



60 GHz

Technical Specification

Version 1.0

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Document Revision History

Version	Date YYYY-MM-DD	Remarks
1.0	2016-07-06	Initial release

Table of Contents

1	INTRODUCTION	5
1.1	Scope	5
1.2	References	5
1.3	Definitions and acronyms	5
1.3.1	Shall/should/may/might word usage	5
1.3.2	Conventions	5
1.3.3	Definitions	5
1.3.4	Abbreviations and acronyms	6
2	ARCHITECTURAL OVERVIEW	7
3	INFORMATION ELEMENTS, ATTRIBUTES AND FRAME FORMATS	8
3.1	60 GHz Information Element	8
3.1.1	60 GHz Information Element format	8
3.1.2	60 GHz Capability attribute	9
3.2	Management and extension frame formats	10
3.2.1	DMG Beacon frame format	10
3.2.2	Announce frame format	10
3.2.3	Probe Request frame format	10
3.2.4	Probe Response frame format	10
3.2.5	Association Request and Reassociation Request frame formats	11
3.2.6	Association Response and Reassociation Response frame formats	11
3.2.7	Information Request frame format	11
3.2.8	Information Response frame format	11
4	FUNCTIONAL DESCRIPTION AND BEHAVIOR	12
4.1	60 GHz Information Element	12
4.2	60 GHz Attribute ID	12
4.3	60 GHz Capability attribute	12

List of Tables

Table 1.	Definitions	6
Table 2.	Abbreviations and acronyms	6
Table 3.	60 GHz Information Element format	8
Table 4.	General format of 60 GHz attributes	8
Table 5.	Attribute ID definitions	8
Table 6.	60 GHz Capability attribute format	9
Table 7.	Capabilities field definition	9
Table 8.	60 GHz attributes in the DMG Beacon frame	10
Table 9.	60 GHz attributes in the Announce frame	10
Table 10.	60 GHz attributes in the Probe Request frame	10
Table 11.	60 GHz attributes in the Probe Response frame	10
Table 12.	60 GHz attributes in the Association Request and Reassociation Request frames	11
Table 13.	60 GHz attributes in the Association Response and Reassociation Response frames	11
Table 14.	60 GHz attributes in the Information Request frame	11
Table 15.	60 GHz attributes in the Information Response frame	11

1 Introduction

This document is the technical specification for the Wi-Fi Alliance Wi-Fi CERTIFIED WiGig® program for 60 GHz devices. This specification defines a mechanism to declare whether a 60 GHz device can receive A-MSDUs.

1.1 Scope

The scope of the feature requirements is limited to that defined in this specification.

1.2 References

Knowledge of the documents listed in this section is required for understanding this technical specification. If a reference includes a date or a version identifier, only that specific version of the document is required. If the listing includes neither a date nor a version identifier, then the latest version of the document is required. In the event of a conflict between this specification and the following referenced documents, the contents of this specification take precedence.

- [1] 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, IEEE P802.11-REVmcD6.0

1.3 Definitions and acronyms

1.3.1 Shall/should/may/might word usage

The words *shall*, *should*, and *may* are used intentionally throughout this document to identify the requirements for the 60 GHz program. The words *can* and *might* shall not be used to define requirements.

The word *shall* indicates a mandatory requirement. All mandatory requirements must be implemented to assure interoperability with other 60 GHz devices.

The word *should* denotes a recommended approach or action.

The word *may* indicates a permitted approach or action with no implied preference.

The words *might* and *can* indicate a possibility or suggestion and should be used sparingly.

1.3.2 Conventions

The ordering of bits and bytes in the fields within information elements, attributes and action frames shall follow the conventions in Section 8.2.2 of IEEE 802.11-REVmc [1] unless otherwise stated.

The word *ignored* shall be used to describe bits, bytes, fields or parameters whose values are not verified by the recipient.

