regulatory class that has at least 1 channel to report.</u>
<u>27</u>	<u>BSS Average Access Delay</u>	The BSS Average Access Delay element <u>can be present if dot11RRMBSSAverageAccessDelayEnabled is true and the value of the AP Average Access Delay field is not equal to 255 (measurement not available).</u>

Table 7-15—Probe Response frame body (continued)

Order	Information	Notes
<u>28</u>	<u>Antenna Information</u>	<u>The Antenna Information element can be present if dot11RRMAntennaInformationEnabled is true and the value of the Antenna ID field is not equal to 0 (unknown antenna).</u>
<u>29</u>	<u>BSS Available Admission Capacity</u>	<u>The BSS Available Admission Capacity element can be present if dot11RRMBSSAvailableAdmissionCapacityEnabled is true with the following exceptions: 1) when Available Admission Capacity Bitmask equals 0 (Available Admission Capacity List contains no entries), or 2) when the BSS Load element is present and the Available Capacity Bitmask equals 256 (Available Admission Capacity List contains only the AC_VO entry).</u>
<u>30</u>	<u>BSS AC Access Delay</u>	<u>The BSS AC Access Delay element can be present if dot11RRMBSSAverageAccessDelayEnabled is true and at least one field of the element is not equal to 255 (measurement not available).</u>
Last- <i>n</i>	Requested information elements	Elements requested by the Request information element of the Probe Request frame: <u>are included if dot11MultiDomainCapabilityEnabled is true. See 11.1.3.2.1.</u>

7.3 Management frame body components

7.3.1 Fields that are not information elements

7.3.1.4 Capability Information field

Change the contents of Figure 7-22 as follows:

B0	B1	B2	B3	B4	B5	B6	B7
ESS	IBSS	CF Pollable	CF-Poll Request	Privacy	Short Preamble	PBCC	Channel Agility

B8	B9	B10	B11	B12	B13	B14	B15
Spectrum Mgmt	QoS	Short Slot Time	APSD	~~Reserved~~ <u>Radio Measurement</u>	DSSS-OFDM	Delayed Block Ack	Immediate Block Ack

Figure 7-22—Capability Information field

Insert the following text at the end of 7.3.1.4:

A STA sets the Radio Measurement subfield in the Capability Information field to 1 when the MIB attribute dot11RadioMeasurementEnabled is true, and sets it to 0 otherwise.

7.3.1.11 Action field

Insert the following rows into Table 7-24 and change the reserved value as shown:

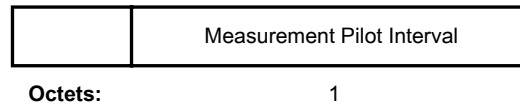
Table 7-24—Category values

Code	Meaning	See subclause
<u>4</u>	<u>Public</u>	<u>7.4.7</u>
<u>5</u>	<u>Radio measurement</u>	<u>7.4.6</u>
<u>46</u> –126	Reserved	—

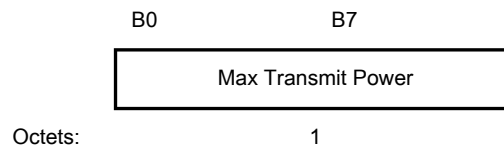
Insert the following subclauses after 7.3.1.17:

7.3.1.18 Measurement Pilot Interval field

The Measurement Pilot Interval field represents the number of time units (TUs) between target measurement pilot transmission times (TMPTTs). The length of the Measurement Pilot Interval field is 1 octet. The Measurement Pilot Interval field is illustrated in Figure 7-36a.

**Figure 7-36a—Measurement Pilot Interval fixed field****7.3.1.19 Max Transmit Power field**

The Max Transmit Power field is a 2's complement signed integer and is 1 octet in length, providing an upper limit, in units of dBm, on the transmit power as measured at the output of the antenna connector to be used by that AP on the current channel. The maximum tolerance for the value reported in Max Transmit Power field shall be 5 dB. The value of the Max Transmit Power field shall be less than or equal to the Max Regulatory Power value for the current channel. The Max Transmit Power field is illustrated in Figure 7-36b.

**Figure 7-36b—Max Transmit Power field****7.3.1.20 Transmit Power Used field**

The Transmit Power Used field is a 2's complement signed integer and is 1 octet in length. It shall be less than or equal to the Max Transmit Power and indicates the actual power used as measured at the output of the antenna connector, in units of dBm, by a STA when transmitting the frame containing the Transmit

Power Used field. The Transmit Power Used value is determined anytime prior to sending the frame in which it is contained and has a tolerance of ± 5 dB. The Transmit Power Used field is illustrated in Figure 7-36c.

