



**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 3: 3650–3700 MHz Operation in USA

IEEE Computer Society

Sponsored by the
LAN/MAN Standards Committee

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

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as amended by IEEE Std 802.11k™-2008
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Approved 26 September 2008

IEEE-SA Standards Board

Abstract: This amendment defines enhancements to the IEEE 802.11 physical layer (PHY) and medium access control (MAC) to support operation in the 3650–3700 MHz band in the United States.

Keywords: 3650 MHz, wireless local area network, WLAN

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This amendment defines enhancements to the IEEE 802.11 physical layer (PHY) and medium access control (MAC) to support operation in the 3650–3700 MHz band in the United States.

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Specific requirements**

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

Amendment 3: 3650–3700 MHz Operation in USA

(This amendment is based on IEEE Std 802.11TM-2007, as amended by IEEE Std 802.11kTM-2008 and IEEE Std 802.11rTM-2008.)

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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 and its amendments to form the comprehensive standard.¹

The editing instructions are shown in ***bold italic***. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using ~~strike through~~ (to remove old material) and 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 instructions. ***Replace*** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editorial notes will not be carried over into future editions because the changes will be incorporated into the base standard.

3. Definitions

Insert the following new definitions in alphabetical order into Clause 3, renumbering as necessary:

3.216 dependent station (STA): A STA that is not registered and whose operational parameters are dictated by messages it receives from an enabling STA. Once enabled by the dynamic STA enablement (DSE) process, a dependent STA's continued operation becomes contingent upon being able to receive messages from its enabling STA over the air.

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

3.217 dynamic station (STA) enablement (DSE): The process by which an enabling STA grants permission and dictates operational procedures to STAs that are subject to its control.

3.218 enabling station (STA): A registered STA that has the authority to control when and how a dependent STA can operate. An enabling STA communicates an enabling signal to its dependants over the air. An enabling STA may choose for other dynamic STA enablement (DSE) messages to be exchanged over the air, over the distribution system (DS), or by mechanisms that rely on transport via higher layers.

3.219 extended channel switching (ECS): A procedure that is used to announce a pending change of operating channel, regulatory class, or both.

3.220 fixed station (STA): A STA that is physically attached to a specific location. In licensed bands, a fixed STA may be authorized to operate only at a specific location.

3.221 registered station (STA): A STA for which information must be submitted to an appropriate regulatory or coordination authority before it is allowed to transmit.

3.222 restricted channel: A radio channel in which transmission is restricted to stations (STAs) that operate under the control of licensed operators.

4. Abbreviations and acronyms

Insert the following abbreviations in alphabetical order into Clause 4:

CBP	Contention-Based Protocol
DSE	dynamic station enablement
ECS	extended channel switching
ULS	Universal Licensing System

5. General description

5.1 General description of the architecture

5.1.1 How WLAN systems are different

Change the title and text of 5.1.1.1 as shown:

5.1.1.1 Wireless station (STA)~~Destination address does not equal destination location~~

~~In wired LANs, an address is equivalent to a physical location. This is implicitly assumed in the design of wired LANs. In the design of wired LANs it is implicitly assumed that an address is equivalent to a physical location. In wireless networks, this is not always the case. In IEEE Std 802.11, the addressable unit is a station (STA). The term implies no more than the origin or/and destination of a message. Physical and operational characteristics are defined by modifiers that are placed in front of the term STA. For example, in the case of location and mobility, the addressable units are the fixed STA, the portable STA and the mobile STA. The STA is a message destination, but not (in general) a fixed location.~~

A STA can take on multiple distinct characteristics, each of which shape its function. For example, a single addressable unit can simultaneously be a portable STA, a quality of service (QoS) STA, a dependent STA and a hidden STA.

5.2 Components of the IEEE 802.11 architecture

Insert subclauses (5.2.8 through 5.2.8.4) after 5.2.7.11:

5.2.8 Operation in licensed frequency bands

IEEE 802.11 devices can operate on frequencies that are licensed by national regulatory bodies. Although this standard has been generalized so that it is independent of license type, band, and country of operation, only the bands and associated regulations listed in Annex I have been specifically considered.

