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Wi-Fi CERTIFIED 6™

Test Plan

Version 1.1

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1 Overview

1.1 Scope and purpose

A primary goal of Wi-Fi Alliance® is to ensure interoperability among Wi-Fi CERTIFIED 6™ products from multiple manufacturers, and to promote this technology within both the business and consumer markets. To this end, the following test plan was developed. Working in conjunction with authorized test labs, these tests will be executed on vendor products to grant products Wi-Fi CERTIFIED 6 certification upon successful test completion.

The test plan exercises various combinations of PHY layer, MAC layer, general and security features. IEEE 802.11ax [7] adds a number of mandatory and optional PHY and MAC features to the features of IEEE Std 802.11 [2] that includes IEEE Std 802.11ac and 802.11n. The interoperability of Wi-Fi CERTIFIED 6 products with the 802.11n and 802.11 ac features are tested according to the Wi-Fi CERTIFIED n Test Plan [4] and Wi-Fi CERTIFIED ac Test Plan [3].

Wi-Fi Alliance members in good standing, whose products pass the tests specified in this test plan and receive certification from Wi-Fi Alliance, may use the certification mark Wi-Fi CERTIFIED 6 on both product and marketing materials.

The scope of this test plan is governed by the Wi-Fi Alliance Marketing Requirements Document (MRD) [1] for Wi-Fi CERTIFIED 6.

1.2 Definition of devices under test

The device under test (DUT) may be an Access Point (APUT),Mobile Access point (MAPUT), Station (STAUT) or 20 MHz-only STAUT, that may be certified for Wi-Fi CERTIFIED 6 using this test plan. The general characteristics of the DUT are entered in the Wi-Fi Alliance website registration system and are summarized in Table 1 and Table 2 respectively.

Prior to submission to an authorized test lab, the implementer shall complete the following capabilities declaration tables for use in performing this certification testing.

Table 1. APUT general capabilities declaration

Item	Question	Test case	Vendor response
1	Primary product category	N/A	AP/Mobile AP
2	Secondary product category	N/A	Value
3	Device serial number	N/A	Value
4	Device firmware version	N/A	Value
5	Maximum number of transmitted spatial streams supported in 2.4 GHz		1/2/3/4/5/6/7/8
6	Maximum number of received spatial streams supported in 2.4 GHz		1/2/3/4/5/6/7/8
7	Maximum number of transmitted spatial streams supported in 5 GHz		1/2/3/4/5/6/7/8
8	Maximum number of received spatial streams supported in 5 GHz		1/2/3/4/5/6/7/8
9	Provide user instructions to configure the following parameters:	4.5.2, 4.2.1, 4.4.1 and 4.4.2	Value

Item	Question	Test case	Vendor response

	• SSID
	• Wireless operational mode, a/n/ac/ax
	• Channel
	• Local IP address and netmask
	• Security:
	    ▪ WPA2™ or Open
	    ▪ WPA2-Personal pass phrase
	    ▪ WPA3-SAE pass phrase		

10	Does the APUT support 2.4 GHz?		Yes/No
11	Does the APUT support 5 GHz?		Yes/No
12	Does the APUT support dual band operation (2.4 GHz and 5 GHz)?	4.7.1	Yes/No
13	In which band does the APUT support WPA2-Enterprise?	4.2.1, 4.4.1	2.4 GHz/5 GHz/Both/Neither
14	In which band does the APUT support Open Security?	4.5.2, 4.12.1	2.4 GHz/5 GHz/Both/Neither
15	In which band does the APUT support receiving A-MDPU with A-MSDU?	4.17.1	2.4 GHz/5 GHz/Both/Neither
16	Does the APUT support 160 MHz bandwidth? Note: this is applicable only for APUT supporting 5 GHz	4.5.3,4.35.3, 4.38.1, 4.39.1, 4.44.1, 4.47.1, 4.48.1	Yes/No
17	In which band does the APUT support BSRP Trigger frame transmission?	4.49.1	2.4 GHz/5 GHz/Both/Neither
18	In which band does the APUT support transmission of MCS 8-9?	4.31.1, 4.36.1	2.4 GHz/5 GHz/Both/Neither
19	In which band does the APUT support reception of MCS 8-9?	4.32.1, 4.63.1	2.4 GHz/5 GHz/Both/Neither
20	In which band does the APUT support transmission of MCS 10-11?	4.33.1, 4.37.1	2.4 GHz/5 GHz/Both/Neither
21	In which band does the APUT support reception of MCS 10-11?	4.34.1, 4.64.1	2.4 GHz/5 GHz/Both/Neither
22	Does the APUT support transmit beamforming with sounding dimension of 8 SS?	4.35.2, 4.53.2	Yes/No
23	Does the APUT support LDPC for 2.4 GHz?	4.20.1, 4.21.1, 4.40.3	Yes/No
24	In which band does the APUT support MU-BAR Trigger frame transmission?	4.45.1	2.4 GHz/5 GHz/Both/Neither
25	In which band does the APUT support four or more transmit antennas?	4.35.1, 4.53.1, 4.54.1	2.4 GHz/5 GHz/Both/Neither
If the answer to question 25 is No, then answer questions 25.a and 25.b. If the answer to question 25 is Yes, then go to question 26.			
25.a	In which band does the APUT support DL MU MIMO? Note: This is applicable only to APUTs that support less than four transmit antennas.	4.35.1, 4.53.1, 4.54.1	2.4 GHz/5 GHz/Both/Neither
25.b	In which band does the APUT support SU beamforming? Note: This is applicable only to APUTs that support less than four transmit antennas.	4.35.1	2.4 GHz/5 GHz/Both/Neither

Item	Question	Test case	Vendor response
26	In which band does the APUT support Compressed BlockAck (C-BA) fames with up to 256 MSDUs/A-MSDUs, received with no fragmentation?	4.50.1	2.4 GHz/5 GHz/Both/Neither
27	In which band does the APUT support Compressed BlockAck (C-BA) fames with up to 256 MSDUs/A-MSDUs, transmitted with no fragmentation?	4.51.1	2.4 GHz/5 GHz/Both/Neither
28	In which band does the APUT support Basic Trigger frames in HE MU PPDU to solicit Ack/C-BA in HE TB PPDU ?	4.62.1	2.4 GHz/5 GHz/Both/Neither
29	In which band does the APUT support the MU EDCA Parameter Set element?	4.65.1	2.4 GHz/5 GHz/Both/Neither
30	In which band does the APUT support the TXOP duration-based RTS threshold?	4.66.1	2.4 GHz/5 GHz/Both/Neither
31	In which band does the APUT support the Multi-BSSID feature?	4.67.1	2.4 GHz/5 GHz/Both/Neither
32	In which band does the APUT support MU-RTS Trigger frame transmission?	4.68.1	2.4 GHz/5 GHz/Both/Neither
33	Does APUT support operation in DFS channels?	4.60.1	Yes/No
If DUT is a Mobile AP, in addition to above questions, answer the following questions			
34	In which band does the Mobile APUT support DL OFDMA?	4.29.1,4.30.1, 4.69.1	2.4 GHz/5 GHz/Both/Neither
35	In which band does the Mobile APUT support UL OFDMA?	4.40.x ,4.41.x, 4.43.1,4.60.1, 4.58.2	2.4 GHz/5 GHz/Both/Neither
36	In which band does the Mobile APUT support iTWT?	4.56.2	2.4 GHz/5 GHz/Both/Neither

Table 2. STAUT general capabilities declaration

Item	Question	Test case	Vendor response
1	DUT type	N/A	STA/20 MHz-only STA
2	Primary product category	N/A	Value
3	Secondary product category	N/A	Value
4	Device serial number	N/A	Value
5	Device firmware version	N/A	Value
6	Does the STAUT support 2.4 GHz?		Yes/No
7	Does the STAUT support 5 GHz?		Yes/No
8	Maximum number of transmitted spatial streams supported in 2.4 GHz Wi-Fi 6		1/2/3/4/5/6/7/8
9	Maximum number of received spatial streams supported in 2.4 GHz Wi-Fi 6		1/2/3/4/5/6/7/8
10	Maximum number of transmitted spatial streams supported in 5 GHz Wi-Fi 6		1/2/3/4/5/6/7/8

Item	Question	Test case	Vendor response
11	Maximum number of received spatial streams supported in 5 GHz Wi-Fi 6		1/2/3/4/5/6/7/8
12	In which band does the STAUT support Open Security?	5.5.2	2.4 GHz/5 GHz/Both/Neither
13	In which band does the STAUT support WPA2-Enterprise?	5.4.1, 5.6.1	2.4 GHz/5 GHz/Both/Neither
14	In which band does the STAUT support receiving A-MPDU with A-MSDU?	5.21.1	2.4 GHz/5 GHz/Both/Neither
15	Does the STAUT support LDPC for 2.4 GHz?	5.24.1, 5.25.1, 5.44.3	Yes/No
16	In which band does the STAUT support two spatial streams?	5.28.1	2.4 GHz/5 GHz/Both/Neither
17	In which band does the STAUT support reception of MCS 8-9?	5.35.1, 5.40.1	2.4 GHz/5 GHz/Both/Neither
18	In which band does the STAUT support transmission of MCS 8-9?	5.36.1, 5.69.1	2.4 GHz/5 GHz/Both/Neither
19	In which band does the STAUT support reception of MCS 10-11?	5.37.1, 5.41.1	2.4 GHz/5 GHz/Both/Neither
20	In which band does the STAUT support transmission of MCS 10-11?	5.38.1, 5.70.1	2.4 GHz/5 GHz/Both/Neither
21	Does the STAUT support 160 MHz bandwidth? Note; This is applicable for STAUT supporting 5 GHz (not applicable for 20 MHz-only STAUT)	5.39.3, 5.42.1, 5.43.1, 5.49.1	Yes/No
22	Does the STAUT support receiving HE NDP sounding with 8 SS?	5.39.2, 5.57.2	Yes/No
23	In which band does the STAUT support Compressed BlockAck (C-BA) fames with up to 256 MSDUs/A-MSDUs, transmitted with no fragmentation ?	5.54.1	2.4 GHz/5 GHz/Both/Neither
24	In which band does the STAUT support Compressed BlockAck (C-BA) fames with up to 256 MSDUs/A-MSDUs, received with no fragmentation?	5.55.1	2.4 GHz/5 GHz/Both/Neither
25	In which band does the STAUT support receiving the OM subfield in the A-Control field?	5.56.1	2.4 GHz/5 GHz/Both/Neither
26	In which band does the STAUT support iTWT?	5.60.1	2.4 GHz/5 GHz/Both/Neither
26.a	If the answer to question 26 is Yes, does the STAUT support Announced or Unannounced TWT?	5.60.1	Announced/Unannounced/Both
27	In which band does the STAUT support for transmitting the OM Control field within the HE Variant of the HT Control field?	5.74.1	2.4 GHz/5 GHz/Both/Neither
28	Does STAUT support operation in DFS channels?	5.63.1	Yes/No
If DUT is 20 MHz-only STAUT, in addition to above quesitons, fill in below questions.			
29	Does 20 MHz-only STAUT support LDPC coding in 5 GHz ?	5.24.1	Yes/No
30	In which band does the 20 MHz-only STAUT support DL MU-MIMO RX?	5.57.1, 5.58.1	2.4 GHz/5 GHz/Both/Neither
31	Does the 20 MHz-only STAUT support BIT 5=1 in HE PHY capablities?	5.34.4	Yes/No

1.3 References

The documents listed in this section are included in requirements made in the body of this test plan. Knowledge of their contents is required for the understanding and implementation of this test plan. If a listing 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, the latest version of the document is required.

[1] Wi-Fi Alliance Marketing Requirements Document for Interoperability Testing of Wi-Fi CERTIFIED 6, https://www.wi-fi.org/members/certification-programs

[2] IEEE Std 802.11™-2016 - IEEE Standard for Local and Metropolitan Area Networks -Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications

[3] Wi-Fi CERTIFIED™ ac Interoperability Test Plan, https://www.wi-fi.org/members/certification-programs

[4] Wi-Fi CERTIFIED™ n Test Plan, https://www.wi-fi.org/members/certification-programs

[5] WMM System Interoperability Test Plan, https://www.wi-fi.org/members/certification-programs

[6] Wi-Fi Multimedia™ Technical Specification, https://www.wi-fi.org/members/certification-programs

[7] IEEE Std 802.11™ax/D4.0-Feb 2019 - IEEE Standard for Local and Metropolitan Area Networks -Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications

[8] RFC 2285, Benchmarking Terminology for LAN Switching Devices, https://tools.ietf.org/html/rfc2285

[9] WPA3™-SAE Test Plan: https://www.wi-fi.org/members/certification-programs

1.4 Acronyms and definitions

1.4.1 Acronyms and abbreviations

Table 3 defines the acronyms and abbreviations used throughout this document. Some acronyms and abbreviations 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 3. Acronyms and abbreviations

Acronyms	Definition
AC	Access category
ADDBA	Add block acknowledgment
AID	Association identifier

Acronyms	Definition
AKM	Authentication and Key Management
A-MPDU	Aggregate MAC protocol data unit
A-MSDU	Aggregate MAC service data unit
APSD	Automatic power save delivery
AP	Access point
BA	Block acknowledgment
BAR	Block acknowledgment request
BCC	Binary convolutional code
BFRP	Beamforming report poll
BSS	Basic service set
BSSID	Basic service set identifier
BSR	Buffer Status Report
BSRP	Buffer Status Report Poll
BQR	Bandwidth query report
BW	Bandwidth
CAPI	Control application programming interface
C-BA	Compressed BlockAck
CCMP	Counter mode with cipher block chaining message authentication code protocol
CFO	Carrier frequency offset
CQI	Channel quality indication
CS	Carrier sense
CTS	Clear to send
CTT	Compliance test tool
DCM	Dual carrier modulation
DL	Downlink
DUT	Device Under Test
EAP	Extensible Authentication Protocol

Acronyms	Definition
EAPOL	Extensible Authentication Protocol over LANs
ED	Energy detection
EDCA	Enhanced distributed channel access
EOF	End-of-frame
FCS	Frame check sequence
FEC	Forward error correction
GI	Guard interval
HE	High efficiency
HE-MCS	High efficiency modulation and coding scheme
HE-SIG-A	High efficiency signal A field
HE-SIG-B	High efficiency signal B field
HLA	HE link adaptation
HT	High throughput
HTC	High throughput control
HTP ACK	HE TB PPDU ACK
IP	Internet protocol
LAN	Local area network
LDPC	Low-density parity check
LTF	Long Training field
MAC	Medium access control
MCS	Modulation and coding scheme
MFPC	Management frame protection capable
MFPR	Management frame protection required
MIMO	Multiple input, multiple output
MPDU	Media access control protocol data unit
MSDU	MAC service data unit
MU	Multi-user

Acronyms	Definition
MU-BAR	Multi-user Block Ack request
MU-MIMO	Multi-user multiple input, multiple output
NAV	Network allocation vector
NDP	Null data packet
NDPA	NDP Announcement
NFRP	NDP feedback report poll
NSS	Number of spatial streams
NSTS	Number of space-time streams
OBSS	Overlapping basic service set
OFDM	Orthogonal frequency division multiplexing
OFDMA	orthogonal frequency division multiplexing access
OM	Operating mode
OMI	Operating mode indication
OMN	Operating mode notification
PE	Packet extension
PHY	Physical layer
PM	Power management
PMK	Pairwise master key
PMKID	Pairwise master key identifier
PPDU	PHY protocol data unit
PPE	Physical layer (PHY) packet extension
PPET	Physical layer (PHY) packet extension threshold
PS	Power save (mode)
PSDU	PHY service data unit
QoS	Quality of service
S-MPDU	Single medium access control (MAC) protocol data unit
RA	Receiver address or receiving station address

Acronyms	Definition
RSN	Robust security network
RSNE	Robust Security Network element
RSSI	Receive signal strength indicator
RTP	Real-time transport protocol
RTS	Request to send
RU	Resource unit
RX	Receiver
SAE	Simultaneous authentication of equals
SIFS	Short interframe space
SM	Spatial multiplexing
SP	Service period
SR	Spatial reuse
SRP	Spatial reuse parameters
SS	Station service
SSID	Service set identifier
STA	Station
STAAID	Station association identifier
STBC	Space-time block coding
STS	Space-time streams
SU	Single user
TA	Transmitter address
TB	Trigger-based
TBTT	Target beacon transmission time
TF	Trigger frame
TID	Traffic identifier
TIM	Traffic indication map
TKIP	Temporal key integrity protocol

Acronyms	Definition
TLS	Transport layer security
TRS	Triggered response scheduling
TWT	Target wake time
TWT SP	Target wake time service periods
Tx	Transmitter
TXOP	Transmission opportunity
UDP	User datagram protocol
UL	Uplink
UPH	UL power headroom
VHT	Very high throughput
WEP	Wired equivalent protection
WMM	Wi-Fi Multimedia™

1.4.2 Definitions

There are no special definitions that are applicable to this document.