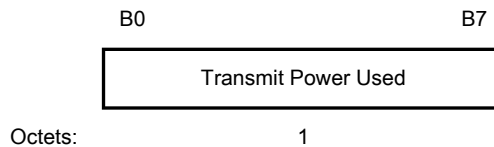


Figure 7-36c—Transmit Power Used field

7.3.2 Information elements

Insert a column to the right of the Length column in Table 7-26 as shown. Insert Element IDs and change the Measurement Request, Measurement Report, and Reserved rows as follows:

Table 7-26—Element IDs

Information Element	Element ID	Length (in octets)	<u>Extensible</u>
Measurement Request (see 7.3.2.21)	38	5 to ~~4~~ <u>257</u>	<u>Subelements, for formats using 7.3.21.4 to 7.3.21.11.</u>
Measurement Report (see 7.3.2.22)	39	5 to ~~24~~ <u>257</u>	<u>Subelements, for formats using 7.3.22.4 to 7.3.22.10.</u>
<u>AP Channel Report (see 7.3.2.36)</u>	<u>51</u>	<u>3 to 257</u>	
<u>Neighbor Report (see 7.3.2.37)</u>	<u>52</u>	<u>15 to 257</u>	<u>Subelements</u>
<u>RCPI (see 7.3.2.38)</u>	<u>53</u>	<u>3</u>	<u>Yes</u>
<u>Reserved</u>	<u>54–62</u>		
<u>BSS Average Access Delay (see 7.3.2.39)</u>	<u>63</u>	<u>3</u>	<u>Yes</u>
<u>Antenna Information (see 7.3.2.40)</u>	<u>64</u>	<u>3</u>	<u>Yes</u>
<u>RSNI (see 7.3.2.41)</u>	<u>65</u>	<u>3</u>	<u>Yes</u>
<u>Measurement Pilot Transmission Information (see 7.3.2.42)</u>	<u>66</u>	<u>3 to 257</u>	<u>Subelements</u>
<u>BSS Available Admission Capacity (see 7.3.2.43)</u>	<u>67</u>	<u>4 to 28</u>	<u>Yes</u>
<u>BSS AC Access Delay (see 7.3.2.44)</u>	<u>68</u>	<u>6</u>	<u>Yes</u>
<u>Reserved</u>	<u>69</u>		
<u>RRM Enabled Capabilities (see 7.3.2.45)</u>	<u>70</u>	<u>7</u>	<u>Yes</u>

Table 7-26—Element IDs (continued)

Information Element	Element ID	Length (in octets)	<u>Extensible</u>
<u>Multiple BSSID (see 7.3.2.46)</u>	<u>71</u>	<u>3 to 257</u>	<u>Subelements</u>
Reserved	~~54~~ <u>72</u> –126		

Insert the following paragraph at the end of 7.3.2:

A Yes in the Extensible column of an element listed in Table 7-26 indicates that the Length of the element might be extended in future revisions or amendments of this standard. See 9.14.1. When the Extensible column of an element is set to Subelements, then the element might be extended in future revision or amendments of this standard by defining additional subelements. See 9.14.2.

7.3.2.12 Request information element

Delete the last paragraph, and add the following paragraph:

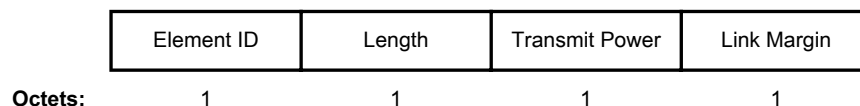
~~A STA shall return only those information elements that it supports. In an improperly formed Request information element, a STA may ignore the first information element requested that is not ordered properly and all subsequent information elements requested. In the probe response frame, the STA shall return the requested information elements in the same order requested in the Request information element of the probe request frame.~~

See 11.1.3.2.1 for additional requirements.

7.3.2.18 TPC Report element

Change 7.3.2.18 as follows:

The TPC Report element contains transmit power and link margin information sent in response to a TPC Request element or a Link Measurement Request frame. A TPC Report element is included in a Beacon frame or Probe Response frame without a corresponding request. The format of the TPC Report element is shown in Figure 7-55.

**Figure 7-55—TPC Report element format**

The Length field in octets is set to 2.

The Transmit Power field ~~is shall be~~ set to the transmit power used to transmit the frame containing the TPC Report element. The field is coded as a 2's complement signed integer in units of decibels relative to 1 mW. The maximum tolerance for the transmit power value reported in the TPC Response element shall be ± 5 dB. This tolerance is defined as the difference, in decibels, between the reported power value and the actual EIRP of the STA (~~measured~~ or maximum MPDU sized-frames, whichever is smaller).