5.2.8.1 Dynamic STA enablement (DSE) in licensed bands

The DSE operating procedures are used to automate the channel permissioning and regulatory controls needed for unregistered IEEE 802.11 STAs to operate as dependent STAs in licensed spectrum.²

5.2.8.2 Contention-Based Protocol (CBP) in nonexclusively licensed bands

The granting of licenses on a nonexclusive, uncoordinated basis in the same area leads to the possibility of overlapping networks. When overlapping networks cause co-channel interference, regulations, such as those governing the 3650 MHz band in the United States, require the use of a CBP “by which a transmitter provides reasonable opportunities for other transmitters to operate.”³ IEEE 802.11 carrier sense multiple access with collision avoidance (CSMA/CA) is suitable for this purpose in most situations.

5.2.8.3 Using DSE STA identification to resolve interference

When CSMA/CA is not able to sufficiently sense the presence of another licensee’s STA (i.e., a hidden STA) or if a secondary licensee causes interference to a primary licensee, the licensee is obliged to resolve complaints that result from interference caused by any STA under its control (including dependent STAs). In order to facilitate the interference resolution processes, all STAs operating in nonexclusively licensed spectrum use the DSE STA and location information procedures.

The STA identification and location information procedures are inherently tied because, by default, registered STAs broadcast their actual location as their unique identifier. Dependent STAs broadcast the location of the STA that has enabled them as well as a unique code selected by the licensee. This method ensures that a victim of the interference is always put in contact with the party responsible for rectifying the problem, and, at the same time, it protects the privacy of the dependent STA’s operator.

5.2.8.4 Further coexistence enhancements in nonexclusively licensed bands

While not explicitly required to meet specific rules, a number of optional IEEE 802.11 mechanisms, when used together, are able to meet general requirements for spectrum sharing, incumbent detection, and other cognitive radio functions in licensed bands. The specific mechanisms for each band are detailed in J.2.

²In some licensed frequency bands, wireless equipment can be owned and operated by individuals who do not hold a license. In such instances, devices must be either communicating with, or receiving permission to transmit from, a STA that is maintained by a licensed operator. The Japanese 4.9 GHz band and the U.S. 4.94–4.99 GHz public safety band are examples in which IEEE 802.11 STAs operate under such arrangements.

³Definition of CBP from FCC 05-56, Report and ORDER AND MEMORANDUM OPINION AND ORDER, clause 58.

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) Medium access control (MAC) service data unit (MSDU) delivery
- j) Dynamic frequency selection (DFS)
- k) Transmit power control (TPC)
- l) Higher layer timer synchronization (QoS facility only)
- m) QoS traffic scheduling (QoS facility only)
- n) Radio measurement
- o) DSE

5.3.1 STA service (SS)

Change the list of 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
- j) DSE

5.3.2 Distribution system service (DSS)

Change the list of DDSs in 5.3.2 as follows:

- a) Authentication
- b) Disassociation
- c) Distribution
- d) Integration
- e) Reassociation
- f) QoS traffic scheduling (QoS facility only)
- g) DSE

7. Frame formats

7.2 Format of individual frame types

7.2.3 Management frames

7.2.3.1 Beacon frame format

Insert order 34 through 36 information fields into Table 7-8:

Table 7-8—Beacon frame body

Order	Information	Notes
34	DSE registered location	The DSE Registered Location information element shall be present if dot11LCIDSERequired is true.
35	Extended Channel Switch Announcement	The Extended Channel Switch Announcement information element may be present if dot11ExtendedChannelSwitchEnabled is true.
36	Supported Regulatory Classes	The Supported Regulatory Classes information element shall be present if dot11ExtendedChannelSwitchEnabled is true.

7.2.3.4 Association Request frame format

Change order 7 information field and insert order 12 information field into Table 7-10 as shown:

Table 7-10—Association Request frame format

Order	Information	Notes
7	Supported Channels	The Supported Channels element shall be present if dot11SpectrumManagementRequired is true <u>and dot11ExtendedChannelSwitchEnabled is false.</u>
<u>12</u>	<u>Supported Regulatory Classes</u>	<u>The Supported Regulatory Classes information element is present if dot11ExtendedChannelSwitchEnabled is true.</u>

7.2.3.5 Association Response frame format

Insert order 12 information field into Table 7-11:

Table 7-11—Association Response frame format

Order	Information	Notes
12	DSE registered location	The DSE Registered Location information element is present if dot11LCIDSERequired is true

7.2.3.6 Reassociation Request frame format

Change order 8 information field and insert order 15 information field into Table 7-12 as shown:

