802.11p™

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 6: Wireless Access in Vehicular Environments

IEEE Computer Society

Sponsored by the
LAN/MAN Standards Committee

IEEE
3 Park Avenue
New York, NY 10016-5997, USA

15 July 2010

IEEE Std 802.11p™-2010
(Amendment to IEEE Std 802.11™-2007
as amended by IEEE Std 802.11k™-2008,
IEEE Std 802.11r™-2008,
IEEE Std 802.11y™-2008,
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Approved 17 June 2010

IEEE SA-Standards Board

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Abstract: This amendment specifies the extensions to IEEE Std 802.11 for wireless local area networks (WLANs) providing wireless communications while in a vehicular environment.
Keywords: 5.9 GHz, wireless access in vehicular environments

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This introduction is not part of IEEE Std 802.11p-2010, IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan networks—Specific requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications—Amendment 6: Wireless Access in Vehicular Environments.

IEEE 802.11™ devices may be used in environments where the physical layer properties are rapidly changing and where very short-duration communications exchanges are required. The purpose of this standard is to provide the minimum set of specifications required to ensure interoperability between wireless devices attempting to communicate in potentially rapidly changing communications environments and in situations where transactions must be completed in time frames much shorter than the minimum possible with infrastructure or ad hoc IEEE 802.11 networks. In particular, time frames that are shorter than the amount of time required to perform standard authentication and association to join a BSS are accommodated in this amendment.

This specification accomplishes the following:

— Describes the functions and services required by stations to operate in a rapidly varying environment and to exchange messages without joining a BSS

— Defines the signaling techniques and interface functions used by stations communicating outside of the context of a BSS that are controlled by the IEEE 802.11 MAC

This amendment to IEEE Std 802.11-2007 is based on extensive testing and analyses of wireless communications in a mobile environment. The results of these efforts are documented in ASTM E2213-03, Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems—5.9 GHz Band Wireless Access in Vehicular Environments (WAVE)/Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Specifications.[a] This amendment to IEEE Std 802.11-2007 is technically compatible with ASTM E2213-03.

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1. Overview

1.2 Purpose

Insert a new list item after the first dashed list item:

— Describes the functions and services that allow an IEEE 802.11™-compliant device to communicate directly with another such device outside of an independent or infrastructure network.

2. Normative references

Insert the following reference in alphanumeric order in Clause 2:

ITU-R Recommendation TF.460-4(2002), Standard-frequency and time-signal emissions.

4. Abbreviations and acronyms

Insert the following new abbreviations and acronyms in alphabetical order:

GPS Global Positioning System

UTC Coordinated Universal Time

5. General description

5.2 Components of the IEEE 802.11 architecture

5.2.6 QoS BSS: The QoS network

Change the second paragraph in 5.2.6 as follows:

The enhancements that distinguish QoS STAs from non-QoS STAs and QoS APs from non-QoS APs are collectively termed the *QoS facility.* The quantity of certain, QoS-specific, mechanisms may vary among QoS implementations, as well as between QoS STAs and QoS APs, over ranges specified in subsequent clauses. All service primitives, frame formats, coordination function and frame exchange rules, and management interface functions except for the Block Acknowledgment (Block Ack) function, direct-link setup (DLS), and automatic power-save delivery (APSD) are part of the core QoS facilities. A QoS STA or QoS AP must implement those core QoS facilities necessary for its QoS functions to interoperate with other QoS STAs ~~in the BSS~~. Functions such as the Block Ack, DLS, and APSD are separate from the core QoS facilities; and the presence of these functions is indicated by STAs separately from the core QoS facilities. A comprehensive statement on mandatory and optional functionalities is available in Annex A.

Insert the following new subclause (5.2.10) after the last subclause in 5.2, renumbering as necessary:

5.2.10 STA transmission of data frames outside the context of a BSS

In addition to defining procedures for STA communication within a BSS, this standard also allows a STA that is not a member of a BSS to transmit data frames. Such data frames are defined as being transmitted

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outside the context of a BSS. A STA transmits a data frame outside the context of a BSS only if dot11OCBEnabled is true.

NOTE—The specific frame subtypes that a STA is allowed to send when it has dot11OCBEnabled true are specified in 11.19.

When dot11OCBEnabled is true, a data frame can be sent to either an individual or a group destination MAC address. This type of communication is only possible between STAs that are able to communicate directly over the wireless medium. It allows immediate communication, avoiding the latency associated with establishing a BSS. When dot11OCBEnabled is true, a STA is not a member of a BSS and it does not utilize the IEEE 802.11 authentication, association, or data confidentiality services. This capability is particularly well-suited for use in rapidly varying communication environments such as those involving mobile STAs where the interval over which the communication exchanges take place may be of very short-duration (e.g., on the order of tens or hundreds of milliseconds). Since IEEE 802.11 MAC sublayer authentication services are not used when dot11OCBEnabled is true, any required authentication services would be provided by the station management entity (SME) or by applications outside of the MAC sublayer. A STA whose MIB does not include the dot11OCBEnabled attribute operates as if the attribute is false.

Communication of data frames when dot11OCBEnabled is true might take place in a frequency band that is dedicated for its use, and such a band might require licensing depending on the regulatory domain. A STA for which dot11OCBEnabled is true initially transmits and receives on a channel known in advance, either through regulatory designation or some other out-of-band communication. A STA's SME determines PHY layer parameters, as well as any changes in the operating channel, e.g., using information obtained via out-of-band communication or over-the-air frame exchange. The Vendor Specific Action frame (see 7.4.5) provides one means for STAs to exchange management information prior to communicating data frames outside the context of a BSS. When dot11OCBEnabled is true, a sending STA sets the BSSID field to the wildcard BSSID value (see 7.1.3.3.3).

5.3 Logical service interfaces

5.3.1 SS

Change the lettered list items (a) through (c) of 5.3.1 as follows:

a) Authentication (not used when dot11OCBEnabled is true)
b) Deauthentication (not used when dot11OCBEnabled is true)
c) Data confidentiality (not used when dot11OCBEnabled is true)

7. Frame formats

7.1 MAC frame formats

7.1.3 Frame fields

7.1.3.1 Frame Control field

7.1.3.1.2 Type and Subtype fields

Insert a new row 7 in the management type rows of Table 7-1 as shown. Change the management frame subtype value(s) as appropriate.

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Table 7-1—Valid type and subtype combinations

Type value b3 b2	Type description	Subtype value b7 b6 b5 b4	Subtype Description
00	Management	0110	Timing Advertisement
00	Management	~~0110~~ 0111	Reserved

7.1.3.1.3 To DS and From DS fields

Change the first row of Table 7-2 as shown:

Table 7-2—To/From DS combinations in data frames

To DS and From DS values	Meaning
To DS = 0 From DS = 0	A data frame direct from one STA to another STA within the same IBSS, ~~or~~ a data frame direct from one non-AP STA to another non-AP STA within the same BSS, or a data frame outside the context of a BSS, as well as all management and control frames.

7.1.3.3 Address fields

7.1.3.3.3 BSSID field

Change the first paragraph of 7.1.3.3.3 as shown:

The BSSID field is a 48-bit field of the same format as an IEEE 802 MAC address. When dot11OCBEnabled is false, the value of this ~~This~~ field uniquely identifies each BSS. The value of this field, in an infrastructure BSS, is the MAC address currently in use by the STA in the AP of the BSS.

Change the last paragraph of 7.1.3.3.3 as follows:

The value of all 1s is used to indicate the wildcard BSSID. ~~A~~The wildcard ~~BSSID~~value shall not be used in the BSSID field except ~~for management frames of subtype probe request and of subtype Action with Category Public.~~ where explicitly permitted in this standard. When dot11OCBEnabled is true, the wildcard value shall be used in the BSSID field.

7.1.3.5 QoS Control field

7.1.3.5.1 TID subfield

Insert the following at the end of the last paragraph of 7.1.3.5.1:

For STAs where dot11OCBEnabled is true, traffic streams are not used and the TID always corresponds to a TC.