The Link Margin field contains the link margin ~~for~~at the receive time and for the receive rate of ~~at which~~ the frame containing the TPC Request element or the Link Measurement Request frame~~was received~~. The field is coded as a 2's complement signed integer in units of decibels. The Link Margin field ~~shall be~~ is set to 0 and shall be ignored when a TPC Report element is included in a Beacon frame or Probe Response frame. The measurement method of Link Margin is beyond the scope of this standard.

The TPC Report element is included in TPC Report frames, as described in 7.4.1.4; Link Measurement Report frames as described in 7.4.6.4; Beacon frames, as described in 7.2.3.1; and Probe Response frames, as described in 7.2.3.9. The use of TPC Report elements and frames is described in 11.8.4.

7.3.2.21 Measurement Request element

Change 7.3.2.21 as follows:

The Measurement Request element contains a request that the receiving STA undertake the specified measurement action. The Measurement Request element is included in Spectrum Management Measurement Request frames as described in 7.4.1.1 or Radio Measurement Request frames as described in 7.4.6.1. Measurement Types 0, 1, and 2 are defined for spectrum management and shall only be included in Spectrum Management Measurement Request frames. The use of Measurement Request elements for spectrum management is described in 11.9.6. Measurement Types 3 through 9 and 255 are defined for radio measurement and shall only be included in Radio Measurement Request frames. The use of Measurement Request elements for radio measurement is described in 11.10.

The format of the Measurement Request element is shown in Figure 7-58.

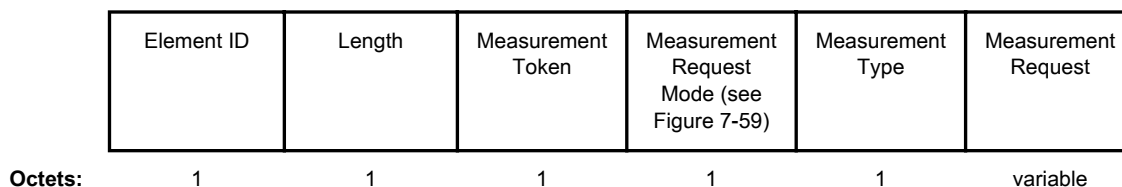


Figure 7-58—Measurement Request element format

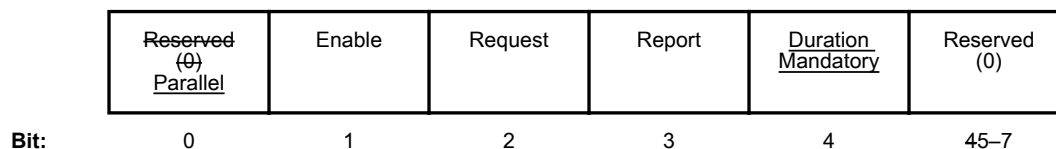


Figure 7-59—Measurement Request Mode field

The value of the Length field in octets is variable and depends on the length of the Measurement Request field. The minimum value of the Length field is 3 (based on a minimum length for the Measurement Request field of 0 octets).

The Measurement Token ~~is shall be~~ set to a nonzero number that is unique among the Measurement Request elements sent in a particular Measurement Request frame.

The Measurement Request Mode field (shown in Figure 7-59) is a bit field with the following bits defined:

- The Parallel bit (bit 0) is used to request that more than one measurement is to be started in parallel. Parallel is set to 1 to request that the measurement is to start at the same time as the measurement described by the next Measurement Request element in the same Measurement Request frame. Parallel is set to 0 if the measurements are to be performed in sequence. The Parallel bit is reserved when Enable is set to 1, in the last or only measurement request element in the frame, or when the value of the Measurement Type field is 0, 1, or 2 (Spectrum Management measurements). See 11.10.5.
- The Enable bit (bit 1) is used to differentiate between a request to make a measurement and a request to control the measurement requests and triggered or autonomous reports generated by the destination STA. The Enable bit is further described in Table 7-28, indicates whether this element is used to request the destination STA to enable or disable the sending of measurement requests and autonomous measurement reports of a specified type to this STA. The Enable bit shall be set to 1 when the Request bit and Report bit are valid. The Enable bit shall be set to 0 when the Request bit and Report bit are invalid.
- Request bit (bit 2) is described in Table 7-28, indicates whether the STA receiving the request shall enable or disable measurement requests of the type specified in the Measurement Type field. The Request bit shall be set to 1 when enabling a measurement request. The Request bit shall be set to 0 when disabling a measurement request or when the Request bit is invalid (i.e. when Enable bit is set to 0 or when the Measurement Type field contains a reserved measurement request type value).
- Report bit (bit 3) is described in Table 7-28, indicates whether the STA receiving the request shall enable or disable autonomous measurement reports of the type specified in the Measurement Type field. The Report bit shall be set to 1 when enabling an autonomous measurement report. The Report bit shall be set to 0 when disabling an autonomous measurement report or when the Report bit is invalid (i.e. when Enable bit is set to 0 or when the Measurement Type field contains a reserved measurement report type value).
- The Duration Mandatory bit (bit 4) indicates whether the measurement duration contained within the Measurement Request is interpreted as mandatory by the STA receiving the request. A value of 0 indicates that the duration requested is a maximum duration, and the requesting STA will accept measurement results taken over any shorter duration. A value of 1 indicates that the duration requested is a mandatory duration. The Duration Mandatory bit is reserved when the Enable bit is set to 1, or when the value of the Measurement Type field is 0, 1, 2, 8, or 255. See 11.10.3.
- All other bits are reserved and shall be set to 0.