Table 7-12—Reassociation Request frame format

Order	Information	Notes
8	Supported Channels	The Supported Channels element shall be present if dot11SpectrumManagementRequired is true <u>and</u> dot11ExtendedChannelSwitchEnabled is false.
<u>15</u>	<u>Supported Regulatory Classes</u>	<u>The Supported Regulatory Classes information element is present if dot11ExtendedChannelSwitchEnabled is true.</u>

7.2.3.7 Reassociation Response frame format

Insert order 14 information field into Table 7-13:

Table 7-13—Reassociation Response frame body

Order	Information	Notes
14	DSE registered location	The DSE Registered Location information element is present if dot11LCIDSERequired is true

7.2.3.8 Probe Request frame format

Insert order 6 information field into Table 7-14:

Table 7-14—Probe Request frame format

Order	Information	Notes
6	Supported Regulatory Classes	The Supported Regulatory Classes information element is present if dot11ExtendedChannelSwitchEnabled is true.

7.2.3.9 Probe Response frame format

Insert order 32 through 34 information fields into Table 7-15:

Table 7-15—Probe Response frame body

Order	Information	Notes
32	DSE registered location	The DSE Registered Location information element shall be present if dot11LCIDSERequired is true.
33	Extended Channel Switch Announcement	The Extended Channel Switch Announcement information element may be present if dot11ExtendedChannelSwitchEnabled is true.
34	Supported Regulatory Classes	The Supported Regulatory Classes information element is present if dot11ExtendedChannelSwitchEnabled is true.

7.3 Management frame body components

7.3.2 Information elements

Insert element identifiers (IDs) 58 through 60 into Table 7-26:

Table 7-26—Element IDs

Information Element	Element ID	Length (in octets)	Extensible
DSE Registered Location (see 7.3.2.52)	58	22	
Supported Regulatory Classes (see 7.3.2.54)	59	4 to 255	
Extended Channel Switch Announcement (see 7.3.2.53)	60	6	

7.3.2.27 Extended Capabilities information element

Change last paragraph of 7.3.2.27 as follows:

The Capabilities field is a bit field indicating the capabilities being advertised by the STA transmitting the information element. ~~There are no capabilities defined for this field in this revision of the standard. The length of the Capabilities field is a variable n . The Capabilities field is shown in Table 7-35a.~~

Table 7-35a—Capabilities field

Bit	Information	Notes
0, 1	Reserved	
2	Extended Channel Switching	The Extended Channel Switching field is 1 to indicate support for the communication of channel switching information through the transmission and reception of the Extended Channel Switch Announcement element and management frame as described in 7.4.7.6. The Extended Channel Switching field is 0 to indicate a lack of support for extended channel switching.
3– n	Reserved	

If a STA does not support any of capabilities defined in the Extended Capabilities information element, then the STA is not required to transmit the Extended Capabilities information element.

Insert the following subclauses (7.3.2.52 through 7.3.2.54) after 7.3.2.51:

7.3.2.52 DSE Registered Location element

A DSE Registered Location element includes DSE location configuration information (LCI), which contains latitude, longitude, and altitude information. The DSE Registered Location element format is shown in Figure 7-95o11

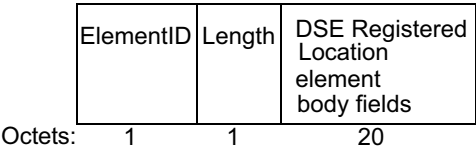


Figure 7-95o11—DSE Registered Location element format

The Length field is set to 20.

The structure and information fields are little endian, per conventions defined in 7.1.1, and are based on the LCI format described in IETF RFC 3825.

The DSE Registered Location element body fields are shown in Figure 7-95o12.