2 Test tools, methodology and approach

This section defines the tools, methodology, and approach for testing and certifying devices for Wi-Fi CERTIFIED 6.

2.1 Sniffer

A Sniffer test tool is required to be used for test cases throughout this test plan. The Sniffer test tool requirements are:

- All requirements for wireless ac Sniffer as specified in [3]
- Dual band (2.4 GHz and 5 GHz)
- Ability to decode the HE preamble:
  - HE-SIG-A: BW, STBC, NSTS, Beamformed, Coding
  - BSS Color, UL Spatial Reuse, GI+LTF
  - HE-SIG-B: MCS, NSS, RU allocation, etc.
  - TWT action frames
- Supports the new MAC structure:
  - Trigger frame
  - HE Control field
  - New HE elements
- Capable of reporting packet extension duration of received PPDUs
- Ability to capture and parse Trigger frames
- Ability to parse SAE 802.11 Authentication frames
- Ability to parse EAPOL key frames used in the 4-way handshake

2.2 Wi-Fi Test Suite software

Wi-Fi Alliance's Wi-Fi Test Suite provides configuration, test control, traffic generation, and results analysis services. Unless otherwise noted, the entire test plan may be executed in a fully automated manner using Wi-Fi Alliance-distributed Wi-Fi Test Suite Command Scripts and the Wi-Fi Test Suite Unified CAPI Console. Additional information is available through the member website https://www.wi-fi.org/members/certification-testing/wi-fi-test-suite.

2.3 Basic system test configuration

Figure 1 depicts the basic system test configuration for testing and certifying Wi-Fi CERTIFIED 6 devices.

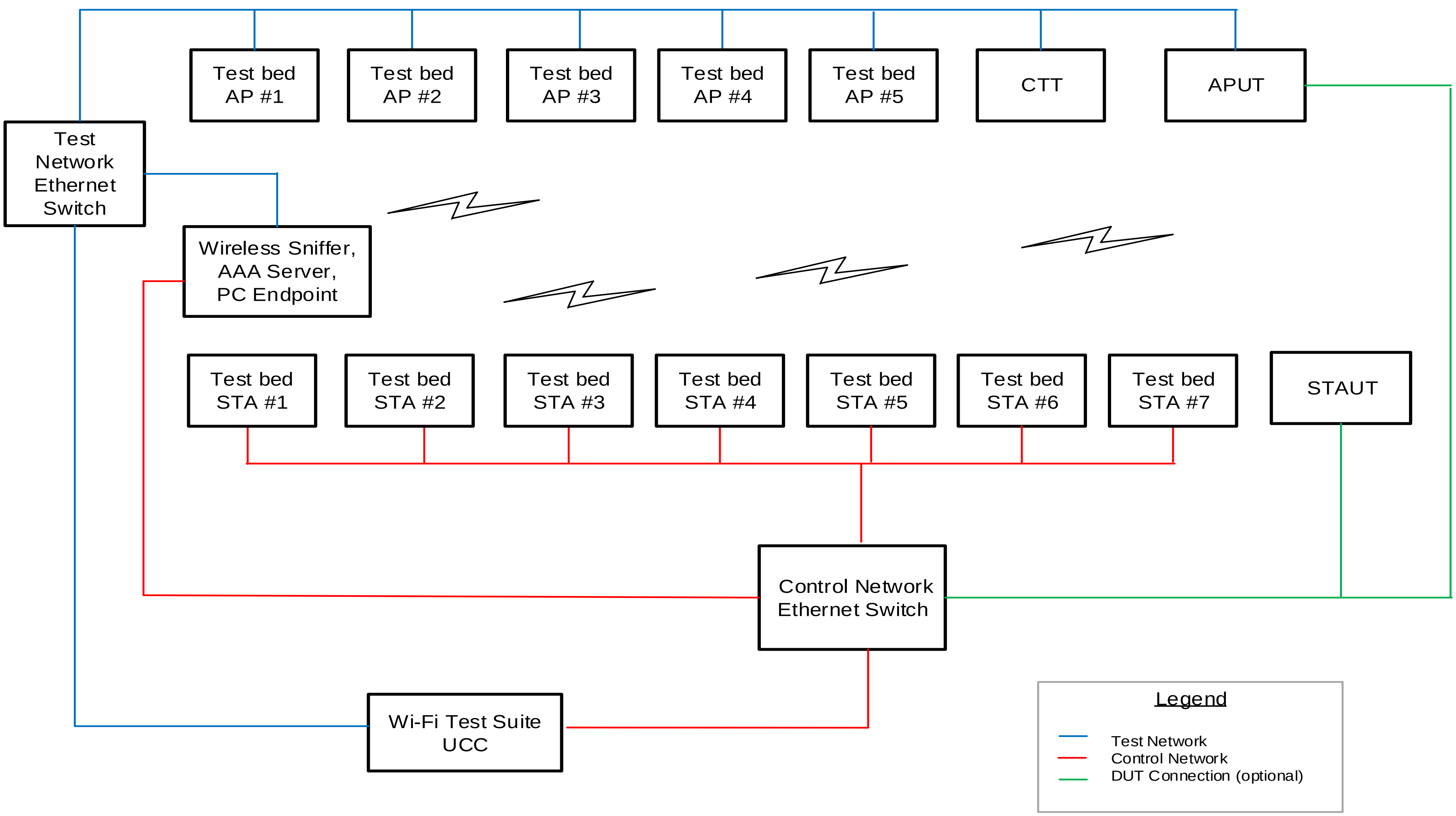

Figure 1. System test configuration

The CTT is used to execute the STAUT pre-correction test cases (see 5.59.1 and 5.59.2). The test bed APs and STAs are used to perform the APUT and STAUT test cases. The wireless sniffer is needed for capturing frame exchanges among the CTT, test bed APs, and test bed STAs. The PC endpoint machine is used to generate traffic employed in the test cases. Finally, the AAA server is used to perform WPA2-Enterprise security testing.

2.4 Test Bed capability requirements

2.4.1 Test bed AP requirements

The following capabilities are required of the test bed AP.

- Dual band device
- Ability to configure WEP and TKIP with HE rates, and able to generate a Probe Request frame
- Ability to configure bandwidth to 20MHz or 40MHz or 80MHz or 160MHz(if supported)
- Ability to configure the ACK Policy for DL MU MIMO PPDU
- Ability to configure transmit and receive 256 Bitmap Block Ack
- Ability to configure BCC and LDPC coding in payload
- Ability to configure LTF+GI combination setting for HE NDP frame
- Ability to configure LTF+GI combination setting for PPDUs
- Ability to configure the maximum number of fragmented MSDUs and/or A-MSDUs that should be configured when Fragmentation Support subfield > 0
- Ability to configurable to send OM Control field in +HTC Field in a HE PPDU and configure the NSS and Channel Bandwidth fields
- Ability to configure for WPA2-personal, WPA2-Enterprise and WPA3-SAE
- Ability to configure Transmit Trigger frames with specific parameters
- The RU allocation shall be only on primary 20 MHz if DUT is 20 MHz only STAUT
- If the DUT is 20 MHz-only STA, AP shall schedule the DL OFDMA transmission to 20 MHz-only STA and 80 MHz STA simultaneously.

Table 4 defines the Wi-Fi CERTIFIED 6 configuration parameters and their default values for the test bed AP. If required, the following parameter values are modified for specific test cases.

Table 4. Test bed AP default parameters

Parameter	Description	Default value
+HTC-HE support	Ability to configure the reception of an HE variant HT Control field carried in a QoS Data, QoS Null, or Management frame	Enabled
20 MHz in 160/ 80+80 MHz HE PPDU	Ability to configure the 26-, 52-, and 106-tone mapping for a 20 MHz operating non-AP HE STA that is the receiver of an 80+80 MHz or a 160 MHz HE MU PPDU, or the transmitter of an 80+80 MHz or 160 MHz HE TB PPDU	Disabled
20 MHz in 40 MHz HE PPDU in 2.4 GHz band	Ability to configure the 26-, 52-, and 106-tone mapping for a 20 MHz operating non-AP HE STA that is the receiver of a 40 MHz HE MU PPDU in 2.4 GHz band, or the transmitter of a 40 MHz HE TB PPDU in 2.4 GHz band	Disabled
32-bit BA Bitmap Support field	Ability to configure the 32-bit BA Bitmap Support field	Disabled
6 GHz Operation Information Present field	Configurable 6 GHz Operation Information field. A value zero indicates the 6 GHz Operation Information field is present in the HE Operation element	0

Parameter	Description	Default value
80 MHz in 160/ 80+80 MHz HE PPDU	Ability to configure the 80 MHz in 160/ 80+80 MHz HE PPDU when receiving an 80+80 MHz or a 160 MHz HE MU PPDU, or transmitting an 80+80 MHz or a 160 MHz HE TB PPDU	Disabled
Wi-Fi mode	Configurable in 11a, 11g, 11n, 11ac or 11ax mode	11ax
Disable BA	Configurable to not send any ADDBA Request and decline any ADDBA Request	Disabled
A-MSDU aggregation and transmit A-MSDU	Configurable to send A-MSDU	Off
A-MPDU Aggregation	Configurable to not send ADDBA Request frames	Enable A-MPDU
AC tagging	Ability to configure the AC tagging setting	DSCP
Ack-Enabled Aggregation Support	Ability to receive an aggregation that requires an Ack	Disabled
ACM set	Ability to configure the ACM setting for each AC	0 for each AC
All Ack support	Configurable support for the reception of a Multi-STA BlockAck frame under the all Ack context	Disabled
A-MSDU fragmentation support	Configurable A-MSDU fragmentation support. Applicable only if Fragmentation > 0	Disabled
A-MSDU In Ack-Enabled A-MPDU Support	Configurable A-MSDU in Ack-Enabled A-MPDU Support	Disabled
A-MSDU in A-MPDU support	Configurable support for receiving A-MSDU (with no BA session) in A-MPDU	Disabled
AP UL MU OFDMA for UL flows	When disabled, use UL OFDMA to solicit UL OFDMA PPDUs from its associated STAs	Disabled
Beamformee STS > 80 MHz subfield	Configurable Beamformee STS > 80 MHz subfield. Valid only if SU Beamformee capable and indicates space-time streams that the STA can receive in an HE NDP	Disabled
Beamformee STS ≤ 80 MHz	Configurable Beamformee STS ≤ 80 MHz subfield. Valid only if SU Beamformee capable and indicates space-time streams that the STA can receive in an HE NDP	Disabled
Bitmap/Buffersize	Ability to configure the default Bitmap/Buffersize in ADDBA Request/Response frames	64
BQR support	Configurable support for receiving a bandwidth query report	Disabled
Broadcast TWT support	Configurable support for Broadcast Target Wake Time	Disabled
BSR support	Configurable support to receive BSR in A-Control field	Disabled
BSRP BQRP A-MPDU Aggregation	For a non-AP STA, ability to configure whether or not the STA accepts a BSRP Trigger frame or BQRP Trigger frame that is aggregated with other Control, Data and Management frames in an A-MPDU destined to the STA	Disabled
BSS Color	Ability to configure a BSS color (1-63)	1
BSS Color Disabled	Subfield of BSS Color Information field to indicate disable the use of color for the BSS as defined in [8] in HE Operation element	0 (Disabled)
Channel bandwidth	Ability to configure the channel bandwidth of the BSS	20 MHz when operating in the 2.4 GHz band.

Parameter	Description	Default value
		80 MHz when operating in the 5 GHz band.
Codebook Size (ϕ, ψ) = {4, 2} SU Feedback	Configurable HE beamformee support for a codebook size (ϕ, ψ) = {4, 2} in the HE Compressed Beamforming Report field for SU feedback	Disabled
Codebook Size (ϕ, ψ) = {7, 5} MU Feedback	Configurable HE beamformee support for a codebook size (ϕ, ψ) = {7, 5} in the HE Compressed Beamforming Report field for MU type feedback	Disabled
Codebook size for MU type feedback	Ability to configure the Codebook size to be requested when soliciting HE CBF using MU type feedback	{9,7}
Co-Hosted BSS	Ability to configure that the AP transmitting this element shares the same operating class, channel and antenna connectors with at least one other BSS in the HE Operation element	0
DCM Max bandwidth	Configurable DCM Max bandwidth. Applicable only when DCM TX, DCM RX BW > 0.	0
DCM Max Constellation RX	Ability to configure Max Supported Constellation for DCM in Data field and Sig-B for RX	0
DCM Max Constellation TX	Ability to configure Max Supported Constellation for DCM in Data field in HE TB PPDU	0
DCM Max NSS RX	Ability to configure Max NSS when DCM is used (Reserved when DCM RX = 0)	0
DCM Max NSS TX	Ability to configure Max NSS when DCM is used (Reserved when DCM TX = 0)	0
Device Class	Ability to configure STA device class	0
DL-MU-MIMO transmission	Configurable to transmit DL-MU-MIMO PPDU	Disabled
DL OFDMA	Configurable to transmit DL OFDMA	Disabled
Doppler transmit and receive	Ability to transmit and receive HE PPDUs with midamble	Not supported
Doppler transmit and receive	Ability to transmit and receive HE PPDUs with midamble	Not supported
EDCA parameter set	Configurable AIFSN, CWmin, CWmax, TXOP Limit setting for each AC	Per [5], both for AP operation and signaled to STA; the TXOP Limit is that used for 802.11a/g
Encryption key	Configurable encryption key to be used	12345678
ER SU Disable	Ability to configure that 242-tone HE ER SU PPDU reception is disabled in the HE Operation element	1
Flexible TWT Schedule support	Configurable support for the reception of TWT Information frames with any non-zero value in the Next TWT field	0
Fragmentation support	Configurable level of dynamic fragmentation	0
Full BW UL MU-MIMO	Ability to configure UL MIMO in HE TB PPDU	Disabled
HE Dynamic SM Power Save	Configurable Dynamic SM Power Save feature support	Disabled
HE ER SU PPDU with 1x HE-LTF and 0.8 µs GI	Configurable support of the reception of an HE ER SU PPDU with 1x LTF and 0.8 µs guard interval duration	Disabled