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7.1.3.5.5 Queue Size subfield

Change the second sentence of the first paragraph of 7.1.3.5.5 as follows:

The Queue Size subfield is present in QoS data frames sent by non-AP STAs ~~associated in a BSS~~ with bit 4 of the QoS Control field set to 1.

7.2 Format of individual frame types

7.2.2 Data frames

Change the paragraph immediately following Table 7-7 as shown:

A STA uses the contents of the Address 1 field to perform address matching for receive decisions. In cases where the Address 1 field contains a group address, the BSSID also is validated to ensure either that the broadcast or multicast originated from a STA in the BSS of which the receiving STA is a member, or that it contains the wildcard BSSID value, indicating a data frame sent outside the context of a BSS (dot11OCBEnabled is true in the transmitting STA).

Insert the following new item c) in the lettered list immediately after the sentence "The BSSID of the Data frame is determined as follows":

c) If the STA is transmitting a data frame when dot11OCBEnabled is true, the BSSID shall be the wildcard BSSID.

7.2.3 Management frames

Insert the following new item d) at the end of the lettered list immediately after the sentence "The BSSID of the management frame is determined as follows":

d) If dot11OCBEnabled is true, the BSSID shall be the wildcard BSSID.

Insert the following new subclause (7.2.3.14) after the last subclause in 7.2.3, renumbering as necessary:

7.2.3.14 Timing Advertisement frame format

The frame body of a management frame of subtype Timing Advertisement contains the information shown in Table 7-19b.

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Table 7-19b—Timing Advertisement frame body

Order	Information	Notes
1	Timestamp	See 7.3.1.10 for Timestamp format.
2	Capability	
3	Country	Optional. The Country information element shall be present when dot11MultidomainCapabilityEnabled is true or dot11SpectrumManagementRequired is true.
4	Power Constraint	Optional and may only be present if the Country element is present.
5	Time Advertisement	Optional. See 7.3.2.61.
6	Extended Capabilities	Optional.
Last	Vendor specific	One or more vendor specific information elements may appear in this frame. This information element follows all other information elements.

7.3 Management frame body components

7.3.1 Fields that are not information elements

7.3.1.10 Timestamp field

Change the first sentence as follows:

This field represents the value of the timing synchronization function (TSF) timer (see 11.1 and 11.20) of a frame's source.

Insert the following new subclause (7.3.1.31) after the last subclause in 7.3.1, renumbering as necessary:

7.3.1.31 Organization Identifier field

The Organization Identifier field shall contain a public organizationally unique identifier assigned by the IEEE. The order of the Organization Identifier field shall follow the ordering convention for MAC addresses from 7.1.1. The IEEE has assigned public organizationally unique identifiers both of 24-bit length (OUI) and longer length. In the latter case specific OUI values are shared over multiple organizations, e.g., using 36-bit length identifiers (OUI-36 and IAB) (see IEEE Registration Authority [Bc]). The length of the Organization Identifier field (*j*) shall be the minimum number of octets required to contain the entire organizationally unique identifier (see Figure 7-75), and the first 3 octets shall contain the OUI portion of the identifier. Thus, the Organization Identifier field is 3 octets in length if the organizationally unique identifier is an OUI, or 5 octets in length if the organizationally unique identifier is 36 bits in length. The IEEE assigns 36-bit organizationally unique identifiers such that the OUI portion indicates that total length of the identifier is 36 bits. If the length of the organizationally unique identifier is not an integral number of octets, the least significant bits of the last octet are specified by the organization identified.

NOTE—For example, for the organizationally unique identifier 0x0050C24A4, the Organization Identifier field would contain 0x0050C24A4*y* where *y* represents the four least significant bits of the fifth octet of the field. The value of *y* is specified by the organization whose identifier is 0x0050C24A4.

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7.3.2 Information elements

Insert the following entry into Table 7-26 in the appropriate row as shown:

Table 7-26—Element IDs

Information Element	Element ID	Length (in octets)	Extensible
Time Advertisement (see 7.3.2.61)	69	18 to 257	Yes

7.3.2.26 Vendor Specific information element

Change 7.3.2.26 as follows:

The Vendor Specific information element is used to carry information not defined in this standard within a single defined format, so that reserved information element IDs are not usurped for nonstandard purposes and so that interoperability is more easily achieved in the presence of nonstandard information. The information element is in the format shown in Figure 7-75 and requires that the first 3 or more octets of the information field ~~contain the OUI of~~ identify the entity that has defined the content of the particular Vendor Specific information element. The length of the information field n is constrained by ~~3~~ length (Organization Identifier) $\leq n \leq 255$. ~~The OUI field shall be a public OUI assigned by the IEEE. It is 3 octets in length.~~ The length of the vendor specific content is $n-3$~~j~~ octets, where j is the length of the Organization Identifier field as described in 7.3.1.31.

	Element ID	Length	~~OUI~~ Organization Identifier (see 7.3.1.31)	Vendor-specific content
Octets:	1	1	~~3~~ j	$n-j$~~3~~

Figure 7-75—Vendor Specific information element format

Multiple Vendor Specific information elements may appear in a single frame. Each Vendor Specific information element can have a different Organization Identifier ~~OUI~~ value. The number of Vendor Specific information elements that may appear in a frame is limited only by the maximum frame size.

7.3.2.29 EDCA Parameter Set element

Change the second paragraph of 7.3.2.29 as follows:

For an infrastructure BSS, ~~The~~ the EDCA Parameter Set element is used by the AP to establish policy (by changing default MIB attribute values), to change policies when accepting new STAs or new traffic, or to adapt to changes in offered load. The most recent EDCA parameter set element received by a non-AP STA is used to update the appropriate MIB values.

Change the paragraph before Table 7-37 of 7.3.2.29 as follows:

Table 7-37 defines ~~The~~ the default ~~values used by non-AP STAs for the parameters in the EDCA Parameter Set element are defined in Table 7-37~~ EDCA parameter values used by a non-AP STA with dot11OCBEnabled set to FALSE.

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Change the title of Table 7-37 of 7.3.2.29 as follows:

Table 7-37—Default EDCA Parameter Set element parameter values
<u>if dot11OCBEnabled is false</u>

Insert the following new paragraph and table at the end of 7.3.3.29:

If dot11OCBEnabled is true, the default EDCA parameter set for STAs transmitting QoS frames is given in Table 7-37a.

Table 7-37a—Default EDCA parameter set for STA operation if dot11OCBEnabled is true

AC	CWmin	CWmax	AIFSN	TXOP Limit OFDM/CCK-OFDM PHY
AC_BK	aCWmin	aCWmax	9	0
AC_BE	aCWmin	aCWmax	6	0
AC_VI	(aCWmin+1)/2–1	aCWmin	3	0
AC_VO	(aCWmin+1)/4–1	(aCWmin+1)/2–1	2	0

Insert the following new subclause (7.3.2.61) after the last subclause in 7.3.2, renumbering as necessary:

7.3.2.61 Time Advertisement information element

The Time Advertisement information element, shown in Figure 7-95o28, specifies fields describing the source of time corresponding to a time standard, an external clock (external time source), an estimate of the offset between that time standard and the TSF timer, and an estimate of the standard deviation of the error in the offset estimate. This information is used by a receiving STA to align its own estimate of the time standard based on that of another STA.

	Element ID	Length	Timing Capabilities	Time Value (if needed)	Time Error (if needed)
Octets:	1	1	1	10	5

Figure 7-95o28—Time Advertisement element format

The Timing Capabilities field specifies the STA's source and encoding of the Time Value field. The encoding of the Timing Capabilities field is specified in Table 7-43q.

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Table 7-43q—Encoding of the Timing Capabilities field

Value	Usage
0	No standardized external time source
1	Timestamp offset based on UTC [see ITU-R Recommendation TF.460-4(2002)]. The Timestamp offset value in nanoseconds is defined to be 0 at the beginning of the first nanosecond of the first day of the year 1958.
2–255	Reserved

When the value of the Timing Capabilities field is 0, only the Element ID, Length, and Timing Capabilities fields are included in the Time Advertisement information element.