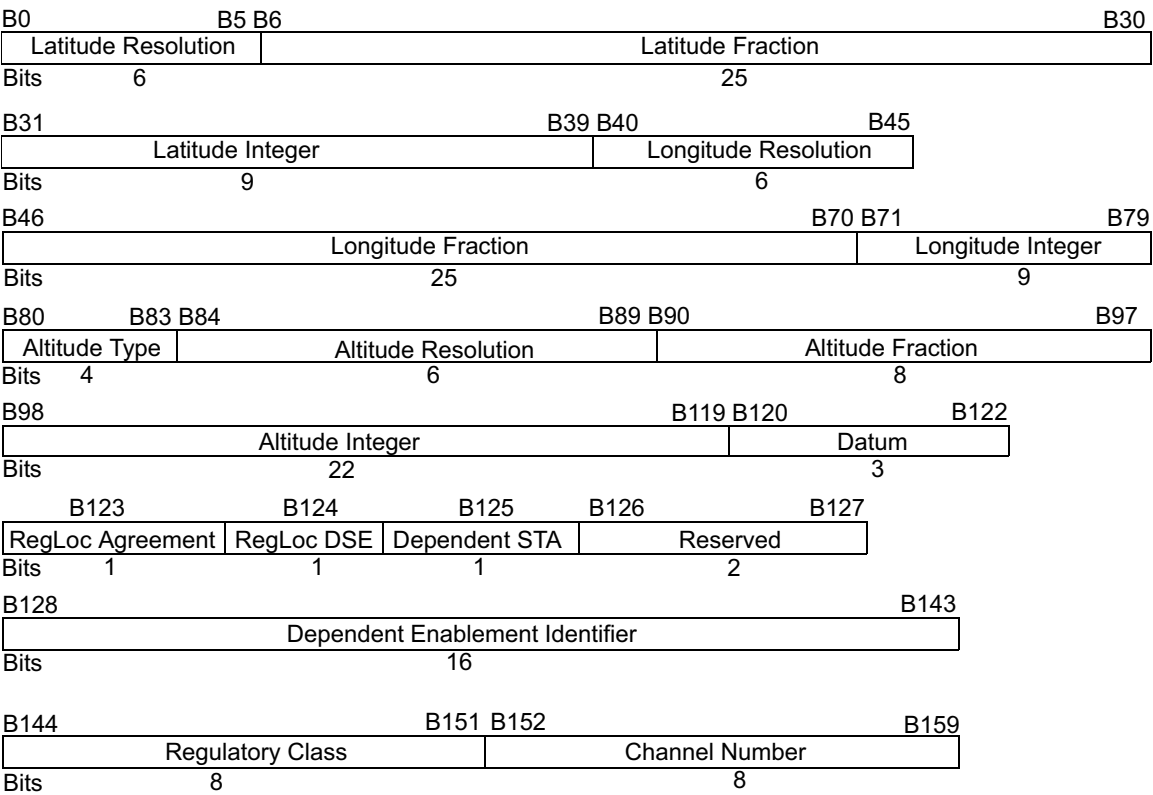


Figure 7-95o12—DSE registered location element body fields format

The definition of fields within the DSE Registered Location element body shall be as defined in Section 2.1 of IETF RFC 3825 except as defined in this standard.

With an Altitude Type field value of 3 (i.e., height above ground in meters), the altitude is defined to be in meters and is formatted in twos-complement, fixed-point, 22-bit integer part with 8-bit fraction.

The Datum field is a 3-bit field, rather than the 8-bit field defined in IETF RFC 3825, and the codes used are as defined in IETF RFC 3825.

The RegLoc Agreement bit field is set to 1 to report that the STA is operating within a national policy area or an international agreement area near a national border (see 11.11.3); otherwise, it is 0.

The RegLoc DSE bit field is set to 1 to report that the enabling STA is enabling the operation of STAs with DSE; otherwise, it is 0.

The Dependent STA bit field is set to 1 to report that the STA is operating with the enablement of the enabling STA whose LCI is being reported; otherwise, it is 0.

The Dependent Enablement Identifier field is a 16-bit field with a value set by the enabling STA via the DSE Enablement frame; otherwise, it is set to 0.

The Regulatory Class field indicates the channel set for which the enablement request, report, or announcement applies. The Regulatory Class and Channel Number fields together specify the channel frequency and channel bandwidth for which the report applies. Valid values for the Regulatory Class field are shown in Annex J.

The Channel Number field indicates the channel number for which the enablement request, report, or announcement applies. The channel number is defined within a regulatory class as shown in Annex J.