Parameter	Description	Default value
HE ER SU PPDU with 4x HE-LTF and 0.8 µs GI	Configurable support for the reception of an HE ER SU PPDU with 4x LTF and 0.8 µs guard interval duration	Disabled
HE Link Adaptation support	Configurable support for Link Adaptation using the HLA Control subfield	Disabled
HE-MCS support Tx	Configurable to transmit a specific HE-MCS value	7
HE SU PPDU and HE MU PPDU with 4x HE-LTF and 0.8µs GI	Configurable support for the reception of an HE SU PPDU and HE MU PPDU with 4x LTF and 0.8 µs guard interval duration	Disabled
HE SU PPDU With 1x HE-LTF and 0.8 µs GI	Ability to configure the reception of an HE SU PPDU with 1x LTF and 0.8 µs guard interval duration	Disabled
HE subchannel selective transmission support	Ability to configure whether an HE STA supports an HE subchannel selective transmission operation	Disabled
HE_SU	Ability to transmit HE_SU PPDU	Enabled
HE-MCS support Rx	Configurable to receive a specific range of HE-MCS values (0-7, 0-9 or 0-11)	0-7
HESIGA_Spatial_reuse_value15_allowed	Ability to configure the HESIGA_Spatial_result_value15_allowed subfield in the SR Control field in the Spatial Reuse Parameter Set element to a specific value	1
HT And VHT Trigger frame RX Support	Configurable support for HT and VHT Trigger frame Rx	Disabled
Longer than 16 HE-SIG-B OFDM symbols support	For non-AP STA, configurable for receiving a DL HE MU PPDU where the number of OFDM symbols in the HE-SIG-B field is greater than 16	Disabled
Max Nc	Ability to configure the maximum Nc for beamforming sounding feedback supported when a transmitting STA acts as a beamformee. Reserved when not SU Beamformee capable	0
Maximum A-MPDU Length Exponent	Ability to configure the Maximum A-MPDU Length Exponent subfield of the VHT Capabilities element. When VHT capabilities is present, the Maximum A-MPDU Length Exponent subfield of the VHT Capabilities element is set to 7. When VHT capabilities is not present, the Maximum A-MPDU Length Exponent subfield of the HT Capabilities element is set to 3.	0
MBO capability	Ability to advertise Wi-Fi CERTIFIED Agile Multiband™ capability	OFF
M-BSSID	Ability to enable/disable Multi-BSSID support	Disabled
Midamble Tx/Rx 2x and 1x HE-LTF	Ability to configure the Midamble Tx/Rx 2x and 1x HE-LTF. Applicable only when there is support for Doppler.	0
Midamble Tx/Rx Max NSTS	Ability to configure the Midamble Tx/Rx Max NSTS. Applicable only when Doppler TX, RX are supported.	0
MU Beamformer	Configurable support for operation as MU Beamformer	Disabled
MU Cascading support	Configurable support for signaling MU Cascading	Disabled
MU transmit beamformer	Ability to enable and disable MU transmit beamformer capability	Disabled
MU transmit beamformer	Ability to enable and disable MU beamformer operation	Disabled

Parameter	Description	Default value
Multi-TID Aggregation RX support	Ability to configure the number of TIDs of QoS Data frames that an HE STA can receive in a multi- TID A-MPDU	0
Multi-TID Aggregation TX support	Ability to configure the number of TIDs of QoS Data frames that an HE STA can receive in a multi- TID A-MPDU	0
NDP Feedback Report support	Configurable support for NDP feedback and responding to NFRP Trigger frame	Disabled
NDP With 4x HE-LTF and 3.2µs GI	Ability to receive an NDP with 4x LTF and 3.2 µs guard interval duration	Disabled
Ng = 16 MU Feedback	Ability to configure Tone grouping of 16 in HE CBF in MU type feedback	0
Ng = 16 SU Feedback	Ability to configure Tone grouping of 16 in HE CBF in SU feedback	0
Ng for MU type feedback	Ability to configure the Ng (tone grouping) to be requested when soliciting HE CBF using MU type feedback	4
Non-triggered CQI feedback	Ability to configure TX, RX of full BW non-triggered CQI-only feedback	0
NSS Limit	Ability to force a strict limit on NSS when the STA is transmitting PPDUs, with the transmitter using exactly this NSS value for all PPDU transmissions, where the limit value is specified in the test procedure	Disabled
Number of Sounding Dimensions > 80 MHz	Ability to configure Number of Sounding Dimensions > 80 MHz. Valid only if SU Beamformer capable and indicates the maximum value of the TXVECTOR parameter NUM_STS for an HE NDP	0
Number of Sounding Dimensions ≤ 80 MHz	Ability to configure Number of Sounding Dimensions ≤ 80 MHz. Valid only if SU Beamformer capable and indicates the maximum value of the TXVECTOR parameter NUM_STS for an HE NDP.	0
Number of spatial streams to transmit	Configurable to transmit using a specific number of spatial streams	2
Number of Sounding Dimensions for HE NDP	Ability to configure the maximum value of the TXVECTOR parameter NUM_STS for an HE NDP	1
OBSS Narrow Bandwidth RU in OFDMA Tolerance Support	Ability to configure the OBSS Narrow Bandwidth RU in OFDMA Tolerance Support field (Bit 79) in the Extended Capabilities element	0
OFDMA RA support	Configurable OFDMA RA support. Non-AP STA signals support for Random Access Procedure, and AP STA side signals support for Tx of Trigger frame with Random Access RA-RU	Disabled
OM Control support	Configurable signaling for OM Reception in A-Control	Enabled
OM Control UL MU Data Disable RX support	Configurable support for RX of UL MU Data Disable	Disabled
OMI and OMN transmission	Ability to configure the OMI and OMN transmission	Disabled
OPS support	Configurable support for Opportunistic power save	Disabled
Partial Bandwidth DL MU-MIMO	Ability to configure Partial Bandwidth DL MU-MIMO. For a non-AP STA, indicates support for the reception of a DL MU-MIMO transmission on an RU in an HE MU PPDU where the RU does not span the entire PPDU bandwidth (DL MU-MIMO within OFDMA)	Disabled
Partial BSS Color	Ability to configure the subfield of BSS Color Information field indicating that an AID assignment rule based on the BSS color in the HE Operation element	0 (Disabled)
Partial BW Extended Range	Configurable support for transmission and reception of the Data field of the HE ER SU PPDU when transmitted over the high frequency 106-tone RU within primary 20 MHz channel	Disabled

Parameter	Description	Default value
Partial BW UL MU-MIMO	Configurable UL MIMO in Partial BW in HE TB PPDU	Disabled
PMF	Ability to configure the Protected Management Frame	MFPC (bit 7) = 0 MFPR (bit 6) = 0 (Off)
Power Boost Factor support	Ability to configure if the STA supports a power boost factor αr for the r-th RU in the range [0.5, 2]	Disabled
PPE Threshold Present	Ability to configure PPE Threshold is Present subfield	1
Punctured preamble RX	Ability to configure RX for punctured preamble	Disabled
Punctured Sounding Support	Configurable support for the Punctured Sounding Support subfield	Disabled
QTP support	Ability to configure the quiet time period	Disabled
RTS Threshold	Ability to configure the TXOP Duration RTS Threshold value in HE Operation Parameters field	1023 (no RTS Threshold is used)
Rx 1024-QAM support < 242-tone RU	Configurable support for MCS10-11 RX in RU < 242	Disabled
Rx Control frame to MultiBSS	Configurable Multi-BSSID related support	Disabled
Rx Full BW SU using HE MU PPDU with Compressed HE-SIGB	Configurable support for reception of an HE MU PPDU with an RU spanning the entire PPDU bandwidth and a compressed HE-SIG-B format	Disabled
Rx Full BW SU using HE MU PPDU with non-Compressed HE-SIGB	Configurable support for reception of an HE MU PPDU with a bandwidth less than or equal to 80 MHz, an RU spanning the entire PPDU bandwidth and a non-compressed HE-SIG-B format	Disabled
Rx HE MU PPDU from non-AP STA	Configurable support for the reception on an RU in an HE MU PPDU from a non-AP STA where the RU does not span the entire PPDU bandwidth	Disabled
Spatial Reuse Parameter Set element present	Ability to configure whether to enable including the Spatial Reuse Parameter Set element when transmitting Beacon, Association Response, Re-Association Response and Probe Response frames	Enabled
SR Responder	Configurable support for the role of SRP responder	Disabled
SRP-based SR support	Configurable support for SRP-based operation	Disabled
STBC RX > 80 MHz	Configurable support for STBC RX when BW > 80MHz	Disabled
STBC Rx ≤ 80 MHz	Configurable RX of an HE PPDU when BW ≤ 80	Disabled
STBC TX > 80 MHz	Configurable support for STBC TX when BW > 80 MHz	Disabled
STBC Tx ≤ 80 MHz	Configurable TX of an HE PPDU when BW ≤ 80	Disabled
SU beamformer	Ability to configure operation as an SU beamformer	Disabled
SU Beamformee	Configurable support for SU Beamformee	Disabled
SU transmit beamformer	Ability to enable and disable SU transmit beamformer capability	Disabled
Transmit Trigger frames with constant TX power	Configurable to transmit all PPDUs containing Trigger frames using the same TX power.	Disabled

Parameter	Description	Default value
	When enabled, all Trigger frames should indicate the same value for the AP TX Power subfield of the Common Info field and the test bed AP should strive to have consistent TX power for all PPDUs carrying Trigger frames. When disabled, TX power setting of PPDUs carrying Trigger frames is implementation specific to each test bed AP.	
Trigger frame	Configurable to send Trigger frames in UL OFDMA with specific configurations. The common parameters are: • Trigger Common Info field: ▪ Trigger Type: Basic Trigger ▪ MU-MIMO LTF Mode, STBC = 0 ▪ More TF, UL Spatial Reuse = 0 • User Info fields ▪ MCS = MCS7 ▪ Coding = BCC ▪ DCM = 0 ▪ TID Aggregation Limit = 1 ▪ Doppler = 0	N/A
Trigger frame MAC padding duration	Ability to configure the MinTrigProcTime, which is used in padding for Trigger frames	0
Triggered CQI Feedback	Configurable support for partial and full BW CQI feedback in HE TB sounding sequence	Disabled
Triggered CQI Feedback type	Ability to receive partial and full bandwidth CQI-only feedback which is to be signaled in the HE PHY Capabilities element	Not supported
Triggered MU Beamforming Partial BW	Ability to support partial BW MU type feedback which is to be signaled in the HE PHY Capabilities element	Not supported
Triggered MU Beamforming Partial BW Feedback	Configurable support for Partial BW MU CBF in HE TB sounding sequence	Disabled
Triggered SU Beamforming Feedback	Configurable support for Partial and Full BW SU CBF in HE TB sounding sequence	Disabled
TRS support	Configurable support for receiving an MPDU that contains a TRS Control subfield for a non-AP STA.	Disabled
TWT Requester	Configurable TWT Requester support	Disabled
TWT Required	Ability to configure the TWT Requirement as defined in [7] in the HE Operation element	0
TWT Responder	Configurable TWT Responder support	Disabled
Tx 1024-QAM support < 242-tone RU	Configurable support for MCS10-11 TX in RU < 242	Disabled
Transmit Coding	Ability to set the coding to BCC or LDPC	BCC (20 MHz), LDPC (80 MHz)
UL 2×996-tone RU support	Configurable support for RU allocation of 2x996	Disabled

Table 5 lists the typical test bed AP MU EDCA configuration parameters that are used in some test cases.

Table 5. Test bed AP MU EDCA configuration parameters

Parameter	Description	Default value
MU EDCA parameters	The test bed AP is required to be configurable with the following MU EDCA parameters: • AC_BK: AIFSN = 0, ECWmin = 15, ECWmax = 15, MU EDCA Timer = 255 • AC_BE: AIFSN = 0, ECWmin = 15, ECWmax = 15, MU EDCA Timer = 255 • AC_VI: AIFSN = 0, ECWmin = 15, ECWmax = 15, MU EDCA Timer = 255 • AC_VO: AIFSN = 0, ECWmin = 15, ECWmax = 15, MU EDCA Timer = 255	Does not advertise MU EDCA parameters

2.4.2 Test bed STA requirements

The following capabilities are required of the test bed STA.

- Dual band
- Ability to configure in 11a/11g/11an/11gn/11ac/11ax mode
- Ability to configure in 11n mode
- Ability to configure WEP and TKIP with HE rates, and able to generate a Probe Request frame
- Ability to configure for WPA2-personal, WPA2-Enterprise and WPA3-SAE
- Ability to disable MAC address randomization
- Ability to configure transmit and receive 256 Bitmap Block Ack
- Ability to configure BCC and LDPC coding in payload
- Ability to configure LTF+GI combination setting for PPDUs
- Ability to configure the Maximum Number of Fragmented MSDUs/A-MSDUs Exponent subfield which indicates the maximum number of fragmented MSDUs and/or A-MSDUs that should be configured when Fragmentation Support > 0
- Ability to configure the minimum frame body size of the fragment of first MSDU that should be configured when Fragmentation Support > 0
- Ability to configure to send OM Control field in +HTC field in a HE PPDU and configure the NSS and Channel Bandwidth fields.
-

Table 6 defines the Wi-Fi CERTIFIED 6 configuration parameters and their default values for the test bed STA. If required, the following parameter values are modified for specific test cases.

Table 6. Test bed STA default parameters

Parameter	Description	Default value
+HTC-HE support	Configurable support for the reception of an HE variant HT Control field carried in a QoS Data, QoS Null, or Management frame	Disabled

Parameter	Description	Default value
20 MHz in 160/ 80+80 MHz HE PPDU	Configurable support of 26-, 52-, and 106-tone mapping for a 20 MHz operating non-AP HE STA that is the receiver of a 80+80 MHz or a 160 MHz HE MU PPDU, or the transmitter of a 80+80 MHz or 160 MHz HE TB PPDU	Disabled
20 MHz in 40 MHz HE PPDU in 2.4 GHz band	Configurable support of 26-, 52-, and 106-tone mapping for a 20 MHz operating non-AP HE STA that is the receiver of a 40 MHz HE MU PPDU in 2.4 GHz band, or the transmitter of a 40 MHz HE TB PPDU in 2.4 GHz band	Disabled
32-bit BA Bitmap support	Configurable support for 32-bit BA Bitmap	Disabled
80 MHz in 160/ 80+80 MHz HE PPDU	Ability to configure 80 MHz in 160/ 80+80 MHz HE PPDU. The capability bit is applicable while receiving a 80+80 MHz or a 160 MHz HE MU PPDU, or transmitting a 80+80 MHz or a 160 MHz HE TB PPDU	Disabled
Transmission bandwidth	Configurable to 20 MHz or 40 MHz or 80 MHz bandwidths	20 MHz or 2.4 GHz 80 MHz for 5 GHz
Wi-Fi mode	Configurable in 11a, 11g, 11n, 11ac or 11ax mode	11ax
Disable BA	Configurable to not send ADDBA Request frames and decline ADDBA Request frames	Disabled
A-MSDU aggregation and transmit A-MSDU	Configurable to send A-MSDU	Off
Ack-Enabled Aggregation Support	Ability to receive an aggregation that requires an Ack	Disabled
ADDBA Request with Buffer Size ≤ 64 ADDBA Response with Buffer Size ≤ 64	Ability to configure the default Buffer Size	1..64
All Ack support	Configurable support for the reception of a Multi-STA BlockAck frame under the all Ack context	Disabled
A-MSDU Fragmentation support	Ability to configure A-MSDU Fragmentation support. Applicable only if Fragmentation > 0	Disabled
A-MSDU In Ack- Enabled A-MPDU Support	Configurable A-MSDU in Ack-Enabled A-MPDU Support	Disabled
A-MSDU in A-MPDU support	Configurable support for receiving A-MSDU (with no BA session) in A-MPDU	Disabled
Beamformee STS > 80 MHz	Ability to configure Beamformee STS > 80 MHz subfield. Valid only if SU Beamformee capable and indicates space-time streams that the STA can receive in an HE NDP	0
Beamformee STS ≤ 80 MHz	Ability to configure Beamformee STS ≤ 80 MHz subfield. Valid only if SU Beamformee capable and indicates space-time streams that the STA can receive in an HE NDP	3
BQR support	Configurable support for transmitting a bandwidth query report	Disabled
Broadcast TWT Support	Configurable support for Broadcast Target Wake Time	Disabled
BSR support	Configurable support to receive BSR in A-Control field	Disabled
BSRP BQRP A-MPDU Aggregation	Ability to configure the BSRP BQRP A-MPDU Aggregation field. For a non-AP STA, indicates whether or not the STA accepts a BSRP Trigger frame or BQRP Trigger frame that is aggregated with other Control, Data and Management frames in an A-MPDU destined to the STA	Disabled
Codebook Size $(\phi, \psi) = \{4, 2\}$ SU feedback	Configurable HE beamformee support for a codebook size $(\phi, \psi) = \{4, 2\}$ in the HE Compressed Beamforming Report field for SU feedback	Disabled