When the value of the Timing Capabilities is 1, the following additional fields are included in the Time Advertisement information element:

— Time Value field, a two's complement integer in nanoseconds that, when added to the Timestamp present in the same transmitted frame, gives the receiving STA an estimate of the time standard at the time the frame was transmitted. The Timestamp is derived from the TSF Timer as defined in 11.20.
— Time Error field, which is set to an unsigned integer in nanoseconds that defines the standard deviation of the error in the Time Value estimate. The value of all 1s is used to indicate that the error is unknown.

7.4 Action frame format details

7.4.5 Vendor-specific action details

Change 7.4.5 as follows:

The Vendor Specific Action frame is defined for vendor-specific signaling. The format of the Vendor Specific Action frame is shown in Figure 7-101. An ~~OUI~~Organization Identifier, in the octet field immediately after the Category field, differentiates the vendors (see 7.3.1.31).

	Category	~~OUI~~ Organization Identifier	Vendor Specific content
Octets:	1	~~3~~ *j*	Variable

Figure 7-101—Vendor Specific Action frame format

The Category field is set to the value indicating the vendor-specific category, as specified in Table 7-24.

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~~The OUI field is a public OUI assigned by the IEEE. It is 3 octets in length. It contains the OUI of the entity that has defined the content of the particular vendor-specific action.~~ The Organization Identifier contains a public organizationally unique identifier assigned by the IEEE and is specified in 7.3.1.31.

The Vendor Specific Content contains vendor-specific field(s). The length of the Vendor Specific Content in a Vendor Specific Action frame is limited by the maximum allowed MMPDU size.

9. MAC sublayer functional description

9.1 MAC architecture

9.1.1 DCF

Change the first paragraph of 9.1.1 as follows:

The fundamental access method of the IEEE 802.11 MAC is a DCF known as *carrier sense multiple access with collision avoidance* (CSMA/CA). The DCF shall be implemented in all STAs~~, for use within both IBSS and infrastructure network configurations~~.

9.1.3 Hybrid coordination function (HCF)

9.1.3.1 HCF contention-based channel access (EDCA)

Change the second paragraph of 9.1.3.1 as shown, incorporating ordered list a) into the paragraph (and deleting it from the list), insert a new paragraph, and reletter the ordered list following the new paragraph:

For each AC, an enhanced variant of the DCF, called an *enhanced distributed channel access function* (EDCAF), contends for TXOPs using a set of EDCA parameters. When communicating data frames outside the context of a BSS (dot11OCBEnabled is true), the EDCA parameters are the corresponding default values or are as set by the SME in the MIB attribute table dot11EDCATable (except for TXOP limit values, which shall be set to zero for each AC). When communicating within a BSS, the EDCA parameters used are from the EDCA Parameter Set element or from the default values for the parameters when no EDCA Parameter Set element is received from the AP of the BSS with which the STA is associated., ~~where~~ The parameters used by the EDCAF to control its operation are defined by MIB attribute table dot11QAPEDCATable at the AP and by MIB attribute table dot11EDCATable at the non-AP STA.

~~a) The parameters used by the EDCAF to control its operation are defined by MIB attribute table dot11QAPEDCATable at the AP and by MIB attribute table dot11EDCATable at the non-AP STA.~~

The following rules apply for HCF contention-based channel access:

9.2 DCF

9.2.3 IFS

9.2.3.4 AIFS

Change the third paragraph of 9.2.3.4 as follows:

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A non-AP QoS STA computes the time periods for each AIFS[AC] from the dot11EDCATableAIFSN attributes in the MIB. In an infrastructure BSS, QoS STAs update their dot11EDCATableAIFSN values using information in the most recent EDCA Parameter Set element of Beacon frames received from the AP of the BSS (see 7.3.2.28). A QoS AP computes the time periods for each AIFS[AC] from the dot11QAPEDCATableAIFSN attributes in its MIB.

9.6 Multirate support

9.6.0a Overview

Insert the following paragraph after the first paragraph of 9.6.0a:

Only the data transfer rates of the mandatory rate set of the attached PHY are guaranteed to be supported when a STA for which dot11OCBEnabled is true transmits a management or data frame. Higher layer protocols may negotiate a rate outside the mandatory rate set.

9.9 HCF

9.9.1 HCF contention-based channel access (EDCA)

9.9.1.2 EDCA TXOPs

Insert the following text at the end of the third paragraph of 9.9.1.2 after NOTE 3:

When dot11OCBEnabled is true, TXOP limits shall be zero for each AC.

9.9.1.3 Obtaining an EDCA TXOP

Change the third paragraph of 9.9.1.3 as follows:

The value of AIFSN[AC] shall be greater than or equal to 2 for non-AP STAs. In an infrastructure BSS, AIFSN[AC] ~~and~~ is advertised by the AP in the EDCA Parameter Set information element in Beacon and Probe Response frames transmitted by the AP. The value of AIFSN[AC] shall be greater than or equal to 1 for APs. An EDCA TXOP is granted to an EDCAF when the EDCAF determines that it shall initiate the transmission of a frame exchange sequence. Transmission initiation shall be determined according to the following rules:

10. Layer management

10.3 MLME SAP interface

10.3.9 Reset

10.3.9.1 MLME-RESET.request

10.3.9.1.4 Effect of receipt

Insert the following text at the end of 10.3.9.1.4:

If dot11OCBEnabled is true and if the SetDefaultMIB parameter is false, MAC operation shall resume in less than 2 TU after the STAAddress parameter is changed.

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10.3.29 Vendor-specific action

Change the sentence as follows:

This set of primitives supports the signaling of Vendor Specific Action frames among~~between~~ peer SMEs.

10.3.29.1 MLME-VSPECIFIC.request

10.3.29.1.1 Function

Change the sentence as follows:

This primitive requests transmission of a Vendor Specific Action frame~~ to a peer entity~~.

10.3.29.1.2 Semantics of the Service Primitive

Change the parameter list and the first and second rows of the table as follows:

The primitive parameters are as follows:

MLME-VSPECIFIC.request(
PeerMACAddress,
~~OUI~~Organization Identifier,
VendorSpecificContent
)

Name	Type	Valid range	Description
PeerMACAddress	MACAddress	Any valid individual or group MAC address	The address of the peer MAC entity or group of entities to which the Vendor Specific Action frame is sent.
~~OUI~~ Organization Identifier	~~3 octets~~ As defined in 7.3.1.31	~~00-00-00 to FF-FF-FF~~ As defined in 7.3.1.31	~~A~~ Contains a public value assigned by the IEEE to identify the ~~entity~~ organization that has defined the content of the particular vendor-specific action.

10.3.29.1.3 When Generated

Change the sentence as follows:

This primitive is generated by the SME to request that a Vendor Specific Action frame be sent~~ to a peer entity~~.

10.3.29.1.4 Effect of Receipt

Change the sentence as follows:

On receipt of this primitive, the MLME constructs a Vendor Specific Action frame containing the set of information elements and vendor-specific fields. The STA then attempts to transmit the frame~~ to the peer entity~~.

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10.3.29.2 MLME-VSPECIFIC.confirm

10.3.29.2.1 Function

Change the sentence as follows:

This primitive reports the result of a request to send a Vendor Specific Action frame ~~to the peer entity~~.

10.3.29.3 MLME-VSPECIFIC.indication

10.3.29.3.2 Semantics of the Service Primitive

Change 10.3.29.3.2 as follows:

The primitive parameters are as follows:

MLME-VSPECIFIC.indication(
PeerMACAddress,
~~OUI~~Organization Identifier,
RCPI,
VendorSpecificContent
)

Change the first and second rows of the table and insert a row for "RCPI" before the "VendorSpecificContent" row as follows:

NAME	TYPE	VALID RANGE	DESCRIPTION
PeerMACAddress	MACAddress	Any valid individual or group MAC address	The address of the peer MAC entity or group of entities from which the Vendor Specific Action frame was received.
~~OUI~~Organization Identifier	~~3 octets~~As defined in 7.3.1.31	~~00-00-00 to FF-FF-FF~~ As defined in 7.3.1.31	~~A~~ Contains a public value assigned by the IEEE to identify the ~~entity~~ organization that has defined the content of the particular vendor-specific action.
RCPI	As defined in 7.3.2.38	As defined in 7.3.2.38	Present when dot11OCBEnabled is true. RCPI is the measured value of received channel power on the received Vendor Specific Action frame.