The word *reserved* shall be used to describe objects (bits, bytes, or fields or their assigned values) whose usage and interpretation will be defined in the future by this specification or by other technical specifications/bulletins. A reserved object shall be set to zero unless otherwise stated. The recipient of a reserved object shall ignore its value unless that object becomes defined at a later date. The sender of an object defined by this technical specification shall not use a reserved code value.

1.3.3 Definitions

The following definitions are applicable to this specification.

Table 1. Definitions

Term	Definition
60 GHz IE	A vendor specific 60 GHz Information Element defined by this specification.
60 GHz device	A wireless device that operates in 60 GHz band.

1.3.4 Abbreviations and acronyms

This section defines the acronyms used throughout this document. Some acronyms are commonly used in publications and standards defining the operation of wireless local area networks, while others have been generated by Wi-Fi Alliance.

Table 2. Abbreviations and acronyms

Acronyms	Definition
A-MSDU	Aggregated MAC Service Data Unit
AP	Access Point
DUT	Device Under Test
IE	Information Element
OUI	Organizationally Unique Identifier
PCP	Personal Basic Service Set Control Point
STA	Station

2 Architectural overview

This document defines the mechanism to allow a 60 GHz device to advertise its ability to receive A-MSDU from other 60 GHz devices. The mechanism described here defines a vendor specific information element (IE) and the frames in which this information element is included. Devices receiving this information element become aware of the peer device's ability to receive A-MSDU, and thus use this information to decide whether to transmit A-MSDU frames to the peer device.

3 Information Elements, attributes and frame formats

This section describes the information element and frame formats that allow a 60 GHz device to indicate whether it supports reception of A-MSDU frames.

A 60 GHz Information Element (60 GHz IE) utilizes the vendor specific information element defined in IEEE 802.11-REVmc [1]. The 60 GHz IE includes a Wi-Fi Alliance organizationally unique identifier (OUI) and an OUI Type that indicates the element is a 60 GHz IE. A number of 60 GHz attributes are defined; a single 60 GHz IE carries one or more 60 GHz attributes.

A 60 GHz device shall properly construct and decode the 60 GHz IE specified in this section when the IE is included in the frames described in section 3.2.

3.1 60 GHz Information Element

3.1.1 60 GHz Information Element format

The Vendor Specific element format [1] is used to define the 60 GHz IE in this specification. The format of the 60 GHz IE is shown in Table 3.

Table 3. 60 GHz Information Element format

Field	Size (Octets)	Value (Hexadecimal)	Description
Element ID	1	0xDD	IEEE 802.11 vendor specific usage.
Length	1	Variable	The length of the remaining fields in the IE in octets. The value shall be the length of 60 GHz Attributes plus the four octets for the OUI and OUI Type.
OUI	3	50 6F 9A	Wi-Fi Alliance OUI.
OUI Type	1	0x17	Identifier for the 60 GHz IE.
60 GHz Attributes	Variable		One or more 60 GHz attributes that may appear in the 60 GHz IE.

The 60 GHz Attributes field is defined in Table 4. This field consists of a one octet 60 GHz Attribute ID field, a one octet Length field, and a variable length attribute body field.

Table 4. General format of 60 GHz Attributes

Field	Size (Octets)	Value (Hexadecimal)	Description
Attribute ID	1	Variable	Attribute Identifier as defined in Table 5.
Length	1	Variable	Length of the attribute body field.
Attribute body	Variable		Attribute specific information fields.

The defined values for the Attribute ID field are given in Table 5.

Table 5. Attribute ID definitions

Attribute ID	Description
0	Reserved.
1	60 GHz Capability.
2 – 225	Reserved.

3.1.2 60 GHz Capability attribute

The 60 GHz Capability attribute is used to advertise the capability of a 60 GHz device and is defined in Table 6.