The use of the Enable, Request, and Report bits is also summarized in Table 7-28. See 11.9.6 and 11.10.5 for the description of how a STA shall handle requests to enable or disable measurement requests and autonomous reports. See 11.10.7 for a description of the use of the Enable and Report bits in triggered reporting.

Table 7-28—Summary of use of Enable, Request, and Report bits

Bits			Meaning of bits Measurement request meaning
Enable	Request	Report	
0	0 Reserved	0 Reserved	The transmitting STA is requesting that the destination STA make a Measurement of type indicated in the Measurement Type field. When Enable is set to 0, Request and Report bits are reserved and set to 0 invalid and shall be set to 0.
0	0	1	Not allowed
0	1	0	Not allowed

Table 7-28—Summary of use of Enable, Request, and Report bits (continued)

Bits			Meaning of bits Measurement request meaning
Enable	Request	Report	
0	1	1	Not allowed
1	0	0	The transmitting STA is requesting that <u>the destination STA not send any</u> ~~it be sent~~ ~~neither~~ measurement requests ~~or not autonomous measurement~~ reports of the types indicated in the Measurement Type field.
1	1	0	The transmitting STA is indicating <u>to the destination STA that it will</u> ~~can~~ accept measurement requests and <u>is requesting the destination STA</u> ~~not to send it not be sent~~ autonomous ~~or triggered~~ measurement reports of the types indicated in the Measurement Type field (see NOTE).
1	0	1	The transmitting STA is requesting <u>that the destination STA</u> ~~it not send~~ ~~be sent~~ measurement requests and indicating it will accept autonomous ~~or triggered~~ measurement reports of the types indicated in the Measurement Type field.
1	1	1	The transmitting STA is indicating <u>to the destination STA that it will</u> ~~can~~ accept measurement requests and <u>can will</u> ~~accept~~ autonomous ~~or triggered~~ measurement reports of the type indicated in the Measurement Type field.
NOTE—This setting corresponds to the default STA behavior.			

The Measurement Type field ~~shall be~~ set to a number that identifies a type of measurement request or a measurement report. Those Measurement Types that have been allocated for measurement requests are shown in Table 7-29 and measurement reports are shown in Table 7-30 (in 7.3.2.22).

Table 7-29—Measurement Type definitions for measurement requests

Name	Measurement Type	<u>Measurement Use</u>
Basic Request	0	<u>Spectrum Management</u>
Clear Channel assessment (CCA) request	1	
Receive power indication (RPI) histogram request	2	

Table 7-29—Measurement Type definitions for measurement requests (continued)

Name	Measurement Type	Measurement Use
<u>Channel load request</u>	<u>3</u>	<u>Radio Resource Measurement</u>
<u>Noise histogram request</u>	<u>4</u>	
<u>Beacon request</u>	<u>5</u>	
<u>Frame request</u>	<u>6</u>	
<u>STA statistics request</u>	<u>7</u>	
<u>LCI request</u>	<u>8</u>	
<u>Transmit stream/category measurement request</u>	<u>9</u>	
Reserved	<u>10–254</u>	<u>N/A</u>
<u>Measurement Pause request</u>	<u>255</u>	<u>Radio Resource Measurement</u>

~~The Measurement Request field shall be null when the Enable bit is set to 1 and shall contain the specification of the measurement request, as described in 7.3.2.19.1 through 7.3.2.19.3, when the Enable bit is set to 0.~~

When the Enable bit is set to 0, the Measurement Request field contains the specification of a single measurement request corresponding to the Measurement Type as described in 7.3.2.21.1 through 7.3.2.21.11. When the Enable bit is set to 1, the Measurement Request field is only present when requesting a triggered measurement.