Insert the following new subclauses (10.3.45 and 10.3.46) after the last subclause in 10.3, renumbering as necessary:

10.3.45 Get TSF timer

This mechanism is used to request the current value of the TSF timer that the STA maintains.

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10.3.45.1 MLME-GETTSFTIME.request

10.3.45.1.1 Function

This primitive is generated by the SME to request that the MLME returns the value of its TSF timer. The value returned (as specified in 10.3.45.2.1) is the value of the TSF timer at the instant the MLME-GETTSFTIME.request primitive is received.

10.3.45.1.2 Semantics of the service primitive

This primitive has no parameter.

MLME-GETTSFTIME.request(

)

10.3.45.1.3 When generated

This primitive is generated by the SME to request the value of the TSF timer from the MLME.

10.3.45.1.4 Effect of receipt

The MLME issues an MLME-GETTSFTIME.confirm.

10.3.45.2 MLME-GETTSFTIME.confirm

10.3.45.2.1 Function

This primitive is generated by the MLME to report to the SME the result of a request to get the value of the TSF timer.

10.3.45.2.2 Semantics of the service primitive

This primitive uses the following parameters:

MLME-GETTSFTIME.confirm(

ResultCode,
TSFtime
)

Name	Type	Valid range	Description
ResultCode	Enumeration	SUCCESS, FAILURE	Reports the outcome of GETTSFTIME request if ResultCode is SUCCESS.
TSFtime	Integer	$0 – (2^{64} – 1)$	Value of the TSF timer.

10.3.45.2.3 When generated

This primitive is generated by the MLME to report to the SME the result of an MLME-GETTSFTIME.request.

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10.3.45.2.4 Effect of receipt

The SME is notified of the result of an MLME-GETTSFTIME.request primitive and, if successful, has the value of the TSF timer at the instant the MLME-GETTSFTIME.request was received by the MLME. If the result of an MLME-GETTSFTIME.request is failure, the TSFtime parameter is not included in the MLME-GETTSFTIME.confirm primitive.

NOTE—The TSF timer value can be used, along with other information, by the SME to compute an offset between an external time standard such as a version of Universal Coordinated Time (UTC) from a Global Positioning System (GPS) unit and the TSF timer.

10.3.46 Timing Advertisement

The Timing Advertisement primitives are used to communicate timing and other information from the higher layers or the SME of one STA to the higher layers or SME of other STAs.

10.3.46.1 MLME-TIMING_ADVERTISEMENT.request

10.3.46.1.1 Function

This primitive is generated by the SME to request that the MLME generate a Timing Advertisement frame to transmit timing and optionally higher layer information.

10.3.46.1.2 Semantics of the service primitive

This primitive provides the following parameters:

MLME-TIMING_ADVERTISEMENT.request(

PeerMACAddress,
Capability Information,
Country,
Power Constraint,
Time Advertisement,
Extended Capabilities,
VendorSpecificInfo
)

Name	Type	Valid range	Description
PeerMACAddress	MACAddress	Any valid individual or group MAC address	The address of the peer MAC entity or group of entities to which the Timing Advertisement frame is sent.
Capability Information	As defined in 7.3.1.4	As defined in 7.3.1.4	The announced capabilities of the STA.
Country	As defined in 7.3.2.9	As defined in 7.3.2.9	The information required to identify the regulatory domain in which the STA is located and to configure its PHY for operation in that regulatory domain. Present only when TPC functionality is required, as specified in 11.8 or when dot11MultiDomainCapabilityEnabled is true.

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Name	Type	Valid range	Description
Power Constraint	As defined in 7.3.2.15	As defined in 7.3.2.15	Optional. The Power Constraint element contains the information necessary to allow a STA to determine the local maximum transmit power in the current channel.
Time Advertisement	As defined in 7.3.2.61	As defined in 7.3.2.61	Timing announced by the STA.
Extended Capabilities	As defined in 7.3.2.27	As defined in 7.3.2.27	Optional. The Extended Capabilities information element may be present if any of the fields in this element are non-zero.
Vendor-SpecificInfo	A set of information elements	As defined in 7.3.2.26	Zero or more information elements.

10.3.46.1.3 When generated

This primitive is generated by the SME to request that the MLME generates a Timing Advertisement frame for transmission.

10.3.46.1.4 Effect of receipt

Upon the receipt of this primitive, the MLME generates a Timing Advertisement frame for transmission.

10.3.46.2 MLME-TIMING_ADVERTISEMENT. confirm

10.3.46.2.1 Function

This primitive reports the result of an MLME-TIMING_ADVERTISEMENT.request.

10.3.46.2.2 Semantics of the service primitive

This primitive provides the following parameter:

MLME-TIMING_ADVERTISEMENT.confirm(

ResultCode

)

Name	Type	Valid range	Description
ResultCode	Enumeration	SUCCESS, INVALID PARAMETERS	Reports the result of an MLME-TIMING_ADVERTISEMENT.request.

10.3.46.2.3 When generated

This primitive is generated by the MLME in response to an MLME-TIMING_ADVERTISEMENT.request.

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10.3.46.2.4 Effect of receipt

The SME is notified of the result of a MLME-TIMING_ADVERTISEMENT.request.

10.3.46.3 MLME-TIMING_ADVERTISEMENT. indication

10.3.46.3.1 Function

This primitive is generated by the MLME to indicate to the SME the reception of a Timing Advertisement frame.

10.3.46.3.2 Semantics of the service primitive

This primitive provides the following parameters:

MLME-TIMING_ADVERTISEMENT.indication(

Timestamp,
Capability Information,
Local Time,
Country,
Power Constraint,
Time Advertisement,
Extended Capabilities,
RCPI,
Source MAC address,
VendorSpecificInfo
)

Name	Type	Valid range	Description
Timestamp	Integer	N/A	The timestamp of the received frame.
Capability Information	As defined in 7.3.1.4	As defined in 7.3.1.4	The announced capabilities of the STA.
Local Time	Integer	N/A	Local Time is the value of a station's TSF timer at the start of reception of the first octet of the timestamp field of the received Timing Advertisement frame.
Country	As defined in 7.3.2.9	As defined in 7.3.2.9	The information required to identify the regulatory domain in which the STA is located and to configure its PHY for operation in that regulatory domain. Present only when TPC functionality is required, as specified in 11.8 or when dot11MultiDomainCapabilityEnabled is true.
Power Constraint	As defined in 7.3.2.15	As defined in 7.3.2.15	The Power Constraint element contains the information necessary to allow a STA to determine the local maximum transmit power in the current channel.
Time Advertisement	As defined in 7.3.2.61	As defined in 7.3.2.61	Timing announced by the STA.

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Name	Type	Valid range	Description
Extended Capabilities	As defined in 7.3.2.27	As defined in 7.3.2.27	The Extended Capabilities information element may be present if any of the fields in this element are non-zero.
RCPI	Integer as defined in 7.3.2.28	As defined in 7.3.2.28	RCPI is the measured value of received channel power on the received Timing Advertisement frame.
Source MAC Address	As defined in 7.1.3.3.5	As defined in 7.1.3.3.5	The SA field of the MAC header from the received Timing Advertisement frame.
Vendor-SpecificInfo	A set of information elements	As defined in 7.3.2.26	Zero or more information elements.

10.3.46.3.3 When generated

This primitive is generated by the MLME when a Timing Advertisement frame is received.

10.3.46.3.4 Effect of receipt

Upon the receipt of this primitive, the SME is notified that a Timing Advertisement frame has been received.

11. MLME

11.1 Synchronization

Insert the following text into 11.1 as shown:

All STAs within a single BSS shall be synchronized to a common clock using the mechanisms defined herein. A STA for which dot11OCBEnabled is true is not a member of a BSS, and therefore is not required to synchronize to a common clock or use these mechanisms.