Table 6. 60 GHz Capability attribute format

Field	Size (Octets)	Value (Hexadecimal)	Description
Attribute ID	1	0x1	60 GHz Capability Attribute ID.
Length	1	0x7	Length of the remaining fields in the attribute.
STA Address	6		The MAC address of the device whose capability is being advertised.
Capabilities	1	Variable bit mask	A bit mask such that each bit defines different receive capabilities as specified in Table 7.

Table 7 lists the valid values for the Capabilities field and corresponding descriptions.

Table 7. Capabilities field definition

Capabilities Bits	Description
0 (LSB)	If set to 1, the device is capable of receiving A-MSDU [3] frames. Otherwise, it is set to 0.
1	Reserved.
2	Reserved.
3	Reserved.
4	Reserved.
5	Reserved.
6	Reserved.
7 (MSB)	Reserved.

3.2 Management and extension frame formats

This section defines the 802.11 management and extension frame formats where the 60 GHz IE is present.

3.2.1 DMG Beacon frame format

One or more 60 GHz IEs may be inserted after other information elements in DMG Beacon frames transmitted by a 60 GHz device operating as a PCP or as an AP. The 60 GHz Attributes for a 60 GHz IE that are included in the DMG Beacon frame are shown in Table 8.

Table 8. 60 GHz Attributes for a 60 GHz IE in the DMG Beacon frame

Attributes	Attribute ID	Description
60 GHz Capability attribute	1	The 60 GHz Capability attribute shall be present in the 60 GHz IE with the STA Address field being the transmitter MAC address.

3.2.2 Announce frame format

One or more 60 GHz IEs may be inserted after other information elements in Announce frame transmitted by a 60 GHz device operating as a PCP or as an AP. The 60 GHz Attributes for a 60 GHz IE that are included in the Announce frame are shown in Table 9.

Table 9. 60 GHz Attributes for a 60 GHz IE in the Announce frame

Attributes	Attribute ID	Description
60 GHz Capability attribute	1	The 60 GHz Capability attribute shall be present in the 60 GHz IE with the STA Address field being the transmitter MAC address.

3.2.3 Probe Request frame format

One or more 60 GHz IEs shall be inserted after other information elements in Probe Request frames transmitted by a 60 GHz device. The 60 GHz Attributes for a 60 GHz IE that are included in the Probe Request frame are shown in Table 10.

Table 10. 60 GHz Attributes for a 60 GHz IE in the Probe Request frame

Attributes	Attribute ID	Description
60 GHz Capability attribute	1	The 60 GHz Capability attribute shall be present in the 60 GHz IE with the STA Address field being the transmitter MAC address.

3.2.4 Probe Response frame format

One or more 60 GHz IEs shall be inserted after other information elements in Probe Response frames transmitted by a 60 GHz device. The 60 GHz Attributes for a 60 GHz IE that are included in the Probe Response frame are shown in Table 11.

Table 11. 60 GHz Attributes for a 60 GHz IE in the Probe Response frame

Attributes	Attribute ID	Description
60 GHz Capability attribute	1	The 60 GHz Capability attribute shall be present in the 60 GHz IE with the STA Address field being the transmitter MAC address.

3.2.5 Association Request and Reassociation Request frame formats

One or more 60 GHz IEs shall be inserted after other information elements in the (Re)Association Request frame transmitted by a 60 GHz device. The 60 GHz Attributes for a 60 GHz IE that are included in the (Re)Association Request frame are shown in Table 12.

Table 12. 60 GHz Attributes for a 60 GHz IE in the (Re)Association Request frames

Attributes	Attribute ID	Description
60 GHz Capability attribute	1	The 60 GHz Capability attribute shall be present in the 60 GHz IE with the STA Address field being the transmitter MAC address.

3.2.6 Association Response and Reassociation Response frame formats

One or more 60 GHz IEs shall be inserted after other information elements in the (Re)Association Response frame transmitted by a 60 GHz device. The 60 GHz Attributes for a 60 GHz IE that is included in the (Re)Association Response frame are shown in Table 13.