~~The Measurement Request element is included in a Measurement Request frame as described in 7.4.1.1. The use of Measurement Request elements and frames is described in 11.10.6.~~

Insert the following subclauses after 7.3.2.21.3:

7.3.2.21.4 Channel Load Request

The Measurement Request field corresponding to a Channel Load Request is shown in Figure 7-62a.

	Regulatory Class	Channel Number	Randomization Interval	Measurement Duration	Optional Subelements
Octets:	1	1	2	2	variable

Figure 7-62a—Measurement Request field format for Channel Load Request

Regulatory Class indicates the channel set for which the measurement request applies. Country, Regulatory Class, and Channel Number together specify the channel frequency and spacing for which the measurement request applies. Valid values of Regulatory Class are shown in Annex J.

Channel Number indicates the channel number for which the measurement request applies. Channel Number is defined within a Regulatory Class as shown in Annex J.

Randomization Interval specifies the upper bound of the random delay to be used prior to making the measurement, expressed in units of TUs. See 11.10.2.

The Measurement Duration field is set to the preferred or mandatory duration of the requested measurement, expressed in units of TUs. See 11.10.3.

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 7-95p. Any optional subelements are ordered by non-decreasing Subelement ID.

The Subelement ID field values for the defined optional subelements are shown in Table 7-29a. A Yes in the Extensible column of a subelement listed in Table 7-29a 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 set to Subelements, then the subelement might be extended in future revisions or amendments of this standard by defining additional subelements within the subelement. See 9.14.2.

Table 7-29a—Optional Subelement IDs for Channel Load Request

Subelement ID	Name	Length field (octets)	Extensible
0	Reserved		
1	Channel Load Reporting Information	2	Yes
2–220	Reserved		
221	Vendor Specific	1 to 244	
222–255	Reserved		

The Channel Load Reporting Information subelement indicates the condition for issuing a Channel Load Report. Channel Load Reporting Information subelement data field format is shown in Figure 7-62b and contains a 1-octet Reporting Condition subfield and a 1-octet Channel Load Reference Value subfield. The Reporting Condition is described in Table 7-29b. The Channel Load Reference value is a Channel Load value as defined in 11.10.8.3 and is the reference value for the indicated Reporting Condition.

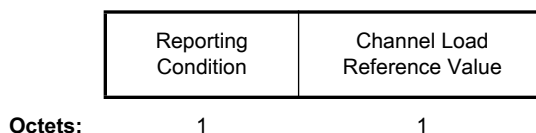


Figure 7-62b—Channel Load Reporting Information data field format

Table 7-29b—Reporting Condition for Channel Load Report

Condition for report to be issued	Reporting Condition
Report to be issued after each measurement (default, used when Channel Load Reporting Information subelement is not included in Channel Load Request).	0
Report to be issued when measured Channel Load is equal to or greater than the reference value.	1
Report to be issued when measured Channel Load is equal to or less than the reference value.	2
Reserved	3–255

The Vendor Specific subelements have the same format as their corresponding elements (see 7.3.2.26). Multiple Vendor Specific subelements can be included in the list of Optional Subelements.

7.3.2.21.5 Noise Histogram Request

The Measurement Request field corresponding to a Noise Histogram Request is shown in Figure 7-62c.

	Regulatory Class	Channel Number	Randomization Interval	Measurement Duration	Optional Subelements
Octets:	1	1	2	2	variable

Figure 7-62c—Measurement Request field format for Noise Histogram Request

Regulatory Class indicates the channel set for which the measurement request applies. Country, Regulatory Class, and Channel Number together specify the channel frequency and spacing for which the measurement request applies. Valid values of Regulatory Class are shown in Annex J.

Channel Number indicates the channel number for which the measurement request applies. Channel Number is defined within a Regulatory Class as shown in Annex J.

Randomization Interval specifies the upper bound of the random delay to be used prior to making the measurement, expressed in units of TUs. See 11.10.2.

The Measurement Duration field is set to the preferred or mandatory duration of the requested measurement, expressed in units of TUs. See 11.10.3.

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 7-95p. Any optional subelements are ordered by non-decreasing Subelement ID.

The Subelement ID field values for the defined optional subelements are shown in Table 7-29c. A Yes in the Extensible column of a subelement listed in Table 7-29c 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 set to Subelements, then the subelement might be extended in future revisions or amendments of this standard by defining additional subelements within the subelement. See 9.14.2.