11.1.1 Basic approach

Change 11.1.1 as follows:

A Timing Synchronization Function (TSF) keeps the timers for all STAs in the same BSS synchronized. All STAs in which dot11OCBEnabled is false shall maintain a local TSF timer. STAs in which dot11OCBEnabled is true may maintain a TSF timer for purposes other than synchronization.

11.3 STA authentication and association

Change 11.3 as follows:

A STA for which dot11OCBEnabled is false keeps two state variables for each STA with which direct communication via the WM is needed:

— *Authentication state:* The values are unauthenticated and authenticated.

— *Association state:* The values are unassociated and associated.

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A STA for which dot11OCBEnabled is true does not use MAC sublayer authentication or association and does not keep these state variables.

Insert the following new subclauses, 11.19 and 11.20, after the last subclause in Clause 11, renumbering as necessary:

11.19 STAs communicating data frames outside the context of a BSS

When dot11OCBEnabled is true in a STA:

a) Synchronization, authentication, association, and frame classes as defined in 11.1 and 11.3 are not used. Data confidentiality as defined in Clause 8 is not used. The STA may send management frames of subtype Action and, if the STA maintains a TSF Timer, subtype Timing Advertisement.
b) The STA may send control frames, except those of subtype PS-Poll, CF-End, and CF-End + CF-Ack.
c) The STA may send data frames of subtype Data, Null, QoS Data, and QoS Null.
d) The STA shall set the BSSID field in all management and data frames to the wildcard BSSID value.

When a STA joins a BSS, it shall set dot11OCBEnabled to FALSE. The STA shall keep dot11OCBEnabled false while joined with the BSS or while the STA is the AP within a BSS. If a STA does not include the dot11OCBEnabled MIB attribute, the STA shall operate as if the attribute is false.

Whenever MAC and PHY sublayer parameters are changed in a STA in which dot11OCBEnabled is true, MAC and PHY sublayer operation shall resume with the appropriate MIB attributes in less than 2 TU.

A STA shall use information from the CF Parameter Set element of all received Beacon frames, without regard for the BSSID, to update its NAV as specified in 9.3.2.2.

11.20 Timing Advertisement

11.20.1 Introduction

A STA that sends a Timing Advertisement frame shall maintain a TSF Timer in order to set the Timestamp field in this frame. When a STA transmits the Timing Advertisement frame, the Timestamp shall be set to the value of the STA's TSF timer at the time that the data symbol containing the first bit of the Timestamp is transmitted to the PHY plus the transmitting STA's delays through its local PHY from the MAC-PHY interface to its interface with the WM [e.g., antenna, light emitting diode (LED) emission surface].

A STA can advertise a time standard by transmitting a Timing Advertisement frame, which includes the Time Advertisement information element. As defined in 7.3.2.61 the Time Advertisement information element contains two estimates. The Time Value field contains an estimate of the difference between a time standard and the timestamp included in the same frame. The Time Error field contains an estimate of the standard deviation of the error in the estimate in the Time Value field. The time standard can be derived from an external time source. A STA with an external time source can implement an estimator in a variety of ways, which are beyond the scope of this standard.

11.20.2 Timing Advertisement Frame Procedures

The SME provides the Time Advertisement information element to the MLME when it requests the MLME to send a Timing Advertisement frame. When a Timing Advertisement frame is received by a STA, its MLME reports the Timestamp, Local Time, Time Advertisement information element, and estimates of propagation delay to the SME. For a STA that maintains a TSF Timer and receives a Timing Advertisement frame, Local Time is the value of the STA's TSF timer at the start of reception of the first octet of the

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Timestamp field of the frame. Otherwise, the Local Time is unspecified. The receiving STA's SME can use the Timestamp, Local Time, and Time Advertisement information element to align its estimate of the time standard to the transmitting STA's estimate of the corresponding time standard.

17. Orthogonal frequency division multiplexing (OFDM) PHY specification for the 5 GHz band

17.3 OFDM PLCP sublayer

17.3.10 PMD receiver specifications

17.3.10.2 Adjacent channel rejection

Insert the following new paragraph and table, Table 17-13a, at the end of 17.3.10.2, renumbering as necessary:

An optional enhanced performance specification is provided for systems requiring improved immunity to out-of-channel interfering emissions. If a STA has dot11ACRType equal to 2, the adjacent channel rejection shall be no less than specified in Table 17-13a. The interfering signal in the adjacent channel shall be a conformant OFDM signal, using transmit mask M (see Figure I.2), unsynchronized with the signal in the channel under test. The corresponding minimum receiver sensitivities for each modulation and coding rate are the same as in Table 17-13.

NOTE—Transmit mask M is equivalent to mask C.

Table 17-13a—Optional enhanced receiver performance requirements

Modulation	Coding rate (R)	Adjacent channel rejection (dB)	Nonadjacent channel rejection (dB)
BPSK	1/2	28	42
BPSK	3/4	27	41
QPSK	1/2	25	39
QPSK	3/4	23	37
16-QAM	1/2	20	34
16-QAM	3/4	16	30
64-QAM	2/3	12	26
64-QAM	3/4	11	25

17.3.10.3 Nonadjacent channel rejection

Insert the following paragraph at the end of 17.3.10.3:

An optional enhanced performance specification is provided for systems requiring improved immunity to out-of-channel interfering emissions. If a STA has dot11ACRType equal to 2, the nonadjacent channel

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rejection shall be no less than specified in Table 17-13a. The interfering signal in the nonadjacent channel shall be a conformant OFDM signal, using transmit mask M (see Figure I.2), unsynchronized with the signal in the channel under test. The corresponding minimum receiver sensitivities for each modulation and coding rate are the same as in Table 17-13.

17.4 OFDM PLME

17.4.1 PLME_SAP sublayer management primitives

Insert the following row at the end of Table 17-14:

Table 17-14—MIB attribute default values/ranges

Managed object	Default value/range	Operational semantics
dot11 PHY OFDM Table		
dot11ACRType	Implementation dependent	Dynamic

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Annex A

(normative)

Protocol Implementation Conformance Statement (PICS) proforma

A.4 PICS proforma—IEEE Std 802.11-2007[2]

A.4.3 IUT Configuration

Insert the following rows in the appropriate places in A.4.3:

Item	IUT configuration	References	Status	Support
*CF2.1	Independent station operating outside the context of a BSS (dot11OCBEnabled is true)	11.19	(not CF17):O, CF17:M	Yes ☐ No ☐
*CF17	5.9 GHz band	Annex J	CF6:O	Yes ☐ No ☐

A.4.4.1 MAC protocol capabilities

Change the following rows in A.4.4.1 as shown:

Item	Protocol capability	References	Status	Support
PC1	Authentication service	5.4.3.1, 5.4.3.2, 8.1, 11.19, Annex C	(not CF2.1):M	Yes ☐ No ☐ N/A☐
PC14	Association and reassociation	5.4, 11.3, 11.3.2, 11.19, Annex C	(not CF2.1):M	Yes ☐ No ☐ N/A☐

[2]*Copyright release for PICS proforma:* Users of this standard may freely reproduce the PICS proforma in this annex so that it can be used for its intended purpose and may further publish the completed PICS.