Parameter	Description	Default value
Codebook Size (ϕ, ψ) = {7, 5} MU feedback	Configurable HE beamformee support for a codebook size (ϕ, ψ) = {7, 5} in the HE Compressed Beamforming Report field for MU type feedback	Disabled
Codebook Size (ϕ,ψ) = {7, 5} MU feedback	Ability to receive MU type sounding feedback with codebook size (ϕ,ψ) = {7, 5} which is to be signaled in the HE PHY Capabilities element	0
DCM Max RU	Ability to configure the DCM Max RU field. Applicable only when DCM TX, DCM RX BW > 0	0
DCM Max Constellation RX	Ability to configure the maximum supported constellation for DCM in the Data field and Sig-B for RX	0
DCM Max Constellation TX	Ability to configure the maximum supported constellation for DCM in the Data field in HE TB PPDU	0
DCM Max NSS RX	Ability to configure the maximum NSS when DCM is used (Reserved when DCM RX = 0)	0
DCM Max NSS TX	Ability to configure the maximum NSS when DCM is used (Reserved when DCM TX = 0)	0
Device Class	Ability to configure the STA device class	Class A (1)
Doppler Tx/Rx support	Ability to configure the Doppler mode support	Disabled
Encryption Key	Configurable encryption key	12345678
Flexible TWT Schedule support	Configurable support for the reception of TWT Information frames with any non-zero value in the Next TWT field	Disabled
Fragmentation support	Configurable level of dynamic fragmentation supported	0
Full BW UL MU-MIMO	Ability to configure the UL MIMO in HE TB PPDU	Disabled
HE Dynamic SM Power Save	Configurable Dynamic SM Power Save feature support	Disabled
HE ER SU PPDU with 1x HE-LTF and 0.8 µs GI	Configurable support of the reception of an HE ER SU PPDU with 1x LTF and 0.8 µs guard interval duration	Disabled
HE ER SU PPDU with 4x HE-LTF and 0.8 µs GI	Configurable support for the reception of an HE ER SU PPDU with 4x LTF and 0.8 µs guard interval duration.	Disabled
HE Link adaptation support	Configurable support for Link Adaptation using the HLA Control subfield	Disabled
HE-MCS support Rx	Configurable to receive a specific range of HE-MCS values (0-7, 0-9 or 0-11)	0-7
HE-MCS support Tx	Configurable to transmit a specific HE-MCS value	7
HE NDP with 4x HE-LTF and 3.2 µs GI	Configurable support for receiving an HE NDP with 4x LTF and 3.2 µs GI duration	0
HE SU PPDU and HE MU PPDU with 4x HE-LTF and 0.8 µs GI	Configurable support for the reception of an HE SU PPDU and HE MU PPDU with 4x LTF and 0.8 µs guard interval duration	Disabled
HE SU PPDU With 1x HE-LTF And 0.8 us GI	Configurable support of the reception of an HE SU PPDU with 1x LTF and 0.8 µs guard interval duration	Disabled
HE Subchannel Selective Transmission support	Configurable whether an HE STA supports an HE subchannel selective transmission operation	Disabled
HE_SU	Configurable to transmit HE_SU PPDU	Enabled
HT And VHT Trigger frame RX Support	Configurable support for HT and VHT Trigger frame Rx	Disabled

Parameter	Description	Default value
Longer than 16 HE-SIG-B OFDM symbols support	Ability to configure the HE-SIG-B OFDM symbols. For a non-AP STA, indicates support for receiving a DL HE MU PPDU where the number of OFDM symbols in the HE-SIG-B field is greater than 16.	Disabled
Max Nc	Ability to configure the maximum Nc supported for sounding feedback which is to be signaled in the HE PHY Capabilities element	Same as the maximum number defined in Rx HE-MCS Map ≤ 80 MHz in the Supported HE-MCS And NSS Set field as part of the HE Capabilities element
Max Nc	Ability to configure the Max Nc subfield. When the transmitting STA is acting as a beamformee, it indicates the maximum Nc for beamforming sounding feedback supported. Reserved when not SU Beamformee capable.	0
Maximum A-MPDU Length Exponent	Ability to configure the Maximum A-MPDU Length Exponent subfield. When VHT capabilities is present, the Maximum A-MPDU Length Exponent subfield of the VHT Capabilities element is set to 7. When VHT capabilities is not present, the Maximum A-MPDU Length Exponent subfield of the HT Capabilities element is set to 3.	0
MBO Capability	Configurable to advertise Wi-Fi CERTIFIED Agile Multiband capability	OFF
Midamble Tx/Rx 2x and 1x HE-LTF	Configurable Midamble Tx/Rx 2x and 1x HE-LTF. Applicable only when Doppler is supported.	0
Midamble Tx/Rx Max NSTS	Configurable Midamble Tx/Rx Max NSTS. Applicable only when Doppler TX, RX are supported.	0
MU Beamformer	Configurable support for operation as MU Beamformer	Disabled
MU Cascading support	Configurable support for signaling Cascading	Disabled
Multi-TID Aggregation RX support	Configurable number of TIDs of QoS Data frames that an HE STA can receive in a multi- TID A-MPDU	0
Multi-TID Aggregation TX support	Configurable number of TIDs of QoS Data frames that an HE STA can receive in a multi- TID A-MPDU	0
NDP Feedback Report support	Configurable support for NDP feedback and responding to NFRP Trigger frames	Disabled
NDP With 4x HE-LTF And 3.2usGI	Configurable support of receiving an NDP with 4x LTF and 3.2 µs guard interval duration	Disabled
Ng = 16 MU feedback	Ability to receive MU type sounding feedback with Ng = 16 which is to be signaled in the HE PHY Capabilities element	0
Ng = 16 MU feedback	Ability to configure tone grouping to 16 in HE CBF in MU type feedback	Disabled
Ng = 16 SU feedback	Ability to configure the tone grouping to16 in HE CBF in SU feedback	Disabled
Non-Triggered CQI feedback	Ability to configure TX, RX of full BW non-triggered CQI-only feedback	Disabled
Number of Sounding Dimensions > 80 MHz	Ability to configure the Number of Sounding Dimensions > 80 MHz subfield.	0

Parameter	Description	Default value
	Valid on if SU Beamformer capable and indicates the maximum value of the TXVECTOR parameter NUM_STS for an HE NDP	
Number of Sounding Dimensions ≤ 80 MHz	Ability to configure the Number of Sounding Dimensions ≤ 80 MHz subfield. Valid on if SU Beamformer capable and indicates the maximum value of the TXVECTOR parameter NUM_STS for an HE NDP	0
Number of spatial streams Tx	Configurable to transmit using a specific number of spatial streams	1
OFDMA RA support	For Non-AP STA, configurable support for random access procedure	Disabled
OM Control support	Configurable signaling for OM Reception in A-Control	Disabled
OM Control UL MU Data Disable RX support	Configurable support for RX of UL MU Data Disable	Disabled
OMI and OMN transmission	Ability to configure OMI and OMN transmission	Disabled
OPS support	Configurable support for Opportunistic power save	Disabled
Partial Bandwidth DL MU-MIMO	Ability to receive DL MU-MIMO transmission on an RU in an HE MU PPDU where the RU does not span the entire PPDU bandwidth which is to be signaled in the HE PHY Capabilities element	0
Partial Bandwidth DL MU-MIMO	For a non-AP STA, configurable support for the reception of a DL MU-MIMO transmission on an RU in an HE MU PPDU where the RU does not span the entire PPDU bandwidth (DL MU-MIMO within OFDMA)	Disabled
Partial Bandwidth DL MU-MIMO support	Ability to disable Partial Bandwidth DL MU-MIMO support	0
Partial BW Extended Range	Configurable support for transmission and reception of the Data field of the HE ER SU PPDU when transmitted over the high frequency 106-tone RU within primary 20 MHz channel	Disabled
Partial BW UL MU-MIMO	Ability to configure UL MIMO in Partial BW in HE TB PPDU	Disabled
PMF	Ability to configure Protected Management Frames	MFPC (bit 7) = 0 MFPR (bit 6) = 0 (OFF)
Power Boost Factor support	Configurable support for a power boost factor αr for the r-th RU in the range [0.5, 2]	Disabled
PPE Threshold present	Configurable if PPE Threshold is present	1
Punctured preamble RX	Ability to configure RX for punctured preamble	Disabled
Punctured Sounding Support	Configurable Punctured Sounding Support subfield	Disabled
QTP support	Configurable support for the Quiet time period	Disabled
Rx 1024-QAM support < 242-tone RU	Configurable support for MCS10-11 RX in RU < 242	Disabled
Rx Control frame to MultiBSS	Configurable Multi-BSSID related support	Disabled
Rx Full BW SU using HE MU PPDU with Compressed HE-SIGB	Configurable support for reception of an HE MU PPDU with an RU spanning the entire PPDU bandwidth and a compressed HE-SIG-B format	Disabled

Parameter	Description	Default value
Rx Full BW SU using HE MU PPDU with Non-Compressed HE-SIGB	Configurable support for reception of an HE MU PPDU with a bandwidth less than or equal to 80 MHz, an RU spanning the entire PPDU bandwidth and a non-compressed HE-SIG-B format	Disabled
Rx HE MU PPDU From Non-AP STA	Configurable support for the reception on an RU in an HE MU PPDU from a non-AP STA where the RU does not span the entire PPDU bandwidth	Disabled
Security	Ability to configure the security mode	WPA2-Personal
SR Responder	Configurable support for the role of SRP responder	Disabled
SRP-based SR support	Configurable support for SRP-based operation	Disabled
STBC RX > 80MHz	Configurable support for STBC RX when BW > 80MHz	Disabled
STBC Rx ≤ 80 MHz	Ability to configure RX of an HE PPDU when BW ≤ 80	Disabled
STBC TX > 80MHz	Configurable support for STBC TX when BW > 80MHz	Disabled
STBC Tx ≤ 80 MHz	Ability to configure TX of an HE PPDU when BW ≤ 80	Disabled
SU Beamformee	Configurable support for SU Beamformee	Enabled
SU Beamformee codebook size	Ability to configure codebook size used when generating HE CBF using SU feedback in a non-trigger-based sounding sequence	{6,4}
SU Beamformee Ng	Ability to configure the Ng (tone grouping) used when generating HE CBF using SU feedback in a non-trigger-based sounding sequence	4
SU Beamformer	Configurable support for SU beamformer	Disabled
Trigger frame MAC Padding duration	Ability to configure MinTrigProcTime, which is used to pad Trigger frames	2
Triggered CQI feedback	Configurable support for partial and full BW CQI feedback in HE TB sounding sequence	Disabled
Triggered CQI feedback type	Ability to transmit partial and full bandwidth CQI-only feedback which is to be signaled in the HE PHY Capabilities element	0
Triggered MU Beamforming partial BW feedback	Ability to support partial BW MU type feedback which is to be signaled in the HE PHY Capabilities element	0
Triggered MU Beamforming Partial BW feedback	Configurable support for Partial BW MU CBF in HE TB sounding sequence	Disabled
Triggered SU Beamforming feedback	Configurable support for Partial and Full BW SU CBF in HE TB sounding sequence	Disabled
TRS support	For a non-AP STA, configurable support for receiving an MPDU that contains a TRS Control subfield.	Disabled
TWT only PS operation	Ability to configure TWT only PS operation. When this configuration is enabled, a STA configured for PS operation will only use TWT SP for buffered data retrieval, the STA will not attempt to retrieve buffered data outside of negotiated TWT SPs.	Disabled
TWT Request	Ability to configure the TWT Request. When disabled, the device will transmit a TWT Request with the parameters as specified in the test procedure. The common parameters are: • Control field:	Disabled

Parameter	Description	Default value
	▪ NDP Paging Indicator = 0 ▪ Responder PM Mode = 0 ▪ Broadcast = 0 ▪ Wake TBTT Negotiation = 0 • Request Type field ▪ TWT Request = 1 ▪ Implicit = 1 ▪ TWT Protection = 0 ▪ TWT Channel = 0	
TWT Requester	Configurable TWT Requester support	Disabled
TWT Responder	Configurable TWT Responder support	Disabled
TWT termination	Ability to configure the TWT termination. When disabled, the device will transmit a TWT Teardown frame with the parameters specified in the test procedure.	Disabled
Tx 1024-QAM support < 242-tone RU	Configurable support for MCS10-11 TX in RU < 242	Disabled
Tx Coding	Ability to set the coding to BCC or LDPC	BCC (20 MHz), LDPC (80 MHz)
UL 2×996-tone RU support	Configurable support for RU allocation of 2x996	Disabled

Table 7 lists the test bed STA MU EDCA override default parameters that are used in some test cases.

Table 7. Test bed STA MU EDCA override default parameters

Parameter	Description	Default value
MU EDCA override	When MU EDCA override is enabled, a STA will enable MU EDCA with the parameters specified in the test procedure and the STA will ignore any MU EDCA parameters transmitted by its associated AP. Typical MU EDCA parameters when needed by a test are: • AC_BK: AIFSN = 0, ECWmin = 15, ECWmax = 15, MU EDCA Timer = 255 • AC_BE: AIFSN = 0, ECWmin = 15, ECWmax = 15, MU EDCA Timer = 255 • AC_VI: AIFSN = 0, ECWmin = 15, ECWmax = 15, MU EDCA Timer = 255 • AC_VO: AIFSN = 0, ECWmin = 15, ECWmax = 15, MU EDCA Timer = 255	Disabled

3 Requirements for Wi-Fi Alliance certification

The following items describe the necessary features that are required for a DUT to pass Wi-Fi CERTIFIED 6 certification.

3.1 General requirements

3.1.1 Prerequisite certification requirements

A Wi-Fi CERTIFIED 6 APUT device shall implement and pass the following Wi-Fi Alliance certifications as a prerequisite:

- Wi-Fi CERTIFIED WPA3™
- Wi-Fi CERTIFIED Agile Multiband™
- Wi-Fi CERTIFIED™ n and/or Wi-Fi CERTIFIED™ ac

A Wi-Fi CERTIFIED 6 Mobile APUT device shall implement and pass the following Wi-Fi Alliance certifications as a prerequisite:

- Wi-Fi CERTIFIED WPA3
- Wi-Fi CERTIFIED n and/or Wi-Fi CERTIFIED ac

A Wi-Fi CERTIFIED 6 STAUT device shall implement and pass the following Wi-Fi Alliance certifications as a prerequisite:

- Wi-Fi CERTIFED WPA3
- Wi-Fi CERTIFIED Agile Multiband
- Wi-Fi CERTIFIED n and/or Wi-Fi CERTIFED ac

A Wi-Fi CERTIFIED 6 20 MHz-only STAUT device shall implement and pass the following Wi-Fi Alliance certifications as a prerequisite:

- Wi-Fi CERTIFIED WPA3
- Wi-Fi CERTIFIED Agile Multiband
- Wi-Fi CERTIFIED n
- Applicable test cases of Wi-Fi CERTIFIED ac test plan per Table 3a[3]

3.1.2 Testing requirements

This section lists the DUT requirements that are necessary to execute the test cases in this test plan.