Table 7-29c—Optional Subelement IDs for Noise Histogram Request

Subelement ID	Name	Length field (octets)	Extensible
0	Reserved		
1	Noise Histogram Reporting Information	2	Yes
2–220	Reserved		
221	Vendor Specific	1 to 244	
222–255	Reserved		

The Noise Histogram Reporting Information subelement indicates the condition for issuing a Noise Histogram Report. The Noise Histogram Reporting Information subelement data field format is shown in Figure 7-62d and contains a 1-octet Reporting Condition subfield and a 1-octet ANPI Reference Value subfield. The Reporting Condition is described in Table 7-29d. The ANPI Reference Value is an ANPI value as defined in 11.10.8.4 and is the reference value for the indicated Reporting Condition.

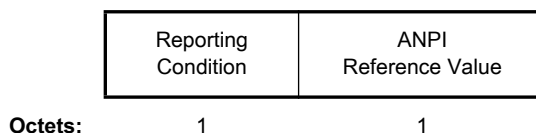


Figure 7-62d—Noise Histogram Reporting Information data field format

The Vendor Specific subelements have the same format as their corresponding elements (see 7.3.2.26). Multiple Vendor Specific subelements can be included in the list of Optional Subelements.

Table 7-29d—Reporting Condition for Noise Histogram Report

Condition for report to be issued	Reporting Condition
Report to be issued after each measurement (default, used when Noise Histogram Reporting Information subelement is not included in Noise Histogram Request).	0
Noise Histogram Report to be issued when measured ANPI is equal to or greater than the reference value.	1
Noise Histogram Report to be issued when measured ANPI is equal to or less than the reference value.	2
Reserved	3–255

7.3.2.21.6 Beacon Request

The Measurement Request field corresponding to a Beacon Request is shown in Figure 7-62e.

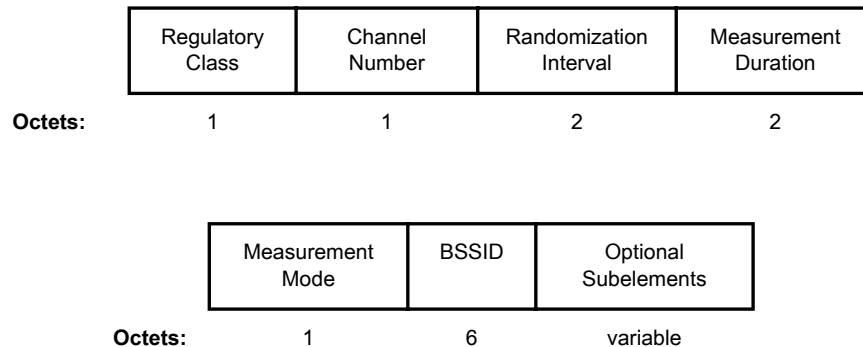


Figure 7-62e—Measurement Request field format for Beacon Request

Regulatory Class indicates the channel set for which the measurement request applies. Country, Regulatory Class, and Channel Number together specify the channel frequency and spacing for which the measurement request applies. Valid values of Regulatory Class are shown in Annex J.

Channel Number indicates the channel number for which the measurement request applies. Channel Number is defined within a Regulatory Class as shown in Annex J. A Channel Number of 0 indicates a request to make iterative measurements for all supported channels in the Regulatory Class where the measurement is permitted on the channel and the channel is valid for the current regulatory domain. A Channel Number of 255 indicates a request to make iterative measurements for all supported channels in the current Regulatory Class listed in the latest AP Channel Report received from the serving AP. The procedures for iterative measurements on multiple channels are described in 11.10.8.1.

Randomization Interval specifies the upper bound of the random delay to be used prior to making the measurement, expressed in units of TUs. See 11.10.2.

The Measurement Duration field is set to the preferred or mandatory duration of the requested measurement, expressed in units of TUs. See 11.10.3.

Measurement Mode indicates the mode to be used for the measurement. The valid measurement modes are listed in Table 7-29e. The procedures for each mode are described in 11.10.8.1.

Table 7-29e—Measurement Mode definitions for Beacon Request element

Mode	Value
Passive	0
Active	1
Beacon Table	2
Reserved	3–255

The BSSID field indicates the BSSID of the BSS(s) for which a beacon report is requested. When requesting beacon reports for all BSSs on the channel, the BSSID field contains the wildcard BSSID; otherwise the BSSID field contains a specific BSSID for a single BSS.

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 7-95p. Any optional subelements are ordered by non-decreasing Subelement ID.

The Subelement ID field values for the defined optional subelements are shown in Table 7-29f. A Yes in the Extensible column of a subelement listed in Table 7-29f 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 set to Subelements, then the subelement might be extended in future revisions or amendments of this standard by defining additional subelements within the subelement. See 9.14.2.