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Change the following rows in A.4.4.1:

Item	Protocol capability	References	Status	Support
PC11	Timing synchronization function (TSF)	11.1, Annex C	(not CF2.1):M, CF2.1:O	Yes ☐ No ☐
PC11.4	TSF synchronization and accuracy	11.1.1, 11.1.2	(not CF2.1):M	Yes ☐ No ☐ N/A☐
PC11.9	Probe response	11.1.3	M	Yes ☐ No ☐ N/A☐
PC38	Dot11OCBEnabled is false when STA is a BSS member	11.19	M	Yes ☐ No ☐ N/A☐

A.4.4.2 MAC frames

Change the following rows in A.4.4.2 as shown:

Item	MAC frame	References	Status	Support
FT1	Association request	Clause 7	CF2 & (not CF2.1):M	Yes ☐ No ☐ N/A☐
FT3	Reassociation request	Clause 7	CF2 & (not CF2.1):M	Yes ☐ No ☐ N/A☐
FT5	Probe request	Clause 7	CF2 & (not CF2.1):M	Yes ☐ No ☐ N/A☐
FT6	Probe response	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FT7	Beacon	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FT8	ATIM	Clause 7	CF2 & (not CF2.1):M	Yes ☐ No ☐ N/A☐
FT9	Disassociation	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FT10	Authentication	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FT11	Deauthentication	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FT12	Power save (PS)-Poll	Clause 7	CF2 & (not CF2.1):M	Yes ☐ No ☐ N/A☐
FR2	Association response	Clause 7	CF2 & (not CF2.1):M	Yes ☐ No ☐ N/A☐
FR4	Reassociation response	Clause 7	CF2 & (not CF2.1):M	Yes ☐ No ☐ N/A☐
FR5	Probe request	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FR6	Probe response	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FR7	Beacon	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FR8	ATIM	Clause 7	CF2 & (not CF2.1):M	Yes ☐ No ☐ N/A☐
FR9	Disassociation	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐

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Item	MAC frame	References	Status	Support
FR10	Authentication	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FR11	Deauthentication	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FR16	CF-End	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FR17	CF End+CF-Ack	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐
FR19	Data + CF-Ack	Clause 7	(not CF2.1):M	Yes ☐ No ☐ N/A☐

Insert two new rows at the end of A.4.4.2 as follows:

Item	MAC Frame	References	Status	Support
FT26	Timing Advertisement frame	Clause 7	O	Yes ☐ No ☐ N/A☐
FR26	Timing Advertisement frame	Clause 7	O	Yes ☐ No ☐ N/A☐

A.4.4.4 MAC addressing function

Insert two new rows at the end of A.4.4.4 as follows:

Item	MAC addressing function	References	Status	Support
AD4	Wildcard BSSID	7.1.3.3.3, 7.2.2	CF2.1:M	Yes ☐ No ☐ N/A☐
AD5	MAC and PHY operation resumes with appropriate MIB attributes in less than 2 TU	11.19	CF2.1:M	Yes ☐ No ☐ N/A☐

A.4.8 OFDM PHY functions

Insert the following new rows into A.4.8:

Item	Feature	References	Status	Support
OF3: PMD Operating Specification General				
*OF3.2.8	5.9 GHz band	Annex J	CF17:M	Yes ☐ No ☐ N/A☐
OF3.3.16	5.9 GHz band (10 MHz channel spacing)	Annex J	CF17:O	Yes ☐ No ☐ N/A☐
OF3.3.17	5.9 GHz band (20 MHz channel spacing)	Annex J	CF17:O	Yes ☐ No ☐ N/A☐
OF3.3.18	5.9 GHz band (5 MHz channel spacing)	Annex J	CF17:O	Yes ☐ No ☐ N/A☐

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Item	Feature	References	Status	Support
OF4: PMD Transmit Specification				
OF4.1.4a	Power Level (5.850–5.925 GHz), Class A	I.2.3	CF17:M	Yes ☐ No ☐ N/A☐
OF4.1.4b	Power Level (5.850–5.925 GHz), Class B	I.2.3	CF17:O	Yes ☐ No ☐ N/A☐
OF4.1.4c	Power Level (5.850–5.925 GHz), Class C	I.2.3	CF17:O	Yes ☐ No ☐ N/A☐
OF4.1.4d	Power Level (5.850–5.925 GHz), Class D	I.2.3	CF17:O	Yes ☐ No ☐ N/A☐
OF4.15a	Spectrum mask, Class A (10 MHz channel spacing)	I.2.3	OF4.1.4a:M	Yes ☐ No ☐ N/A☐
OF4.15b	Spectrum mask, Class B (10 MHz channel spacing)	I.2.3	OF4.1.4b:M	Yes ☐ No ☐ N/A☐
OF4.15c	Spectrum mask, Class C (10 MHz channel spacing)	I.2.3	OF4.1.4c:M	Yes ☐ No ☐ N/A☐
OF4.15d	Spectrum mask, Class D (10 MHz channel spacing)	I.2.3	OF4.1.4d:M	Yes ☐ No ☐ N/A☐
OF5.2.1	Optional adjacent channel rejection	17.3.10.2	O	Yes ☐ No ☐ N/A☐
OF5.3.1	Optional nonadjacent channel rejection	17.3.10.3	O	Yes ☐ No ☐ N/A☐

A.4.15 QoS enhanced distributed channel access (EDCA)

Insert the following new row at the end of A.4.15:

Item	Protocol capability	References	Status	Support
QD8	Default EDCA parameters for communications outside context of BBS	7.3.2.29, 9.9.1.2	CF2.1:M	Yes ☐ No ☐ N/A☐

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Annex D

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ASN.1 encoding of the MAC and PHY MIB

In the `dotStationConfig TABLE` ***of Annex D, change the*** `dot11StationConfigEntry` ***sequence list as follows:***

```
Dot11StationConfigEntry ::=

SEQUENCE {

      dot11StationID                                MacAddress,
      dot11MediumOccupancyLimit                     INTEGER,
      dot11CFPollable                               TruthValue,
      dot11CFPPeriod                                INTEGER,
      dot11CFPMaxDuration                           INTEGER,
      dot11AuthenticationResponseTimeOut            Unsigned32,
      dot11PrivacyOptionImplemented                 TruthValue,
      dot11PowerManagementMode                      INTEGER,
      dot11DesiredSSID                              OCTET STRING,
      dot11DesiredBSSType                           INTEGER,
      dot11OperationalRateSet                       OCTET STRING,
      dot11BeaconPeriod                             INTEGER,
      dot11DTIMPeriod                               INTEGER,
      dot11AssociationResponseTimeOut               Unsigned32,
      dot11DisassociateReason                       INTEGER,
      dot11DisassociateStation                      MacAddress,
      dot11DeauthenticateReason                     INTEGER,
      dot11DeauthenticateStation                    MacAddress,
      dot11AuthenticateFailStatus                   INTEGER,
      dot11AuthenticateFailStation                  MacAddress,
      dot11MultiDomainCapabilityImplemented         TruthValue,
      dot11MultiDomainCapabilityEnabled             TruthValue,
      dot11CountryString                            OCTET STRING,
      dot11SpectrumManagementImplemented            TruthValue,
      dot11SpectrumManagementRequired               TruthValue,
      dot11RSNAOptionImplemented                    TruthValue,
      dot11RSNAPreauthenticationImplemented         TruthValue,
      dot11RegulatoryClassesImplemented             TruthValue,
      dot11RegulatoryClassesRequired                TruthValue,
      dot11QosOptionImplemented                     TruthValue,
      dot11ImmediateBlockAckOptionImplemented       TruthValue,
      dot11DelayedBlockAckOptionImplemented         TruthValue,
      dot11DirectOptionImplemented                  TruthValue,
      dot11APSDOptionImplemented                    TruthValue,
      dot11QAckOptionImplemented                    TruthValue,
      dot11QBSSLoadOptionImplemented                TruthValue,
      dot11QueueRequestOptionImplemented            TruthValue,
      dot11TXOPRequestOptionImplemented             TruthValue,
      dot11MoreDataAckOptionImplemented             TruthValue,
      dot11AssociateinNQBSS                         TruthValue,
```