- All test cases assume that a BA session is established by default

3.2 Applicability of tests

The applicable tests for certification are the tests of mandatory features and tests of optional features that a vendor chooses to declare or that are indicated by the DUT as described in the underlying technical specifications. Table 8 and Table 9 list the applicable tests for the APUT and STAUT respectively.

“Applicability” indicates whether a feature and its associated tests are either mandatory or optional to implement. Mandatory (M) tests are required for certification.

Optional (O) tests are performed if the vendor declares the feature, or the DUT indicates the feature as described in the underlying technical specifications via transmitted frames or transmitted messages or user interfaces. If the optional feature is declared and if that test fails, the DUT shall fail the Wi-Fi CERTIFIED 6 certification. Conditional (C) tests are mandatory if certain specified conditions pertain to the DUT, and are optional otherwise.

If the feature requires information, in particular if the vendor implements or supports an optional feature, the fourth column contains a “Y” and the vendor shall provide information in the DUT Information spreadsheet. (A copy of the spreadsheet is accessible through the online Wi-Fi Alliance Certification System.)

If a vendor declares an optional feature, that feature shall be indicated by the DUT as described in the underlying technical specifications. Declaration of an optional feature by a vendor comprises inclusion of the feature in the appropriate Wi-Fi Alliance registration and DUT Information spreadsheet at the time of submission. An optional feature that was not declared but is indicated within an associated capabilities field(s), element’s, or any transmitted frames comprises inclusion of the feature.

Each vendor shall fill out the DUT Information spreadsheet completely. Test labs will verify that the list of optional features declared by the vendor matches the list indicated by the DUT; each optional feature for which any test exists in this test plan and that appears in one list shall also appear in the other. The information determines which tests and which test parameters apply to the certification.

A “Y” in the last column indicates the certain subset of optional capabilities that will be indicated on the interoperability certificate if they are declared by the vendor.

3.2.1 APUT tests

Table 8 summarizes the APUT tests for Wi-Fi CERTIFIED 6.

Table 8. APUT test applicability

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
APUT security tests	4.2		
APUT security configurability test	4.2.1	M	N
APUT WEP not used with HE associations negative test	4.2.2	M	N
APUT Disallows HE TKIP test	4.2.3	M	N
APUT initial 5 GHz operation tests	4.3.1	M	N
APUT initial ping interoperability with WPA2-Enterprise security test	4.4.1	M	N
APUT initial ping interoperability with WPA3-SAE security test	4.4.2	M	N
APUT association and throughput tests	4.5		

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
APUT association and throughput without security test	4.5.2	C (if Open security supported)	Y
APUT association and throughput using WPA2-Personal security test	4.5.3	Part A: M Part B: O	N
Concurrent dual band APUT test	4.7.1	O	Y
APUT receives A-MPDU aggregation with and without WPA2-Personal test	4.12.1	M	N
APUT A-MSDU reception when AP is the receiver test	4.13.1	M	N
APUT overlapping BSS	4.14		
APUT overlapping BSS at 2.4 GHz test	4.14.1	M for 2.4 GHz	N
APUT overlapping BSS at 5 GHz test	4.14.2	M for 5 GHz	
A-MPDU aggregation when the AP is the transmitter test	4.16.1	M	N
Ability to receive A-MPDU with A-MSDU test	4.17.1	O	N
HE SU preamble format and channel width where AP is the transmitter test	4.18.1	M	N
HE SU preamble format and channel width where AP is the receiver test	4.19.1	M	N
APUT uses LDPC when transmitting HE A-MPDU with MCS 0-7 test	4.20.1	M for 5 GHz O for 2.4 GHz	Y
APUT LDPC when receiving HE A-MPDU with MCS 0-7 test	4.21.1	M for 5 GHz O for 2.4 GHz	N
APUT uses BCC when transmitting HE A-MPDU with MCS 0-7 test	4.22.1	M	N
APUT BCC receives HE A-MPDU with MCS 0-7 test	4.23.1	M	N
APUT SU MIMO with one and two spatial streams test	4.24.1	M	N
APUT receives single TID compressed BA with 64 MSDUs no fragmentation and channel widths test	4.25.1	M	N
APUT transmits single TID compressed BA with 64 MSDUs no fragmentation and channel widths test	4.26.1	M	N
APUT receives HE-LTF, and GI and packet extension test	4.27.1	M	N
APUT transmits HE-LTF and GI test	4.28.1	M	N
APUT DL OFDMA	4.29.1	M	N
APUT DL OFDMA PHY test	4.30.1	M	N
APUT transmits MCS 8-9 test	4.31.1	O	Y

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
APUT receives MCS 8-9 test	4.32.1	O	Y
APUT transmits MCS 10-11 test	4.33.1	O	Y
APUT receives MCS 10-11 test	4.34.1	O	Y
APUT transmits SU beamforming as the beamformer with Sounding Dimension ≤ 4 test	4.35.1	O if supports < 4SS, C is if supports ≥ 4SS	N
APUT transmits SU beamforming as the beamformer with sounding dimension of 8 test	4.35.2	O	Y
APUT transmits SU beamforming as the beamformer at 160 MHz test	4.35.3	O	Y
APUT transmits MCS 8-9 in MU PPDU test	4.36.1	O	Y
APUT transmits MCS 10-11 in MU PPDU test	4.37.1	O	Y
APUT transmits 160 MHz PPDU test	4.38.1	O	Y
APUT receives 160 MHz PPDU test	4.39.1	O	Y
AP UL OFDMA PHY test	4.40		
APUT UL OFDMA at 2.4 GHz using one spatial streams BCC coding	4.40.1	M for 2.4 GHz	N
APUT UL OFDMA at 2.4 GHz using two spatial streams BCC coding	4.40.2	M for 2.4 GHz	N
APUT UL OFDMA at 2.4 GHz using two spatial streams LDPC coding	4.40.3	C for 2.4 GHz	N
APUT ULOFDMA at 5 GHz using one spatial stream	4.40.4	M for 5 GHz	N
APUT UL OFDMA at 5 GHz using two spatial streams LDPC coding	4.40.5	M for 5 GHz	N
APUT basic high efficiency UL MU frame exchange sequence test	4.41		
Basic HE UL MU frame exchange sequence for 2.4 GHz, 20 MHz test	4.41.1	M for 2.4 GHz	N
Basic HE UL MU frame exchange sequence for 5 GHz, 80 MHz test	4.41.2	M for 5 GHz	N
APUT Trigger frame MAC padding test	4.43.1	M	N
APUT DL OFDMA 160 MHz PHY test	4.44.1	O	Y
APUT DL MU MU-BAR for C-BA test	4.45.1	O	Y
APUT M-BA with Ack Type subfield set to 1 and TID 0 to 7 and 15 for Ack context solicited by S-MPDU test	4.46.1	M	N
APUT receives SU MIMO with two spatial streams and 160 MHz PPDU test	4.47.1	O	Y
APUT transmits SU MIMO with two spatial streams and 160 MHz PPDU test	4.48.1	O	Y

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
APUT HE BSR in UL OFDMA test	4.49.1	O	N
APUT receives Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths test	4.50.1	O	Y
APUT transmits Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths test	4.51.1	O	Y
APUT receives A-Control OM for ROM	4.52.1	M	N
APUT MU BFRP test	4.53.1	C (DL-MU-MIMO Tx)	Y
APUT MU BFRP for eight spatial stream sounding test	4.53.2	O	Y
APUT DL-MU-MIMO test	4.54.1	C (≥ 4 SS for transmission	Y
APUT individual TWT test	4.56.1	M	N
APUT transmits and receives its operating mode	4.58.1	M	N
APUT HE TB PPDU channel access rules test	4.60.1	M for 5 GHz	N
APUT generates DL MU PPDU with Trigger frame soliciting an HE TB PPDU response which contains Ack/C-BA test	4.62.1	O	Y
APUT receives MCS 8-9 in HE TB PPDU using one spatial stream test	4.63.1	O	Y
APUT receives MCS 10-11 in HE TB PPDU at 5 GHz using one spatial stream test	4.64.1	O for 5 GHz	Y
APUT MU EDCA parameter test	4.65.1	O	Y
APUT announces TXOP Duration RTS Threshold value test	4.66.1	O	Y
APUT supports Multi-BSSID test	4.67.1	O	Y
APUT transmits HE MU-RTS/CTS Trigger frames test	4.68.1	O	Y
APUT transmits wideband OFDMA packets to 20 MHz only STA test	4.69.1	M	N

3.2.2 STAUT tests

Table 9 summarizes the STAUT tests for Wi-Fi CERTIFIED 6.

Table 9. STAUT test applicability

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
STAUT security tests	5.2		
STAUT WEP not used with HE associations test	5.2.2	M	N
STAUT disallows HE TKIP test	5.2.3	M	N
STAUT basic association in the Wi-Fi CERTIFIED 6 environment test	5.3.1	M	N
STAUT WPA2 initial ping using security test	5.4.1	M	N
STAUT initial ping interoperability with WPA3-SAE security test	5.4.2	M	N
STAUT association and throughput using WPA2-Personal test	5.5.1	M	N
STAUT association and throughput without security test	5.5.2	O	N
STAUT association and throughput using WPA2-Enterprise test	5.6.1	M	N
Roaming single and dual band STAUTs with WPA2-Personal test	5.9.1	M	N
STAUT receives A-MPDU aggregation with and without WPA2-Personal test	5.15.1	M	N
STAUT receives A-MSDU test	5.16.1	M	N
STAUT overlapping BSS at 2.4 GHz test	5.17.1	M for a 2.4 G Hz	N
STAUT overlapping BSS at 5 GHz test	5.18.1	M for a 5 G Hz	N
STAUT transmits A-MPDU aggregation	5.19.1	M	N
STAUT receives A-MPDU with A-MSDU test	5.21.1	O	N
STAUT receives HE SU preamble format and channel width	5.22.1	M	N
STAUT transmits HE SU preamble format and channel width test	5.23.1	M	N
STAUT receives LDPC HE A-MPDU with MCS 0-7 test	5.24.1	M for 5 GHz O for 2.4 GHz	Y
STAUT transmits LDPC HE A-MPDU with MCS 0-7 test	5.25.1	M for 5 GHz O for 2.4 GHz	N
STAUT receives BCC HE A-MPDU with MCS 0-7 test	5.26.1	M	N
STAUT transmits BCC HE A-MPDU with MCS 0-7 test	5.27.1	M	N
STAUT single user MIMO with one and two spatial streams test	5.28.1	O	Y
STAUT transmits single TID compressed BA test	5.29.1	M	N

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
STAUT receives single TID Compressed BA test	5.30.1	M	N
STAUT receives HE-LTF, and GI and packet extension test	5.31.1	M	N
STAUT transmits HE-LTF and GI test	5.32.1	M	N
STAUT DL OFDMA test	5.33.1	M	N
STAUT DL OFDMA PHY test	5.34		
STAUT DL OFDMA PHY test at 20 MHz test	5.34.1	M	N
STAUT DL OFDMA PHY test at 40 MHz (5 GHz) test	5.34.2	M for 5 GHz	N
STAUT DL OFDMA PHY test at 80 MHz (5 GHz) test	5.34.3	M for 5 GHz	N
STAUT receives MCS 8-9 test	5.35.1	O	Y
STAUT transmits MCS 8-9 test	5.36.1	O	Y
STAUT receives MCS 10-11 test	5.37.1	O	Y
STAUT transmits MCS 10-11 test	5.38.1	O	Y
STAUT SU transmit beamforming where AP is the beamformer tests	5.39		
STAUT SU transmit beamforming where AP is the beamformer, Sounding dimension ≤ 4	5.39.1	M	N
STAUT SU transmit beamforming where AP is the beamformer, Sounding dimension 8	5.39.2	O	Y
STAUT SU transmit beamforming where AP is the beamformer, 160 MHz	5.39.3	O	Y
STAUT receives MCS 8-9 in MU PPDU test	5.40.1	O	Y
STAUT receives MCS 10-11 in MU PPDU test	5.41.1	O	Y
STAUT receives 160 MHz PPDU test	5.42.1	O	Y
STAUT transmits 160 MHz PPDU test	5.43.1	O	Y
STAUT UL OFDMA PHY transmit tests	5.44		
STAUT UL OFDMA PHY transmits at 2.4 GHz 1SS, 20 MHz test	5.44.1	M for 2.4 GHz	N
STAUT UL OFDMA PHY transmits at 2.4 GHz 2SS, 20 MHz test	5.44.2	M for 2.4 GHz	N
STAUT UL OFDMA PHY transmits at 2.4 GHz Mixed SS, 20 MHz test	5.44.3	M for 2.4 GHz	N
STAUT UL OFDMA PHY transmits at 5 GHz 1SS, 80 MHz test	5.44.4	M for 5 GHz	N
STAUT UL OFDMA PHY transmits at 5 GHz 2SS, 80 MHz test	5.44.5	M for 5 GHz	N

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
STAUT UL OFDMA PHY transmits at 5 GHz Mixed SS, 80 MHz test	5.44.6	M for 5 GHz	N
STAUT UL OFDMA PHY transmits at 5 GHz 1SS, 40 MHz test	5.44.7	M for 5 GHz	N
STAUT UL OFDMA PHY transmits at 5 GHz 2SS, 40 MHz test	5.44.8	M for 5 GHZ	N
STAUT UL OFDMA PHY transmits at 5 GHz Mixed SS, 40 MHz test	5.44.9	M for 5 GHz	N
STAUT basic HE UL MU frame exchange sequence tests	5.45		
STAUT basic HE UL MU frame exchange sequence at 2.4 GHz, 20 MHz test	5.45.1	M for 2.4 GHz	N
STAUT basic HE UL MU frame exchange sequence at 5 GHz, 80 MHz test	5.45.2	M for 5 GHz	N
STAUT Trigger frame MAC padding test	5.47.1	M	N
STAUT DL OFDMA with S-MPDU test	5.48.1	M	N
STAUT DL OFDMA PHY at 160 MHz (5 GHz) test	5.49.1	O	Y
STAUT DL OFDMA mixed spatial stream PHY test	5.50.1	M	N
STAUT DL MU MU-BAR frame for C-BA test	5.51.1	M	N
STAUT M-BA with Ack Type subfield = 1 with TID 0 to 7 for Ack context solicited by S-MPDU test	5.52.1	M	N
STAUT HE BSR in UL OFDMA test	5.53.1	M	N
STAUT transmits single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths test	5.54.1	O	N
STAUT receives single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths test	5.55.1	O	N
STAUT receives A-Control OM for ROM test	5.56.1	O for 5 GHz O for 2.4 GHz only if NSS for TX > 1	Y
STAUT MU BFRP tests	5.57		
STAUT MU BFRP for ≤4SS sounding dimension test	5.57.1	M	N
STAUT MU BFRP test for 8SS sounding dimension test	5.57.2	O	Y
STAUT DL MU-MIMO test	5.58.1	M	N
STAUT UL MU pre-correction test	5.59		
STAUT UL MU pre-correction time and frequency	5.59.1	M	N
STAUT UL MU Pre-correction power test	5.59.2	M	N

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
STAUT individual TWT test	5.60.1	O	Y
STAUT HE A-MPDU construction of HE TB PPDU test	5.61.1	M	N
STAUT UL MU sensing test	5.62.1	M	N
STAUT trigger-based PPDU transmission test	5.63.1	M for 5 GHz	N
STAUT MU EDCA Parameter set	5.64.1	M	N
STAUT OBSS_PD-based test	5.65.1	M	N
STAUT transmits UPH A-Control test	5.66.1	M	N
STAUT acknowledgement to DL MU PPDU which solicits in HE TB PPDU response containing Ack/C-BA test	5.68.1	M	N
STAUT transmits MCS 8-9 in HE TB PPDU test	5.69.1	O	Y
STAUT transmits MCS 10-11 in HE TB PPDU at 5 GHz using one spatial stream test	5.70.1	O	Y
STAUT RTS exchange based on TXOP Duration RTS Threshold value test	5.71.1	M	N
STAUT Multi-BSSID test	5.72.1	M	N
STAUT HE MU-RTS/CTS test	5.73.1	M	N
STAUT transmits operating mode test	5.74.1	O for 5 GHz, O for 2.4 GHz only if NSS for TX > 1	Y
Notes: LDPC is made mandatory for all device configurations other than devices operating exclusively in 20 MHz channels (AP) operating only at 2.4 GHz, STA operating only at 2.4 GHz, for which it is conditional mandatory (condition: MCS 10 – 11 or SU MIMO with > 4 SS). For many bandwidth and number of spatial stream combinations, LDPC is the only scheme defined in the underlying reference document.			