Table 13. 60 GHz Attributes for a 60 GHz IE in the (Re)Association Response frames

Attributes	Attribute ID	Description
60 GHz Capability attribute	1	The 60 GHz Capability attribute shall be present in the 60 GHz IE with the STA Address field being the transmitter MAC address.

3.2.7 Information Request frame format

One or more 60 GHz IEs may be inserted after other information elements in Information Request frames transmitted by a 60 GHz device. The 60 GHz Attributes for a 60 GHz IE that are included in the Information Request frame are shown in Table 14.

Table 14. 60 GHz Attributes for a 60 GHz IE in the Information Request frame

Attributes	Attribute ID	Description
60 GHz Capability attribute	1	The 60 GHz Capability attribute shall be present in the 60 GHz IE with the STA Address field being the transmitter MAC address.

3.2.8 Information Response frame format

One or more 60 GHz IEs shall be inserted after other information elements in Information Response frames transmitted by a 60 GHz device. The 60 GHz Attributes for a 60 GHz IE that are included in the Information Response frame are shown in Table 15.

Table 15. 60 GHz Attributes for a 60 GHz IE in the Information Response frame

Attributes	Attribute ID	Description
60 GHz Capability attribute	1	The 60 GHz Capability attribute shall be present in the 60 GHz IE with the STA Address field containing the MAC address of the device the 60 GHz Capability belongs to.

4 Functional description and behavior

4.1 60 GHz Information Element

More than one 60 GHz IE may be included in a single frame. The 60 GHz Attributes field of each 60 GHz IE may be any length, up to the maximum of 251 octets. All of the 60 GHz IEs shall fit within a single frame and shall be adjacent in the frame. The content of a single Attribute ID shall not be fragmented across multiple 60 GHz IEs.

4.2 60 GHz Attribute ID

A 60 GHz device that receives an unknown or reserved Attribute ID value in a 60 GHz IE without error shall ignore that 60 GHz attribute and parse any remaining fields for recognizable 60 GHz IE Attribute ID values. A 60 GHz device that encounters a recognizable but unexpected Attribute ID value in the received 60 GHz IE may ignore that 60 GHz attribute.

4.3 60 GHz Capability attribute

A 60 GHz device that supports A-MSDU frame reception [3] shall set the first bit of the Capabilities field within the 60 GHz Capability attribute to one and shall set it to zero otherwise. Reserved bits shall be set to zero on transmission and ignored on reception. A 60 GHz device advertises its 60 GHz IE by including it in a transmitted frame. Within the Capability attribute contained in the 60 GHz IE, the transmitter sets the STA Address field to the MAC address of the device whose capabilities it is advertising.

A 60 GHz device may transmit an Information Request frame including a 60 GHz Capability attribute with the STA Address set to its own MAC Address.

A 60 GHz device as a responder shall transmit an Information Response frame without the 60 GHz IE in response to a received Information Request frame with the Subject Address field set to a single target STA, if either of the conditions below are met.

1. The target STA is not a member of the PBSS and the responder is the PCP of the PBSS.
2. The responder is a non-PCP STA and is not the target STA.

In all other cases, the responder shall include the requested 60 GHz IE in the Information Response frame.

During PBSS information distribution [3], a 60 GHz device operating as a PCP should include in the Information Response frame a 60 GHz IE for the PCP and each STA associated with the PCP. When a device is reporting the capability of a peer device, a reporting device shall report the capability as received from the peer device.

A 60 GHz device that receives a 60 GHz Capability attribute belonging to a peer device, as identified by the STA Address field within the attribute with the least significant bit in the Capabilities field set to zero, should not send frames to the peer device using A-MSDU format or frames that have the A-MSDU subfield of the QoS Control field set to one.

The absence of the 60 GHz IE in a received Probe Request, Probe Response, (Re)Association Request, and (Re)Association Response frame is equivalent to the presence of the 60 GHz IE in the received frame with the first bit within the Capabilities field of the 60 GHz Capability attribute set to one.