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```
dot11DLSAllowedInQBSS                              TruthValue,
dot11DLSAllowed                                    TruthValue,
dot11AssociateStation                              MacAddress,
dot11AssociateID                                   INTEGER,
dot11AssociateFailStation                          MacAddress,
dot11AssociateFailStatus                           INTEGER,
dot11ReassociateStation                            MacAddress,
dot11ReassociateID                                 INTEGER,
dot11ReassociateFailStation                        MacAddress,
dot11ReassociateFailStatus                         INTEGER,
dot11RadioMeasurementCapable                       TruthValue,
dot11RadioMeasurementEnabled                       TruthValue,
dot11RRMMeasurementProbeDelay                      INTEGER,
dot11RRMMeasurementPilotPeriod                     INTEGER,
dot11RRMLinkMeasurementEnabled                     TruthValue,
dot11RRMNeighborReportEnabled                      TruthValue,
dot11RRMParallelMeasurementsEnabled                TruthValue,
dot11RRMRepeatedMeasurementsEnabled                TruthValue,
dot11RRMBeaconPassiveMeasurementEnabled            TruthValue,
dot11RRMBeaconActiveMeasurementEnabled             TruthValue,
dot11RRMBeaconTableMeasurementEnabled              TruthValue,
dot11RRMBeaconMeasurementReportingConditionsEnabled  TruthValue,
dot11RRMFrameMeasurementEnabled                    TruthValue,
dot11RRMChannelLoadMeasurementEnabled              TruthValue,
dot11RRMNoiseHistogramMeasurementEnabled           TruthValue,
dot11RRMStatisticsMeasaurementEnabled              TruthValue,
dot11RRMLCIMeasurementEnabled                      TruthValue,
dot11RRMLCIAzimuthEnabled                          TruthValue,
dot11RRMTransmitStreamCategoryMeasurementEnabled   TruthValue,
dot11RRMTriggeredTransmitStreamCategoryMeasurementEnabled
                                                   TruthValue,
dot11RRMAPChannelReportEnabled                     TruthValue,
dot11RRMMIBEnabled                                 TruthValue,
dot11RRMMaxMeasurementDuration                     Unsigned32,
dot11RRMNonOperatingChannelMaxMeasurementDuration    Unsigned32,
dot11RRMMeasurementPilotTransmissionInformationEnabled TruthValue,
dot11RRMMeasurementPilotCapability                 Unsigned32,
dot11RRMNeighborReportTSFOffsetEnabled             TruthValue,
dot11RRMRCPIMeasurementEnabled                     TruthValue,
dot11RRMRSNIMeasurementEnabled                     TruthValue,
dot11RRMBSSAverageAccessDelayEnabled               TruthValue,
dot11RRMBSSAvailableAdmissionCapacityEnabled       TruthValue,
dot11RRMAntennaInformationEnabled                  TruthValue,
dot11FastBSSTransitionImplemented                  TruthValue,
dot11LCIDSEImplemented                             TruthValue,
dot11LCIDSERequired                                TruthValue,
dot11DSERequired                                   TruthValue,
dot11ExtendedChannelSwitchEnabled                  TruthValue,
dot11RSNAProtectedManagementFramesEnabled          TruthValue,
dot11RSNAUnprotectedManagementFramesAllowed        TruthValue,
dot11AssociationPingResponseTimeout                Unsigned32,
dot11AssociationMaximumPingAttempts                INTEGER,
dot11HighThroughputOptionImplemented               TruthValue,
dot11OCBEnabled                                    TruthValue }
```

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Insert the following elements at the end of the `dot11StationConfigEntry` ***element definitions:***

```
dot11OCBEnabled OBJECT-TYPE

            SYNTAX TruthValue
            MAX-ACCESS read-write
            STATUS current
            DESCRIPTION
               "A STA uses the defined outside the context of a BSS pro-
               cedures if and only if this attribute is true. The
               default value of this attribute is false."
            DEFVAL { false }
     ::= { dot11StationConfigEntry 102 }
```

In `dot11PhyOFDM TABLE`***, change*** `Dot11PhyOFDMEntry` ***as follows:***

```
Dot11PhyOFDMEntry ::=
        SEQUENCE { dot11CurrentFrequency               INTEGER,
                   dot11TIThreshold                    Integer32,
                   dot11FrequencyBandsSupported        INTEGER,
                   dot11ChannelStartingFactor          Integer32,
                   dot11FiveMHzOperationImplemented    TruthValue,
                   dot11TenMHzOperationImplemented     TruthValue,
                   dot11TwentyMHzOperationImplemented  TruthValue,
                   dot11PhyOFDMChannelWidth            INTEGER,
                   dot11STATransmitPowerClass          Unsigned32,
                   dot11ACRType                        Unsigned32 }
```

In `dot11PhyOFDM TABLE`***, insert the following definitions after*** `dot11ChannelStartingFactor` ***as shown:***

```
dot11STATransmitPowerClass OBJECT-TYPE
         SYNTAX Unsigned32 {Class A(1),Class B(2),Class C(3),Class D(4)}
         MAX-ACCESS read-write
         STATUS current
         DESCRIPTION
           "The station transmit power class: Class A=1, Class B=2,
           Class C=3, Class D=4(as defined in I.2.2)."
         DEFVAL { 1 }
     ::=  { dot11PhyOFDMEntry 12 }

dot11ACRType OBJECT-TYPE
         SYNTAX Unsigned32 { Table 17-13(1), Table 17-13a(2) }
         MAX-ACCESS read-only
         STATUS current
         DESCRIPTION
           "This is a status variable.
           It is written by the SME.