3.2.3 Mobile APUT tests

Table 10 summarizes the Mobile APUT tests for Wi-Fi CERTIFIED 6. (If the test cases have specific checks for MAP certification then those checks will be used for the test, if there are none then the conditions for AP are applicable).

Table 10. Mobile APUT test applicability

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
APUT security tests	4.2		

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
APUT security configurability test	4.2.1	M	N
APUT WEP not used with HE associations negative test	4.2.2	M	N
APUT Disallows HE TKIP test	4.2.3	M	N
APUT initial 5 GHz operation tests	4.3.1	M	N
APUT initial ping interoperability with WPA2-Enterprise security test	4.4.1	M	N
APUT initial ping interoperability with WPA3-SAE security test	4.4.2	M	N
APUT association and throughput tests	4.5		
APUT association and throughput without security test	4.5.2	C (if Open security supported)	Y
APUT association and throughput using WPA2-Personal security test	4.5.3	Part A: M Part B: O	N
Concurrent dual band APUT test	4.7.1	O	Y
APUT receives A-MPDU aggregation with and without WPA2-Personal test	4.12.1	M	N
APUT A-MSDU reception when AP is the receiver test	4.13.1	M	N
APUT overlapping BSS	4.14		
APUT overlapping BSS at 2.4 GHz test	4.14.1	M for 2.4 GHz	N
APUT overlapping BSS at 5 GHz test	4.14.2	M for 5 GHz	
A-MPDU aggregation when the AP is the transmitter test	4.16.1	M	N
Ability to receive A-MPDU with A-MSDU test	4.17.1	O	N
HE SU preamble format and channel width where AP is the transmitter test	4.18.1	M	N
HE SU preamble format and channel width where AP is the receiver test	4.19.1	M	N
APUT uses LDPC when transmitting HE A-MPDU with MCS 0-7 test	4.20.1	M for 5 GHz O for 2.4 GHz	Y
APUT LDPC when receiving HE A-MPDU with MCS 0-7 test	4.21.1	M for 5 GHz O for 2.4 GHz	N
APUT uses BCC when transmitting HE A-MPDU with MCS 0-7 test	4.22.1	M	N
APUT BCC receives HE A-MPDU with MCS 0-7 test	4.23.1	M	N
APUT SU MIMO with one and two spatial streams test	4.24.1	O	N

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
APUT receives single TID compressed BA with 64 MSDUs no fragmentation and channel widths test	4.25.1	M	N
APUT transmits single TID compressed BA with 64 MSDUs no fragmentation and channel widths test	4.26.1	M	N
APUT receives HE-LTF, and GI and packet extension test	4.27.1	M	N
APUT transmits HE-LTF and GI test	4.28.1	M	N
APUT DL OFDMA	4.29.1	O	N
APUT DL OFDMA PHY test	4.30.1	O	N
APUT transmits MCS 8-9 test	4.31.1	O	Y
APUT receives MCS 8-9 test	4.32.1	O	Y
APUT transmits MCS 10-11 test	4.33.1	O	Y
APUT receives MCS 10-11 test	4.34.1	O	Y
APUT transmits SU beamforming as the beamformer with Sounding Dimension ≤ 4 test	4.35.1	O if supports < 4SS, C is if supports ≥ 4SS	N
APUT transmits SU beamforming as the beamformer with sounding dimension of 8 test	4.35.2	O	Y
APUT transmits SU beamforming as the beamformer at 160 MHz test	4.35.3	O	Y
APUT transmits MCS 8-9 in MU PPDU test	4.36.1	O	Y
APUT transmits MCS 10-11 in MU PPDU test	4.37.1	O	Y
APUT transmits 160 MHz PPDU test	4.38.1	O	Y
APUT receives 160 MHz PPDU test	4.39.1	O	Y
AP UL OFDMA PHY test	4.40		
APUT UL OFDMA at 2.4 GHz using one spatial streams BCC coding	4.40.1	CM(iTWT)	N
APUT UL OFDMA at 2.4 GHz using two spatial streams BCC coding	4.40.2	O	N
APUT UL OFDMA at 2.4 GHz using two spatial streams LDPC coding	4.40.3	O	N
APUT ULOFDMA at 5 GHz using one spatial stream	4.40.4	CM(iTWT)	N
APUT UL OFDMA at 5 GHz using two spatial streams LDPC coding	4.40.5	O	N
APUT basic high efficiency UL MU frame exchange sequence test	4.41		
Basic HE UL MU frame exchange sequence for 2.4 GHz, 20 MHz test	4.41.1	CM(iTWT)	N

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
Basic HE UL MU frame exchange sequence for 5 GHz, 80 MHz test	4.41.2	CM(iTWT)	N
APUT Trigger frame MAC padding test	4.43.1	CM(iTWT)	N
APUT DL OFDMA 160 MHz PHY test	4.44.1	O	Y
APUT DL MU MU-BAR for C-BA test	4.45.1	O	Y
APUT M-BA with Ack Type subfield set to 1 and TID 0 to 7 and 15 for Ack context solicited by S-MPDU test	4.46.1	CM(iTWT)	N
APUT receives SU MIMO with two spatial streams and 160 MHz PPDU test	4.47.1	O	Y
APUT transmits SU MIMO with two spatial streams and 160 MHz PPDU test	4.48.1	O	Y
APUT HE BSR in UL OFDMA test	4.49.1	O	N
APUT receives Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths test	4.50.1	O	Y
APUT transmits Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths test	4.51.1	O	Y
APUT receives A-Control OM for ROM	4.52.1	M for 5 GHz O for 2.4 GHz(>1 SS)	N
APUT MU BFRP test	4.53.1	C (DL-MU-MIMO Tx)	Y
APUT MU BFRP for eight spatial stream sounding test	4.53.2	O	Y
APUT DL-MU-MIMO test	4.54.1	C (≥ 4 SS for transmission	Y
Mobile APUT individual TWT test	4.56.2	O	N
APUT transmits and receives its operating mode	4.58.1	CM(iTWT)	N
Mobile APUT Transmit operating mode (Receive) test	4.58.2	CM(iTWT)	N
APUT HE TB PPDU channel access rules test	4.60.1	M for 5 GHz	N
APUT generates DL MU PPDU with Trigger frame soliciting an HE TB PPDU response which contains Ack/C-BA test	4.62.1	O	Y
APUT receives MCS 8-9 in HE TB PPDU using one spatial stream test	4.63.1	O	Y
APUT receives MCS 10-11 in HE TB PPDU at 5 GHz using one spatial stream test	4.64.1	O for 5 GHz	Y
APUT MU EDCA parameter test	4.65.1	O	Y
APUT announces TXOP Duration RTS Threshold value test	4.66.1	O	Y
APUT supports Multi-BSSID test	4.67.1	O	Y
APUT transmits HE MU-RTS/CTS Trigger frames test	4.68.1	O	Y

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
APUT transmits wideband OFDMA packets to 20 MHz only STA test	4.69.1	CM(DL OFDMA)	N

3.2.4 20 MHz-only STAUT tests

Table 11 summarizes the STAUT tests for Wi-Fi CERTIFIED 6.

Table 11. 20 MHz-only STAUT test applicability

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
STAUT security tests	5.2		
STAUT WEP not used with HE associations test	5.2.2	M	N
STAUT disallows HE TKIP test	5.2.3	M	N
STAUT basic association in the Wi-Fi CERTIFIED 6 environment test	5.3.1	M	N
STAUT WPA2 initial ping using security test	5.4.1	M	N
STAUT initial ping interoperability with WPA3-SAE security test	5.4.2	M	N
STAUT association and throughput using WPA2-Personal test	5.5.1	M	N
STAUT association and throughput without security test	5.5.2	O	N
STAUT association and throughput using WPA2-Enterprise test	5.6.1	M	N
Roaming single and dual band STAUTs with WPA2-Personal test	5.9.1	M	N
STAUT receives A-MPDU aggregation with and without WPA2-Personal test	5.15.1	M	N
STAUT receives A-MSDU test	5.16.1	M	N
STAUT overlapping BSS at 2.4 GHz test	5.17.1	M for a 2.4 G Hz	N
STAUT overlapping BSS at 5 GHz test	5.18.1	M for a 5 G Hz	N
STAUT transmits A-MPDU aggregation	5.19.1	M	N
STAUT receives A-MPDU with A-MSDU test	5.21.1	O	N
STAUT receives HE SU preamble format and channel width	5.22.1	M	N

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
STAUT transmits HE SU preamble format and channel width test	5.23.1	M	N
STAUT receives LDPC HE A-MPDU with MCS 0-7 test	5.24.1	O	Y
STAUT transmits LDPC HE A-MPDU with MCS 0-7 test	5.25.1	O	N
STAUT receives BCC HE A-MPDU with MCS 0-7 test	5.26.1	M	N
STAUT transmits BCC HE A-MPDU with MCS 0-7 test	5.27.1	M	N
STAUT single user MIMO with one and two spatial streams test	5.28.1	O	Y
STAUT transmits single TID compressed BA test	5.29.1	M	N
STAUT receives single TID Compressed BA test	5.30.1	M	N
STAUT receives HE-LTF, and GI and packet extension test	5.31.1	M	N
STAUT transmits HE-LTF and GI test	5.32.1	M	N
STAUT DL OFDMA test	5.33.1	M	N
STAUT DL OFDMA PHY test	5.34		
STAUT DL OFDMA PHY test at 20 MHz test	5.34.1	M	N
STAUT (20 MHz-Only) downlink OFDMA PHY test for RU 242	5.34.4	O	N
STAUT receives MCS 8-9 test	5.35.1	O	Y
STAUT transmits MCS 8-9 test	5.36.1	O	Y
STAUT SU transmit beamforming where AP is the beamformer, Sounding dimension ≤ 4	5.39.1	M	N
STAUT receives MCS 8-9 in MU PPDU test	5.40.1	O	Y
STAUT UL OFDMA PHY transmit tests	5.44		
STAUT UL OFDMA PHY transmits at 2.4 GHz 1SS, 20 MHz test	5.44.1	M for 2.4 GHz	N
STAUT UL OFDMA PHY transmits at 2.4 GHz 2SS, 20 MHz test	5.44.2	M for 2.4 GHz	N
STAUT UL OFDMA PHY transmits at 2.4 GHz Mixed SS, 20 MHz test	5.44.3	M for 2.4 GHz	N
STAUT UL OFDMA PHY transmits at 5 GHz 1SS for 20 MHz-only STA	5.44.10	M for 5 GHz	
STAUT UL OFDMA PHY transmits at 5 GHz 2SS for 20 MHz-only STA	5.44.11	M for 5 GHz	
STAUT basic HE UL MU frame exchange sequence tests	5.45		
STAUT basic HE UL MU frame exchange sequence at 2.4 GHz, 20 MHz test	5.45.1	M for 2.4 GHz	N

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
STAUT basic HE UL MU frame exchange sequence at 5 GHz, 80 MHz test	5.45.2	M for 5 GHz	N
STAUT Trigger frame MAC padding test	5.47.1	M	N
STAUT DL OFDMA with S-MPDU test	5.48.1	M	N
STAUT DL OFDMA mixed spatial stream PHY test	5.50.1	M	N
STAUT DL MU MU-BAR frame for C-BA test	5.51.1	M	N
STAUT M-BA with Ack Type subfield = 1 with TID 0 to 7 for Ack context solicited by S-MPDU test	5.52.1	M	N
STAUT HE BSR in UL OFDMA test	5.53.1	M	N
STAUT transmits single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths test	5.54.1	O	N
STAUT receives single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths test	5.55.1	O	N
STAUT receives A-Control OM for ROM test	5.56.1	O for 5 GHz O for 2.4 GHz only if NSS for TX > 1	Y
STAUT MU BFRP tests	5.57		
STAUT MU BFRP for ≤4SS sounding dimension test	5.57.1	O	N
STAUT DL MU-MIMO test	5.58.1	O	N
STAUT UL MU pre-correction test	5.59		
STAUT UL MU pre-correction time and frequency	5.59.1	M	N
STAUT UL MU Pre-correction power test	5.59.2	M	N
STAUT individual TWT test	5.60.1	O	Y
STAUT HE A-MPDU construction of HE TB PPDU test	5.61.1	M	N
STAUT UL MU sensing test	5.62.1	M	N
STAUT trigger-based PPDU transmission test	5.63.1	M for 5 GHz	N
STAUT MU EDCA Parameter set	5.64.1	M	N
STAUT OBSS_PD-based test	5.65.1	M	N
STAUT transmits UPH A-Control test	5.66.1	M	N
STAUT acknowledgement to DL MU PPDU which solicits in HE TB PPDU response containing Ack/C-BA test	5.68.1	M	N

Test case description	Test plan section	Applicability: Mandatory (M) / Optional (O) / Conditional (C)	Should feature be listed in the Capabilities Form? (Y/N)
STAUT transmits MCS 8-9 in HE TB PPDU test	5.69.1	O	Y
STAUT RTS exchange based on TXOP Duration RTS Threshold value test	5.71.1	M	N
STAUT Multi-BSSID test	5.72.1	M	N
STAUT HE MU-RTS/CTS test	5.73.1	M	N
STAUT transmits operating mode test	5.74.1	O for 5 GHz, O for 2.4 GHz only if NSS for TX > 1	Y
Notes: LDPC is made mandatory for all device configurations other than devices operating exclusively in 20 MHz channels (AP) operating only at 2.4 GHz, STA operating only at 2.4 GHz, for which it is conditional mandatory (condition: MCS 10 – 11 or SU MIMO with > 4 SS). For many bandwidth and number of spatial stream combinations, LDPC is the only scheme defined in the underlying reference document.			

3.3 DUT requirements

3.3.1 General requirements

The DUT parameters that require manual configuration are listed below.

1. SSID
2. Wireless operational mode (a/n/ac/ax)
3. Channel
4. Local IP address and subnet mask

If any of the above items cannot be configured through the user interface, then the DUT test fails.

3.3.2 APUT requirements

The following capabilities are required of the APUT.

1. WPA2-Personal if WPA2-Enterprise is not supported.
2. Ability to configure both WPA3-SAE and WPA2-Personal on the same BSS
3. Ability to configure the APUT to transmit DL OFDMA.
4. Ability to configure the APUT to use DL OFDMA.

5. Ability to configure the APUT to transmit with different LTF and GI combinations.
6. Configure transmitter APUT AP to send SU or MU PPDU.
7. Ability to configure the APUT to force use of UL MU OFDMA.
8. Ability to configure the APUT to transmit MU EDCA element.
9. Ability to configure the APUT to transmit and receive 256 Bitmap Block Ack.
10. Ability to configure the RU allocations to multiple STAs.
11. Ability to configure the APUT for NSS Limit operation.
12. Ability to configure the APUT to advertise the TXOP Duration RTS Threshold subfield.

Table 12 defines the Wi-Fi CERTIFIED 6 APUT configuration parameters and their default values. If required, these parameter values are modified for specific test cases.