NOTE—An example of fixed/fractional notation, using the longitude of the Sears Tower from IETF RFC 3825, July 2004, page 13, is shown below:

Longitude 87.63602 degrees West (or –87.63602 degrees),

Using twos-complement, 34-bit fixed point, 25-bit fraction,

Longitude = 0xf50ba5b97,

Longitude = 1101010000101110100101101110010111 (big endian)

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

Bits 40–45 Longitude resolution = (bit 40) 0 1 0 0 0 1 (bit 45)

Bits 46–70 Longitude fraction = (bit 46) 1 1 1 0 1 0 0 1 1 1 0 1 1 0 1 0 0 1 0 1 1 1 0 1 0 (bit 70)

Bits 71–79 Longitude integer = (bit 71) 0 0 0 1 0 1 0 1 1 (bit 79)

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

7.3.2.53 Extended Channel Switch Announcement element

The Extended Channel Switch Announcement element is used by an access point (AP) in a basic service set (BSS) or a STA in an independent basic service set (IBSS) to advertise when the BSS is changing to a new channel or a new channel in a new regulatory class. The announcement includes both the regulatory class

and the channel number of the new channel. The element is present only when an extended channel switch is pending. The format of the Extended Channel Switch Announcement element is shown in Figure 7-95o13.

Element ID	Length	Channel Switch Mode	New Regulatory Class	New Channel Number	Channel Switch Count
Octets: 1	1	1	1	1	1

Figure 7-95o13—Extended Channel Switch Announcement element format

The Length field is set to 4.

The Channel Switch Mode field indicates any restrictions on transmission until a channel switch. An AP in a BSS or a STA in an IBSS sets the Channel Switch Mode field to either 0 or 1 on transmission as specified in 11.9.7.1 and 11.9.7.2.

The New Regulatory Class field is set to the number of the regulatory class after the channel switch, as defined in Annex J.

The New Channel Number field is set to the number of the channel after the channel switch. The channel number is a channel from the STA’s new regulatory class as defined in Annex J.

The Channel Switch Count field indicates either the number of target beacon transmission times (TBTTs) until the STA sending the Extended Channel Switch Announcement element switches to the new channel or a value of zero. A value of one indicates that the switch occurs immediately before the next TBTT. A value of zero indicates that the switch occurs anytime after the frame containing the element is transmitted.

7.3.2.54 Supported Regulatory Classes element

The Supported Regulatory Classes element is used by a STA to advertise the regulatory classes that it is capable of operating with in this country. The format of the Supported Regulatory Classes element is shown in Figure 7-95o14.

Element ID	Length	Current Regulatory Class	List of Regulatory Class(es)
Octets: 1	1	1	Length-1

Figure 7-95o14—Supported Regulatory Classes element format

The value of the Length field of the Supported Regulatory Classes element is between 2 and 253. The Current Regulatory Class octet indicates the regulatory class in use for transmission and reception. The List of Regulatory Class(es) field lists in ascending order all regulatory classes that the STA is capable of operating with in this country. The use of this element is described in 11.9a.1.

7.4 Action frame format details

7.4.7 Public Action details

7.4.7.1 Public Action frames

Change Table 7-57e as shown:

Table 7-57e—Public Action field values

Action field value	Description
0–6	Reserved
1	DSE enablement
2	DSE deenablement
3	DSE Registered Location Announcement
4	Extended Channel Switch Announcement
5	DSE measurement request
6	DSE measurement report
7	Measurement Pilot
8	DSE power constraint
82–255	Reserved

Insert the following subclauses (7.4.7.3 through 7.4.7.8) after 7.4.7.2:

7.4.7.3 DSE Enablement frame format

The DSE Enablement frame is an Action frame. It is transmitted by a STA as part of enablement. The format of the DSE Enablement frame body is shown in Figure 7-101h1.

Category	Action Value	RequesterSTA Address	ResponderSTA Address	Reason Result Code	Enablement Identifier
Octets: 1	1	6	6	1	2

Figure 7-101h1—DSE Enablement frame body format

The Category field is set to the value for public action defined in Table 7-24.

The Action Value field is set to indicate a DSE Enablement frame, as defined in Table 7-57e.

The RequesterSTAAddress field is the MAC address of the requesting STA that initiates the enablement process. The length of the RequesterSTAAddress field is 6 octets.

The ResponderSTAAddress field is the MAC address of the responding STA that grants enablement. The length of the ResponderSTAAddress field is 6 octets.

The Reason Result Code field is used to indicate the reason that a DSE Enablement frame was generated. The length of the Reason Result Code field is 1 octet. The reason result codes that have been allocated are shown in Table 7-57f1.