           The Adjacent and Nonadjacent Channel Rejection performance:
              when this attribute = 1 the levels in Table 17-13 apply;
              when this attribute = 2 the levels in Table 17-13a apply."
     DEFVAL { 1 }
     ::=  { dot11PhyOFDMEntry 13 }
```


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Annex I

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Regulatory classes

I.1 External regulatory references

Change the list of documents for the United States in Table I.1 as shown:

Table I.1—Regulatory requirement list

Geographic area	Approval standards	Documents	Approval authority
United States	Federal Communications Commission (FCC)	FCC 47 CFR [B8], Part 15, Sections 15.205, 15.209, and 15.247; and Subpart E, Sections 15.401–15.407, Section 90.210, Sections 90.371–383, Sections 90.1201–90.1217, 90.1301–90.1337, Section 95.639, Sections 95.1501–1511	FCC

Insert one new emissions limits set in Table I.2, and change the numbering of the last row as shown:

Table I.2—Emissions limits sets

Emissions limits set	United States	Europe	Japan
7 Intelligent Transportation Systems (ITS) radio service	FCC 47 CFR [B8], Sections 90.375, 90.377, 90.379, 95.639 and 95.1511	ETSI ES 202 663 [Ba], Clause 5, ETSI EN 302 571 [Bb], ETSI EN 301 893	Reserved
~~7~~8–255	Reserved	Reserved	Reserved

Insert two new behavior limits sets in Table I.3, and change the numbering of the last row as shown:

Table I.3—Behavior limits sets

Behavior limits sets	United States	Europe	Japan
17 ITS non-mobile operations	FCC 47 CFR [B8], Sections 90.375, 90.379, and 90.377	ETSI ES 202 663 [Ba], Clause 5, ETSI EN 302 571 [Bb]	Reserved
18 ITS mobile operations	FCC 47 CFR [B8], Sections 95.639 and 95.1511	ETSI ES 202 663 [Ba], Clause 5, ETSI EN 302 571 [Bb]	Reserved
~~16~~19–255	Reserved	Reserved	Reserved

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I.2 Radio performance specifications

I.2.1 Transmit and receive in-band and out-of-band spurious emissions

Change the text in I.2.1 as shown:

Spurious transmissions from compliant devices shall conform to national regulations. For operation in the United States, refer to the FCC 47 CFR~~47~~ [B8]~~, Section 15.407~~sections listed in Table I.2. For operation in Europe, refer to ETSI ES 202 663 [Ba] and ETSI EN 301 893-1. For operation in Japan, refer to MIC EO Article 49.20 and Article 49.21, Section 1.

I.2.2 Transmit power levels

Insert the following text at the end of the first paragraph of I.2.2 (prior to Table I.4):

The maximum allowable STA transmit power classifications for ITS non-mobile operations in the U.S. 5.85–5.925 GHz band are shown in Table I.5a.

Insert a new entry at the end of Table I.4, for the USA 5.85–5.925 GHz frequency band, as follows:

Table I.4—Transmit power level by regulatory domain

Frequency band (GHz)	United States (Maximum output power with up to 6 dBi antenna gain) (mW)	United States (EIRP)	Europe (EIRP)
5.85–5.925	760, power level at antenna input. Antenna gain greater than 6 dBi allowed although additional limitations apply per FCC 47 CFR [B8], Sections 90.375 and 95.1511. See also Table I.5a.	44.8 dBm (30 W). Additional limitations apply per FCC 47 CFR [B8], Sections 90.375 and 95.1511. See also Table I.5a.	33 dBm (2W). Additional limitations apply per ETSI ES 202 663 [Ba], Clause 5.

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Insert new Table I.5a immediately after Table I.5:

Table I.5a—Maximum STA transmit power classification for the 5.85–5.925 GHz band in the United States

STA transmit power classification	Maximum STA transmit power (mW)	Maximum permitted EIRP (dBm)
A	1	23
B	10	23
C	100	33
D	760 Note that for this class higher power is permitted as long as the power level is reduced to this level at the antenna input and the emission mask specifications are met.	33 for non government 44.8 for government

I.2.3 Transmit spectrum mask

Insert the following text, tables, and figure at the end of I.2.3:

For operation in the 5.85–5.925 GHz band in the United States, FCC 47 CFR [B8], Sections 90.377 and 95.1509, the transmitted spectrum shall be as follows:

a) For any STA using 5 MHz channel spacing, the transmitted spectral density shall have a 0 dBr bandwidth not exceeding 4.5 MHz and shall not exceed the spectrum mask created using the permitted power spectral density levels listed in Table I.7 for the transmit power class of the STA.
b) For any STA using 10 MHz channel spacing, the transmitted spectral density shall have a 0 dBr bandwidth not exceeding 9 MHz and shall not exceed the spectrum mask created using the permitted power spectral density levels listed in Table I.8 for the transmit power class of the STA.

Table I.7—Spectrum mask data for 5 MHz channel spacing in the 5.85–5.925 GHz band in the United States

STA transmit power class	Permitted power spectral density, dBr				
	± 2.25 MHz offset (±f1)	± 2.5 MHz offset (±f2)	± 2.75 MHz offset (±f3)	±5 MHz offset (±f4)	± 7.5 MHz offset (±f5)
Class A	0	–10	–20	–28	–40
Class B	0	–16	–20	–28	–40
Class C	0	–26	–32	–40	–50
Class D	0	–35	–45	–55	–65

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Table I.8—Spectrum mask data for 10 MHz channel spacing in the 5.85–5.925 GHz band in the United States

STA transmit power class	Permitted power spectral density, dBr				
	± 4.5 MHz offset (±f1)	± 5.0 MHz offset (±f2)	± 5.5 MHz offset (±f3)	± 10 MHz offset (±f4)	± 15 MHz offset (±f5)
Class A	0	–10	–20	–28	–40
Class B	0	–16	–20	–28	–40
Class C	0	–26	–32	–40	–50
Class D	0	–35	–45	–55	–65

The transmit spectral mask is created and applied as shown in Figure I.2 about the channel center frequency (Fc) defined by the channel starting frequency and channel number from the regulatory class. The 0 dBr level is the maximum power spectral density measured in the channel. The measurements of transmit spectral density are made using a 100 kHz resolution bandwidth and a 30 kHz video bandwidth.

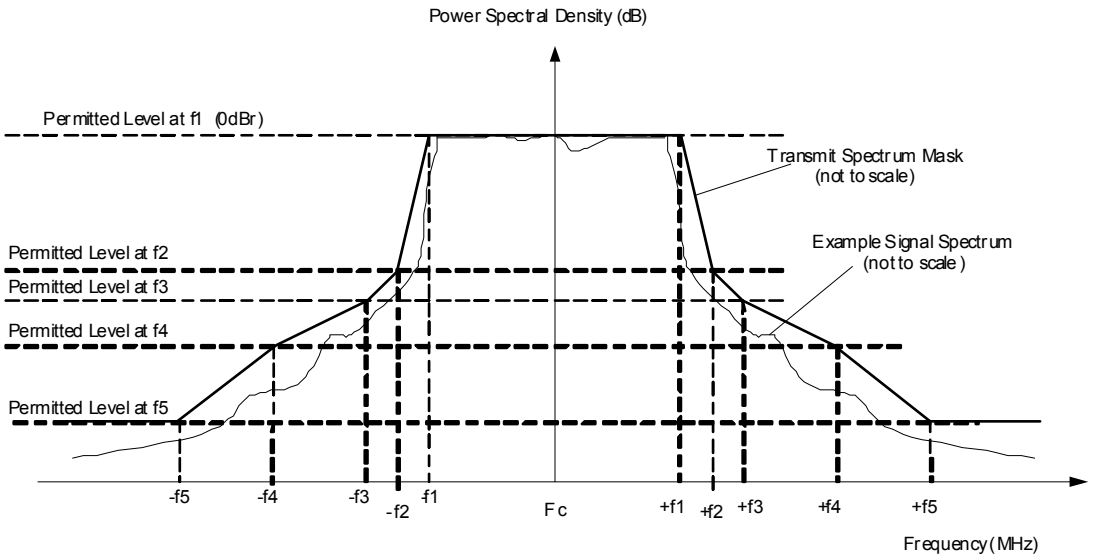

Figure I.2—Transmit spectrum mask and application

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Annex J

(normative)

Country information element and regulatory classes

J.1 Country information and regulatory classes

Insert three new entries and two footnotes to Table J.1 and change the numbering of the last row accordingly:

Table J.1—Regulatory classes in the United States

Regulatory class	Channel starting frequency (GHz)	Channel spacing (MHz)	Channel set	Transmit power limit (mW)	Transmit power limit (EIRP)	Emissions limits set	Behavior limits set
16[a]	5.0025	5	170–184	760	44.8 dBm	7	17, 18
17[a, b]	5	10	171–184	760	44.8 dBm	7	17, 18
18[a, b]	5	20	172–183	100	23 dBm	7	17, 18
~~16~~19–21	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

[a]This regulatory class specifies a list of channels in the 5.9 GHz band. Current regulations may only permit a subset of these channels.
[b]It is the responsibility of management layers outside the scope of this standard to ensure that channels in use at any location are non-overlapping.

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Insert four new entries and two footnotes to Table J.2 and change the numbering of the last row accordingly:

Table J.2—Regulatory classes in Europe

Regulatory class	Channel starting frequency (GHz)	Channel spacing (MHz)	Channel set	Transmit power limit (mW)	Transmit power limit (EIRP)	Emissions limits set	Behavior limits set
13[a]	5.0025	5	171–184	—	33 dBm	7	17, 18
14[a, b]	5	10	171–184	—	33 dBm	7	17, 18
15[a, b]	5	20	172–183	—	23 dBm	7	17, 18
16	5	20	100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140	—	30 dBm	7	1, 3, 4, 17, 18
~~16~~17–255	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

[a]This regulatory class specifies a list of channels in the 5.9 GHz band. Current regulations may only permit a subset of these channels.
[b]It is the responsibility of management layers outside the scope of this standard to ensure that channels in use at any location are non-overlapping.

J.2 Band-specific operating requirements

Insert the following new subclauses, J.2.2 and J.2.3, at the end of Annex J:

J.2.2 5.9 GHz band in the United States (5.850–5.925 GHz)

STAs operating under the behavior limits set 17 in Table I.3 are required to be registered with the FCC ULS. The registration includes the following:

— Classification by coverage size, which is defined by EIRP, and
— Identification of channels the STA is permitted to use.

STAs shall be classified for operation in this band by their maximum transmit power capability, as listed in Table I.5a in I.2.2. STAs shall be compliant with the spectral emission requirements for their class listed in I.2.3.

STAs shall have dot11OCBEnabled set to TRUE.

J.2.3 5.9 GHz band in Europe (5.855–5.925 GHz)

STAs shall have dot11OCBEnabled set to TRUE.

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Annex P

(informative)

Bibliography

P.1 General

Insert the following entries in P.1, renumbering as necessary:

[Ba] ETSI ES 202 663 V1.1.0 (2010-01), Intelligent Transport Systems (ITS); European profile standard for the physical and medium access control layer of Intelligent Transport Systems operating in the 5 GHz frequency band.

[Bb] ETSI EN 302 571 V1.1.1 (2008-09), Intelligent Transport Systems (ITS); Radiocommunications equipment operating in the 5 855 MHz to 5 925 MHz frequency band; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive.

[Bc] IEEE Standards Registration Authority—Frequently Asked Questions. [3]

[3]Available from the IEEE Standards Web site: http://standards.ieee.org/regauth/faqs.html.

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