Table 12. APUT configuration parameters

Parameter	Description	Default value
256 BA	Ability to transmit and receive 256 Bitmap Block Ack (configured)	Enabled if supported else set to ≤ 64
Transmit MU BFRP	Ability to transmit MU BFRP Trigger frame for sounding testing	Disabled
Trigger frame PPDU type	Ability to transmit Trigger frames using specific PPDU type(s). If disabled, the APUT may choose any PPDU type valid in carrying Trigger frames	Disabled
6 GHz Operation Information Present field	Indicates 6 GHz Operation Information field is present in the HE Operation element	0
SU Beamforming	Ability to configure as SU Beamforming	Disabled
MU Beamformer	Ability to configure the MU Beamforming	Disabled
DL OFDMA PPDU Transmission	Ability to configure the DL OFDMA transmission	Disabled
UL OFDMA PPDU Receive	Ability to configure the UL OFDMA reception	Disabled
HE MCS Set	Ability to configure HE MCS Set	0-11 if supported, or 0-9 if supported, or 0-7 by default

Table 13 lists the EAP method default priority order for the APUT.

Table 13. APUT EAP method default priority order

Priority	EAP
First	TTLS
Second	PEAP0
Third	PEAP1
Fourth	SIM
Fifth	FAST
Sixth	AKA

3.3.3 STAUT requirements

The following capabilities are required of the STAUT.

1. Ability to configure SU or MU PPDU.
2. Ability to configure using 256 Bitmap Block Ack.
3. Ability to configure NSS Limit operation.
4. Ability to configure TWT Termination operation.
5. Ability to configure TWT Only PS operation.
6. Ability to report the Beacon RSSI (RSSI of Beacon frames transmitted by the AP to which the STAUT is associated to) in dBm.

Table 14 defines the Wi-Fi CERTIFIED 6 STAUT configuration parameters and their default values. If required, these parameter values are modified for specific test cases.

Table 14. STAUT configuration parameters

Parameter	Description	Default value
256 BA	Ability to transmit and receive 256 Bitmap Block Ack (configured)	Enabled if supported else set to ≤ 64
SU Beamformee	Ability to configure as SU Beamformee	1
Beamformee STS ≤ 80MHz	Ability to configure the Beamformee STS ≤ 80MHz	7 if supported else 3
HE MCS Set	Ability to configure HE MCS Set	0-11 if supported, or 0-9 if supported, or 0-7 by default
OMI transmission	Ability to configure operating mode indication transmission	Disabled

3.4 Testing rules

1. If the DUT fails any tests, no further testing will be performed until the vendor addresses the problems and has updated the device.
2. The default DUT parameters shall be configured on devices at the start of each test case unless otherwise noted.
3. Test script files referenced in the test case procedures are used to generate traffic and to verify the throughput or frame type. Refer to Appendix B for details. All test scripts shall be run for at least 30 seconds.
4. The throughput threshold values listed in the test case procedures of this test plan are given in Appendix C.
5. Appendix D provides the default WMM parameter values that should be used in this test plan.
6. The traffic stream scripts referenced in the test plan procedure can be found in Appendix E.

3.4.1 APUT testing rules

If the vendor declaration in Table 1 indicates the APUT does not support WPA2-Enterprise, then all tests that specify WPA2-Enterprise shall be replaced with WPA2-Personal, and the ASCII string “12345678” shall be used for the pass phrase.

3.4.2 STAUT testing rules

If the vendor declaration in Table 2 indicates the STAUT does not support WPA2-Enterprise, then all tests that specify WPA2-Enterprise shall be replaced with WPA2-Personal, and the ASCII string “12345678” shall be used for the pass phrase.

If the vendor declarion in Table 2 indicates that the DUT Type is a 20 MHz only STAUT then the following shall apply in addition to above mentioned rules for all 5 GHz band tests

- The Test Configuration Parameter - Bandwidth for STAUT - "80 MHz in 5 GHz " shall be replaced by "20 MHz in 5 GHz" for all applicable test cases
- All checks for Bandwidth field in HE-SIG-A1 (B19,B20) = 2 (80 MHz) shall be replaced by (B19,B20) = 0 (20 MHz)

4 APUT tests

4.1 Deleted

Table 15. Left blank intentionally

4.2 APUT security tests

4.2.1 APUT security configurability test

Objective

This test case verifies that the APUT is correctly configured for security.

Applicability: Mandatory

References

Test case 4.1.2 [3]

Test environment

- APUT

Test configuration

Test procedure and expected results

Table 16 provides the specific test procedure and expected results for this test case.

Table 16. APUT security configurability test procedure and expected results

Step	APUT	Expected results
1	Configure WPA2-Enterprise if supported.	If the vendor declared support for WPA2-Enterprise and WPA2-Enterprise EAP methods are configurable, then CONTINUE else FAIL.
2	Configure WPA2-Personal if WPA2-Enterprise is not supported.	If the WPA2-Personal pass phrase “12345678” can be configured, then CONTINUE else FAIL.
3	Configure WPA3-SAE	If the WPA3-SAE pass phrase “12345678” can be configured, then PASS else FAIL.

4.2.2 APUT WEP not used with HE associations negative test

Objective

This test case verifies that WEP is not used by the APUT with associations at HE rates.

Applicability: Mandatory

References

Test case 4.2.46 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA capable of setting WEP and TKIP with HE rates, and able to generate a Probe Request frame
- Wireless Sniffer

Test configuration

Table 17 defines the specific parameter values required for this test case.

Table 17. APUT WEP not used with HE associations configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Broadcom 75	N/A
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Channel width	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band
Security	WEP	
Encryption key	0x9876543210	0x9876543210

Test procedure and expected results

Table 18 provides the specific test procedure and expected results for this test case.

Table 18. APUT WEP not used with HE associations procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, go to Step 1, else go to Step 6.				

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 17 in the 2.4 GHz band.	Configure the APUT per Table 12 and Table 17 in the 2.4 GHz band. Enable WEP security.		If the APUT does not prohibit the configuration of WEP when HE is enabled, then CONTINUE else PASS.
2		The APUT sends Beacon frames to STA1.		SN: If none of the HT Capabilities and HE Capabilities elements is present in Beacon frames, then CONTINUE else FAIL. Note : If HE Capabilities and HT Capabilities elements are not present, it is equivalent to operating in legacy a/b/g mode.
3	Force STA1 to perform an active scan and send a Probe Request frame to the APUT.	The APUT sends a Probe Response frame to STA1.		SN; If none of the HT Capabilities and HE Capabilities elements is present in the Probe Response frame, then CONTINUE else FAIL.
4	Associate STA1 to the APUT with STA1 configured for WEP and HE.	The APUT sends an Association Response frame to STA1.	Verify STA1 sends an Association Request frame with WEP as security configuration with HT and HE elements.	If the association is successful, then CONTINUE else PASS. If the HT Capabilities and the HE Capabilities elements are not present in the Association Response frame and the status code = 0, then CONTINUE else FAIL.
5		Run the script APUT-STA1-10 from a PC on the wired Ethernet side of the APUT to the associated STA1 for at least 10 seconds.		SN: If any of the APUT data packets are sent with PPDUs that include HE-SIG-A, then FAIL else CONTINUE.
If the APUT supports 5 GHz, then go to Step 6, else PASS.				
6	Configure STA1 per Table 6 and Table 17 In the 5 GHz band.	Configure the APUT per Table 12 and Table 17 in the 5 GHz band. Enable WEP security.		If the APUT does not prohibit the configuration of WEP when HE is enabled, then CONTINUE else PASS.
7	Repeat Steps 2-5.			The verification in Steps 2-5 is the same except: • VHT Capabilities elements is also not present in Beacon,Probe response and Assoication response frames in Steps 2, 3, 4 If the verification in Steps 2-5 is successful, then PASS else FAIL.

4.2.3 APUT Disallows HE TKIP test

Objective

This test case verifies that the APUT does not use HE rates when using TKIP as the encryption cipher.

Applicability: Mandatory

References

Test case 4.2.44 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 19 defines the specific parameter values required for this test case.

Table 19. APUT Disallows HE TKIP configuration

Parameter	APUT value	Test bed STA1 value
Test bed vendor	N/A	Qualcomm
AP control channel	6 for 2.4 GHz band 36 for 5 GHz band	N/A
Channel width	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band

Test procedure and expected results

Table 20 provides the specific test procedure and expected results for this test case.

Table 20. APUT Disallows HE TKIP procedure and expected results

Step	APUT	Test bed STA1	Test bed validation	Expected result
1	Configure the APUT per Table 12 and Table 19 and enable mixed WPA-Personal/WPA2-Personal security.	Configure STA1 per Table 6 and Table 19.		If the APUT does not prohibit the configuration of WPA-Personal/WPA2-Personal when HE is enabled, then CONTINUE else PASS. (The APUT in mixed mode allows the use of WPA-Personal with TKIP, but no HE rates are allowed in this case. HE rates are only allowed with WPA2-Personal using AES (CCMP))

Step	APUT	Test bed STA1	Test bed validation	Expected result
				SN: If the APUT advertises TKIP as the only Pairwise cipher suite in the RSNE of the Beacon frame, then FAIL else CONTINUE.
2	The APUT sends an Association Response frame to STA1.	STA1 sends an Association Request frame to the APUT with TKIP requested as the pairwise cipher suite.	Verify that STA1 sends an Association Request frame to the APUT with TKIP as the only pairwise cipher suite in WPA element with HT Capabilities, VHT (5 GHz only) Capabilities and HE Capabilities elements	SN: If the Association Response frame status code is non-zero, then PASS else CONTINUE. If the HE Capabilities element is not present in the Association Response frame and the status code is zero, then CONTINUE else FAIL. If the APUT advertises TKIP as the only Pairwise suite in the RSNE of the Association Response frame, then FAIL else CONTINUE.
3	Run the script APUT-STA1-10 from a PC on the wired Ethernet side of the APUT to STA1 for at least 10 seconds.			SN If none of the APUT data packets are sent at HE rates in 10 seconds, then PASS else FAIL.

4.3 APUT initial 5 GHz operation tests

4.3.1 APUT initial 5 GHz operation tests

Objective

This test case verifies that the APUT correctly operates for the given SSID, security mode of either Open authentication mode or WPA2-Personal, and channel width in 5 GHz.

Applicability: Mandatory

References

Test case 4.2.1 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA operating in 11a mode
- Test bed STA3: Wi-Fi CERTIFIED ac STA (or Wi-Fi CERTIFIED 6 STA operating in 11ac mode)
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 21 defines the specific parameter values required for this test case.

Table 21. APUT initial 5 GHz operation test configuration

Parameter	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT value
Test bed vendor	Broadcom75	Broadcom98	Cypress	Marvell	N/A
SSID	wi-fi	wi-fi	wi-fi	wi-fi	wi-fi
Security	None	WEP	WPA-Personal	WPA2-Personal	N/A
Encryption key	N/A	0x9876543210	12345678	Reference the APUT factory default pass phrase in the vendor declaration.	Reference the APUT factory default pass phrase in the vendor declaration.
Channel width	80 MHz in 5 GHz	20 MHz in 5 GHz	40 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz
Spatial streams implemented	2	2	2	2	
AP control channel	N/A	N/A	N/A	N/A	36

Test procedure and expected results

Table 22 provides the test procedure and expected results for this test case.

Table 22. APUT initial 5 GHz operation test procedure and expected results

Step	Test bed STA1	Test bed STA2, operating in 11a mode	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 21.	Configure STA2 to the default mode defined in Table 6 and Table 21.	Configure STA3 to the default mode defined in [3].	Configure STA4 per Table 6 and Table 21.	Configure the APUT per Table 12 and Table 21 and with the default pass phrase.		
2					If not configured for 5 GHz operation by default, configure the APUT for 5 GHz operation.		If able to configure the APUT to 5 GHz, then CONTINUE else FAIL.
3					The APUT starts to send Beacon frames.		
4	STA1 sends an Association Request frame to the APUT.			STA4 sends an Association Request frame to the APUT.			
5					The APUT sends an Association Response frame.		If either STA1 or STA4 associate to the APUT but not both, then CONTINUE, else FAIL.
6		STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.				If STA2 does not associate to the APUT then CONTINUE else FAIL. If STA3 does not associate to the APUT, then CONTINUE else FAIL.
7					If STA1 was associated in Step 5, then RUN: PING <STA1_IP_ADDR> CONTINUOUS=YES		If the pings do not time out, then CONTINUE else FAIL.
8					If STA4 was associated in Step 5, then RUN: PING <STA4_IP_ADDR> CONTINUOUS=YES		If the pings do not time out, then PASS else FAIL.

4.4 APUT initial ping interoperability tests

4.4.1 APUT initial ping interoperability with WPA2-Enterprise security test

Objective

This test case verifies that the APUT is able to authenticate, associate and support pings to a wired authentication server on a subnet connected to the test configuration.

Applicability: Optional and tested if the APUT declared support for WPA2-Enterprise security in Table 1.

References

Test case 4.2.2 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED n STA (or Wi-Fi CERTIFIED 6 STA operating in 11n mode)
- Test bed STA2: Wi-Fi CERTIFIED n STA (or Wi-Fi CERTIFIED 6 STA operating in 11n mode)
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 23 defines the specific parameter values required for this test case.

Table 23. APUT initial ping interoperability with WPA2-Enterprise security test configuration

Parameter	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	DUT value
Test bed vendor	Broadcom98	Broadcom75	Qualcomm	Intel200W	N/A
Security	WPA2-Enterprise	WPA2-Enterprise	WPA2-Enterprise	WPA2-Enterprise	WPA2-Enterprise
Supplicant/Server	N/A	N/A	N/A	N/A	HostAPD
EAP method[1]	TLS	TLS	TLS	TLS	TLS
AP control channel	N/A	N/A	N/A	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Channel width	20 MHz	20 MHz	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band
Notes: 1. If the APUT has an embedded authentication server that does not implement TLS, the EAP method shall be chosen in priority order, according to Table 13.					

Test procedure and expected results

Table 24 provides the specific test procedure and expected results for this test case.

Table 24. APUT initial ping interoperability with WPA2-Enterprise security test procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, go to Step 1, else go to Step 19.							
1	Configure STA1 to Table 23 and the default mode defined in [4].	Configure STA2 to Table 23 and the default mode defined in [4].	Configure STA3 per Table 6 and Table 23 for the 2.4 GHz band.	Configure STA4 to per Table 6 and Table 23 for the 2.4 GHz band.	Configure that APUT per Table 12 and Table 23 for the 2.4 GHz band.		
2					The APUT transmits Beacon frames.		
3	STA1 sends an Association Request frame to the APUT.						
4					The APUT transmits an Association Response frame to STA1.		
5	RUN: PING <APUT IP_ADDR> COUNT=90						If the pings continue for the entire 90 seconds, then CONTINUE else FAIL.
6	STA1 disassociate from the APUT.						
7		STA2 sends an Association Request frame to the APUT.					
8					The APUT transmits an Association Response frame to STA2.		
9		RUN: PING <APUT IP_ADDR> COUNT=90					If the pings continue for the entire 90 seconds, then CONTINUE else FAIL.
10		STA2 disassociates from the APUT.					
11			STA3 sends an Association Request frame to the APUT.				