Table 7-29f—Optional Subelement IDs for Beacon Request

Subelement ID	Name	Length field (octets)	Extensible
0	SSID	0 to 32	
1	Beacon Reporting Information	2	Yes
2	Reporting Detail	1	Yes
3–9	Reserved		
10	Request	0 to 237	
11–50	Reserved		
51	AP Channel Report	1 to 237	
52–220	Reserved		
221	Vendor Specific	1 to 237	
222–255	Reserved		

The SSID subelement indicates the ESS(s) or IBSS(s) for which a beacon report is requested. When SSID is not included in a Beacon Request, the default “wildcard SSID” is used; otherwise the SSID is included in the Beacon Request and contains a specific SSID for a single ESS or IBSS. The wildcard SSID is used to represent all possible SSIDs. The SSID element is described in 7.3.2.1.

The Beacon Reporting Information subelement indicates the condition for issuing a Beacon Report. The Beacon Reporting Information subelement may be included in a Beacon Request only for repeated measurements. The Beacon Reporting Information subelement data field format is shown in Figure 7-62f and contains a 1-octet Reporting Condition subfield and a 1-octet Threshold/Offset Reference Value subfield. The Reporting Condition is described in Table 7-29g. The Threshold/Offset Reference Value provides either the threshold value or the offset value to be used for conditional reporting. For Reporting Conditions 1 to 4, the threshold value is an unsigned 8-bit integer in units of 0.5 dBm. For Reporting Conditions 5 to 10, the offset value is an 8-bit two’s complement integer in units of 0.5 dBm. The indicated

Reporting Condition applies individually to each measured Beacon, Measurement Pilot, or Probe Response. Reporting Conditions are further described in 11.10.8.1.

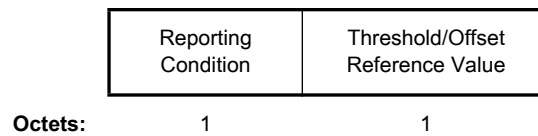


Figure 7-62f—Beacon Reporting Information data field format

Table 7-29g—Reporting Condition for Beacon Report

Condition for report to be issued in Repeated Measurement	Reporting Condition
Report to be issued after each measurement (default, used when Beacon Reporting Information subelement is not included in Beacon Request).	0
The measured RCPI level is greater than the threshold indicated in the Threshold/Offset Reference Value.	1
The measured RCPI level is less the threshold indicated in the Threshold/Offset Reference Value.	2
The measured RSNI level is greater than the threshold indicated in the Threshold/Offset Reference Value.	3
The measured RSNI level is less than the threshold indicated in the Threshold/Offset Reference Value.	4
The measured RCPI level is greater than a threshold defined by an offset from the serving AP's reference RCPI, where the offset is indicated in the Threshold/Offset Reference Value.	5
The measured RCPI level is less than a threshold defined by an offset from the serving AP's reference RCPI, where the offset is indicated in the Threshold/Offset Reference Value.	6
The measured RSNI level is greater than a threshold defined by an offset from the serving AP's reference RSNI, where the offset is indicated in the Threshold/Offset Reference Value.	7
The measured RSNI level is less than a threshold defined by an offset from the serving AP's reference RSNI, where the offset is indicated in the Threshold/Offset Reference Value.	8
The measured RCPI level is in a range bound by the serving AP's reference RCPI and an offset from the serving AP's reference RCPI, where the offset is indicated in the Threshold/Offset Reference Value.	9
The measured RSNI level is in a range bound by the serving AP's reference RSNI and an offset from the serving AP's reference RSNI, where the offset is indicated in the Threshold/Offset Reference Value.	10
Reserved	11–255

The Reporting Detail subelement contains a 1-octet Reporting Detail data field that defines the level of detail per AP to be reported to the requesting STA. The Reporting Detail values are defined in Table 7-29h. The indicated Reporting Detail applies individually to each measured Beacon, Measurement Pilot, or Probe Response. If the Reporting Detail equals 1, a Request information element can be included in the optional subelements field. If included, the Request information element lists the Element IDs of the elements requested to be reported in the Reported Frame Body of the Beacon Report.

Table 7-29h—Reporting Detail values

Level of detail requested	Reporting Detail
No fixed length fields or elements	0
All fixed length fields and any requested elements in the Request information element if present	1
All fixed length fields and elements (default, used when Reporting Detail subelement is not included in Beacon Request)	2
Reserved	3–255

The Request, AP Channel Report, and Vendor Specific subelements have the same format as their corresponding elements (see 7.3.2.12, 7.3.2.36, and 7.3.2.26, respectively). Multiple AP Channel Report and Vendor Specific subelements can be included in the list of Optional Subelements.

If one or more AP Channel Report elements are included, they indicate that iterative measurements are requested first on the channel(s) indicated by the Regulatory Class and Channel Number fields included in the Beacon Request, and second on the channel(s) indicated by the Regulatory Class and Channel List fields of each AP Channel Report element included in the Beacon Request. The procedures for iterative measurements on multiple channels are described in 11.10.8.1.

7.3.2.21.7 Frame Request

The Measurement Request field corresponding to a Frame Request is shown Figure 7-62g.

	Regulatory Class	Channel Number	Randomization Interval	Measurement Duration	Frame Request Type	MAC Address	Optional sub-elements
Octets:	1	1	2	2	1	6	variable

Figure 7-62g—Measurement Request field format for Frame Request

Regulatory Class indicates the channel set for which the measurement request applies. Country, Regulatory Class, and Channel Number together specify the channel frequency and spacing for which the measurement request applies. Valid values of Regulatory Class are shown in Annex J.

Channel Number indicates the channel number for which the measurement request applies. Channel Number is defined within a Regulatory Class as shown in Annex J.

Randomization Interval specifies the upper bound of the random delay to be used prior to making the measurement, expressed in units of TUs. See 11.10.2.

The Measurement Duration field is set to the preferred or mandatory duration of the requested measurement, expressed in units of TUs. See 11.10.3.

The Frame Request Type indicates which subelements are requested in the Frame Report. The value of 1 signifies that a Frame Count Report is requested. The values 0 and 2 to 255 are reserved.

If the MAC Address field is the wildcard address, then all frames are counted towards the Frame Report generated in response to this Frame Request. For other MAC addresses, only frames matching this MAC address as the Transmitter Address are counted towards the Frame Report generated in response to this Frame Request.

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 7-95p. Any optional subelements are ordered by non-decreasing Subelement ID.

The Subelement ID field values for the defined optional subelements are shown in Table 7-29i. A Yes in the Extensible column of a subelement listed in Table 7-29i 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 set to Subelements, then the subelement might be extended in future revisions or amendments of this standard by defining additional subelements within the subelement. See 9.14.2.

The Vendor Specific subelements have the same format as their corresponding elements (see 7.3.2.26). Multiple Vendor Specific subelements can be included in the list of Optional Subelements.

Table 7-29i—Optional Subelement IDs for Frame Request

Subelement ID	Name	Length field (octets)	Extensible
0–220	Reserved		
221	Vendor Specific	1 to 237	
222–255	Reserved		

7.3.2.21.8 STA Statistics Request

The Measurement Request field corresponding to a STA Statistics Request is shown in Figure 7-62h.

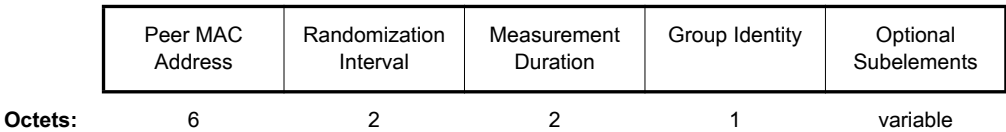


Figure 7-62h—Measurement Request field format for STA Statistics Request

The Peer MAC Address field is the RA or TA MAC address for the frame statistics of this measurement.

Randomization Interval specifies the upper bound of the random delay to be used prior to making the measurement, expressed in units of TUs. See 11.10.2.

The Measurement Duration field is set to the duration of the requested measurement in TUs.

Group Identity indicates the requested statistics group according to Table 7-29j.

Table 7-29j—Group Identity for a STA Statistics Request

Statistics Group Name	Group Identity
STA Counters from dot11CountersTable	0
STA Counters from dot11MacStatistics group	1
QoS STA Counters for UP0 from dot11QosCountersTable	2
QoS STA Counters for UP1 from dot11QosCountersTable	3
QoS STA Counters for UP2 from dot11QosCountersTable	4
QoS STA Counters for UP3 from dot11QosCountersTable	5
QoS STA Counters for UP4 from dot11QosCountersTable	6
QoS STA Counters for UP5 from dot11QosCountersTable	7
QoS STA Counters for UP6 from dot11QosCountersTable	8
QoS STA Counters for UP7 from dot11QosCountersTable	9
BSS Average Access Delays as described in 7.3.2.39 and 7.3.2.44	10
Reserved	11–255

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 7-95p. Any optional subelements are ordered by non-decreasing Subelement ID.

The Subelement ID field values for the defined optional subelements are shown in Table 7-29k. A Yes in the Extensible column of a subelement listed in Table 7-29k 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 set to Subelements, then the subelement might be extended in future revisions or amendments of this standard by defining additional subelements within the subelement. See 9.14.2.

The Vendor Specific subelements have the same format as their corresponding elements (see 7.3.2.26). Multiple Vendor Specific subelements can be included in the list of Optional Subelements.