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
12					The APUT transmits an Association Response frame to STA3.		
13			RUN: PING <APUT IP_ADDR> COUNT=90				Verify the following conditions are true: 1. Pings continue for the entire 90 seconds 2. SN: Verify that PPDUs transmitted by the APUT contain HE-SIG-A and the BW bits of HE-SIG-A = 0. If all the conditions above are true, then CONTINUE else FAIL.
14			STA3 disassociate s from the APUT.				
15				STA4 sends an Association Request frame to the APUT.			
16					The APUT transmits an Association Response frame to STA4.		
17				RUN: PING <APUT IP_ADDR> COUNT=90			If the pings continue for the entire 90 seconds, then CONTINUE. SN: If the PPDUs transmitted by APUT contain HE-SIG-A and the BW bits of HE-SIG-A = 0, then PASS else FAIL.
18				STA4 disassociates from the APUT.			
If the APUT supports 5 GHz, then go to Step 19 else PASS.							
19	Configure STA1 to Table 23 and the default mode defined in [4].	Configure STA2 to Table 23 and the default mode defined in [4].	Configure STA3 per Table 6 and Table 23 for the 5 GHz band.	Configure STA4 to per Table 6 and Table 23 for the 5 GHz band.	Configure that APUT per Table 12 and Table 23 for the 5 GHz band.		
20	Repeat Steps 2-18.						The verification in Steps 2-18 is the same except:

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							• BW bits of HE-SIG-A = 2 in Step 13 • BW bits of HE-SIG-A = 2 in Step 17 If the verification in Steps 2-18 is successful, then PASS else FAIL.

4.4.2 APUT initial ping interoperability with WPA3-SAE security test

Objective

This test case verifies that the APUT is able to successfully authenticate and associate with test bed STA devices using WPA3-SAE or WPA2-Personal security mode configurations.

Applicability: Mandatory

References

Test case 4.2.4 [9]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 25 defines the specific parameter values required for this test case.

Table 25. APUT initial ping interoperability with WPA3-SAE security test configuration

Parameter	Test bed STA1	Test bed STA2	Test bed STA3	DUT value
Test bed vendor	Intel200W	Intel200L	Marvell	N/A
Security	WPA3-SAE	WPA2-Personal	WPA2-Personal	WPA3-SAE Transition Mode
AKM suite type	8 (SAE)	2 (PSK)	2 (PSK)	2 (PSK) and 8 (SAE)
Cipher suite type	4 (CCMP-128)	4 (CCMP-128)	4 (CCMP-128)	4 (CCMP-128)
PMF configuration	Required	Capable	Disabled	Capable
Password	12345678	12345678	12345678	12345678
AP control channel	N/A	N/A	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Channel width	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band

Test procedure and expected results

Table 26 provides the specific test procedure and expected results for this test case.

Table 26. APUT initial ping interoperability with WPA3-SAE security test procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	APUT	Test bed validation	Expected result
1	Configure STA1 to the default mode defined in [4].Configure STA1 per Table 25.	Configure STA2 to the default mode defined in [4]. Configure STA2 per Table 25.	Configure STA3 to the default mode defined in [4]. Configure STA3 per Table 25.	Configure that APUT per Table 12 Configure the APUT per Table 25.		
2				The APUT transmits Beacon frames.		SN: Verify that the captured Beacon frame contains an RSNE with the following: 1. Version field = 01 00 2. Group Data Cipher Suite = 00-0F-AC:4 3. Pairwise Cipher Suite Count = 01 00 4. Pairwise Cipher Suite List = CCMP 00-0F-AC:4 5. AKM Suite Count= 02 00 6. AKM Suite List includes 00-0F-AC:2 and 00-0F-AC:8 7. MFPR bit (bit 6) = 0 and MFPC bit (bit 7) = 1 in RSN Capabilities field If all the conditions above are true, then CONTINUE else FAIL.
3	Trigger STA1 to perform an active scan on the operating channel of the APUT.			The APUT transmits Probe Response frame(s).	Verify that the STA sends a Probe Request frame to the APUT.	SN: Verify that the captured Probe Response frame contains an RSNE with the following: 1. Version field = 01 00 2. Group Data Cipher Suite = 00-0F-AC:4 3. Pairwise Cipher Suite Count = 01 00 4. Pairwise Cipher Suite List = CCMP 00-0F-AC:4 5. AKM Suite Count = 02 00 6. AKM Suite List includes 00-0F-AC:2 and 00-0F-AC:8 7. MFPR bit (bit 6) = 0 and MFPC bit (bit 7) = 1 in RSN Capabilities field If all conditions are true, then CONTINUE else FAIL.
4	Trigger STA1 to associate with the APUT.				Verify that STA1 transmits an Authentication frame with	SN: Verify the following behavior between the APUT and STA1:

Step	Test bed STA1	Test bed STA2	Test bed STA3	APUT	Test bed validation	Expected result
					Authentication Algorithm Number field = 3. to the APUT.	1. Exchanges SAE authentication frames with Authentication Transaction Sequence number = 1. 2. Exchanges SAE authentication frames with Authentication Transaction Sequence number = 2. 3. Completes Association Request and Association Response frame exchange with the following configuration. a. CCMP-128 (00-0F-AC:4) b. SAE AKM (00-0F-AC:8) c. PMF enabled 4. Performs 4-way handshake. If all conditions are true, then CONTINUE, else FAIL.
5	RUN: PING <APUT IP_ADDR> COUNT=30					If the pings continue for the entire 30 seconds, then CONTINUE else FAIL.
6		Trigger STA2 to associate with the APUT.			Verify that STA2 transmits an Authentication frame with Authentication Algorithm Number field = 0 to the APUT.	SN: Verify the following behavior between the APUT and STA2: 1. Completes Association Request and Association Response frame exchange with the following configuration. a. CCMP-128 (00-0F-AC:4) b. PSK AKM (00-0F-AC:2) c. PMF enabled 2. Performs 4-way handshake. If all conditions are true, then CONTINUE else FAIL.
7		RUN: PING <APUT IP_ADDR> COUNT=30				If the pings continue for the entire 30 seconds, then CONTINUE else FAIL.
8			Trigger STA3 to associate with the APUT.		Verify that STA3 transmits an Authentication frame with Authentication Algorithm Number field = 0 to the APUT.	SN: Verify the following behavior between the APUT and STA3: 1. Completes Association Request and Association Response frame exchange with the following configuration. a. CCMP-128 (00-0F-AC:4) b. PSK AKM (00-0F-AC:2) c. PMF disabled 2. Performs 4-way handshake.

Step	Test bed STA1	Test bed STA2	Test bed STA3	APUT	Test bed validation	Expected result
						If all conditions are true, then CONTINUE, else FAIL.
9			RUN: PING <APUT IP_ADDR> COUNT=30			If the pings continue for the entire 30 seconds, then PASS else FAIL.

4.5 APUT association and throughput tests

4.5.1 (Deleted)

4.5.2 APUT association and throughput without security test

Objective

This test case verifies that the APUT can pass traffic without security.

Applicability: Conditional. This test shall be mandatory only if the APUT declared support for Open security in Table 1.

References

Test case 4.2.5.2 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 27 defines the specific parameter values required for this test case.

Table 27. APUT association and throughput without security configuration

Parameter	Test bed STA1 value	APUT value
Vendor	Broadcom98	N/A
Security	None	None
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Channel width	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band

Test procedure and expected results

Table 28 provides the specific test procedure and expected results for this test case.

Table 28. APUT association and throughput without security procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, go to Step 1, else go to Step 7.				
1	Configure STA1 per Table 6 and Table 27 in the 2.4 GHz band.	Configure that APUT per Table 12 and Table 27 in the 2.4 GHz band.		
2		The APUT sends Beacon frames.		
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the Association Response frame contains a SUCCESS status, then CONTINUE else FAIL.
4		Run the script DT1-APUT-STA1.txt to STA1.		If the test runs to completion without error, then CONTINUE to the verification in this step, else FAIL. SN: Verify the following: 1. PPDUs transmitted by APUT contain HE-SIG-A and the BW bits of HE-SIG-A =0 a. 2. APUT sets a valid BSS color (1~63) If all the above conditions are true, then CONTINUE else FAIL.
5	Run the script HE-prereq-DT2-STA1-APUT.txt to the APUT.			If the test runs to completion without error, then CONTINUE else FAIL.
6		Run the script DT3-APUT-STA1.txt to STA1.		If the test runs to completion without error, then CONTINUE
If the APUT supports 5 GHz, then go to Step 7 else PASS.				
7	Configure STA1 per Table 6 and Table 27 in the 5 GHz band.	Configure that APUT per Table 12 and Table 27 in the 5 GHz band.		
8	Repeat Steps 2-6.			The verification in Steps 2-6 is the same except: • BW bits of HE-SIG-A = 2 in Step 4 If the verification in Steps 2-6 is successful, then PASS else FAIL.

4.5.3 APUT association and throughput using WPA2-Personal security test

Objective

This test case verifies that the APUT correctly passes traffic with WPA2-Personal security mode enabled.

Applicability: Part A Mandatory. Part B is optional and tested if the APUT declares support for 160 MHz in Table 1.

References

Test case 4.2.5.1 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA capable of 2 SS and capable of being configured to 1 SS
- Wireless Sniffer

Test configuration

Table 29 defines the specific parameter values required for this test case.

Table 29. APUT association and throughput using WPA2-Personal security test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Marvell	N/A
Security	WPA2-Personal	WPA2-Personal
Encryption key	12345678	12345678
Spatial streams implemented	1 SS or 2 SS	Default
AP control channel	N/A	36 for 5 GHz 6 for 2.4 GHz
Channel width	80 MHz for 5 GHz 20 MHz for 2.4 GHz	Configure the 5 GHz or dual band APUT to 160 MHz channel width if capable of supporting 160 MHz feature. If not, configure the 5 GHz APUT to 80 MHz channel width. Configure the 2.4 GHz APUT to 20 MHz.

Test procedure and expected results

Table 30 provides the specific test procedure and expected results for this test case.

Table 30. APUT association and throughput using WPA2-Personal security test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
Part A: If the APUT supports the 2.4 GHz band, go to Step 1, else go to Step 11.				
1	Configure STA1 per Table 6 and Table 29 in the 2.4 GHz band. Configure STA1 to 1 SS.	Configure the APUT per Table 12 and Table 29 in the 2.4 GHz band.		
2	STA1 sends an Association Request frame to the APUT.	The APUT send an Association Response frame to STA1.		If the Association Response contains a SUCCESS status, then CONTINUE else FAIL.
3		Run the script DT1-APUT-STA1.txt to STA1.		If the test runs to completion without error, then CONTINUE with the verification in this step; else FAIL. If the mesasured throughput ≥ 453S3_TP_1SS_24G, then CONTINUE else FAIL SN: If PPDUs transmitted by the APUT contain HE-SIG-A and the BW bits of HE-SIG-A is 0, then CONTINUE otherwise, FAIL.
4	Run the script DT2-STA1-APUT.txt to the APUT.			If the test runs to completion without error, then CONTINUE with the verification in this step; else FAIL. If the measured throughput ≥ 453S4_TP_1SS_24G, then CONTINUE else FAIL.
5		Run the script DT3-APUT-STA1.txt to STA1.		If the test runs to completion without error, then CONTINUE else FAIL. If the measure throughput ≥ 453S5_TP_1SS_24G, then CONTINUE else FAIL.
6	STA1 disassociates from the APUT.			If DUT is Mobile AP and supports only 1SS, then PASS else CONTINUE
7	Reconfigure STA1 to 2 SS.			
8	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the Association Response frame contains a SUCCESS status, then CONTINUE else FAIL.
9	Run the script HE-prereq-DT2-STA1-APUT to the APUT.			If the test runs to completion without error, then CONTINUE with the verification in this step else FAIL. If the measured throughput ≥ 453S9_TP_2SS_24G, then CONTINUE else FAIL.
10		Run the script HE-prereq-DT1-APUT-STA to STA1.		If the test runs to completion without error, then CONTINUE with the verification in this step; else FAIL. If the measured throughput ≥ 453S10_TP_2SS_24G, then CONTINUE else FAIL.
11	If the APUT only supports the 2.4 GHz band, then PASS. If the APUT supports the 5 GHz band and 80 MHz channel width, go to Step 12. If the APUT supports the 5 GHz band and 160 MHz channel width, go to Step 14.			

Step	Test bed STA1	APUT	Test bed validation	Expected result
12	Configure STA1 per Table 6 and Table 29 in the 5 GHz band. Configure STA1 to 1 SS and the channel width to 80 MHz.	Configure the APUT per Table 12 and Table 29 in the 5 GHz band.		
13	Repeat Steps 2-10.			The verification in Steps 2-10 is the same except: PPDUs transmitted by the APUT contain HE-SIG-A and the BW bits of HE-SIG-A is 2 in Step 3, Measured throughput ≥ 453S13_3_TP_1SS_5G in Step 3 Measured throughput ≥ 453S13_4_TP_1SS_5G in Step 4, Measured throughput ≥ 453S13_5_TP_1SS_5G in Step 5, Measured throughput ≥ 453S13_9_TP_2SS_5G in Step 9, Measured throughput ≥ 453S13_10_TP_2SS_5G in Step 10. If the verification in Steps 2-10 is successful, then PASS else FAIL.
14	If the APUT only supports a channel width of 80 MHz, then PASS Else CONTINUE			
14.a	Part B: If the APUT supports the 5 GHz band and 160 MHz channel width, go to Step 15.			
15	Configure STA1 per Table 6 and Table 29 in the 5 GHz band. Configure STA1 to 1 SS and the channel width to 160 MHz.	Configure the APUT per Table 12 and Table 29 in the 5 GHz band.		
16	Configure STA1 per Table 6 and Table 29. Configure STA1 to 1 SS.	Configure the APUT per Table 12 and Table 29.		
17		The APUT starts transmitting Beacon frames.		SN: 1. Bit 2 of the Channel Width Set in HE PHY Capabilities Information field within HE Capabilities element in Beacon and Probe Response frames transmitted by the APUT = 1 (support for a 160 MHz width). 2. Beacon and Probe Response frames transmitted by the APUT contains VHT Capabilities element, verify: Maximum NSS defined by Rx VHT-MCS Map field and Extended NSS BW Support field in the VHT Capabilities element at 160 MHz is not more than the maximum NSS defined by its Rx HE-MCS Map for 160 MHz field in the HE Capabilities element at 160 MHz. 3. VHT Operation element is present in Beacon and Probe Response frames transmitted by the APUT, and VHT Operation Information Present subfield in HE Operation element = 0, OR VHT Operation element is not present in Beacon/Probe Response frames transmitted by the APUT, and VHT Operation Information Present subfield in HE Operation element = 1. 4. STA Channel Width field in HT Operation element = 1, and Chanel Width field in VHT Operation Information field = 1.

Step	Test bed STA1	APUT	Test bed validation	Expected result
				160 MHz center frequency signaling check: Verify that either C1 or C2 is true in the Beacon and Probe Response frames transmitted by the APUT. C1: Supported Channel Width Subfield in VHT Capabilities element = 1 or 2 In VHT Operation Information field (carried in either VHT Operation Element or HE Operation Element) Channel Center Frequency Segment 0 subfield = 42 and Channel Center Frequency Segment 1 subfield = 50 Channel Center Frequency Segment 2 subfield in HT Operation element = 0 C2: Supported Channel Width Subfield in VHT Capabilities element = 0 Extended NSS BW support subfield in VHT Capabilities element > 0 In VHT Operation Information field (carried in either VHT Operation Element or HE Operation Element) Channel Center Frequency Segment 0 subfield = 42, and Channel Center Frequency Segment 1 subfield= 0 Channel Center Frequency Segment 2 subfield in HT Operation element = 50 If all the conditions above are true, then CONTINUE else FAIL.
18	Repeat Steps 2-10.			The verification in Steps 2-10 is the same except: Measured throughput ≥ 453S18_3_TP_1SS_5G in Step 3, Measured throughput ≥ 453S18_4_TP_1SS_5G in Step 4, Measured throughput ≥ 453S18_5_TP_1SS_5G in Step 5, Measured throughput ≥ 453S18_9_TP_2SS_5G in Step 9, Measured throughput ≥ 453S18_10_TP_2SS_5G in Step 10. If the verification in Steps 2-10 is successful, then PASS else FAIL.

4.6 802.11d and 802.11h tests

4.6.1 (Deleted)

4.7 APUT dual band tests

4.7.1 Concurrent dual band APUT test

Objective

This test verifies that the APUT is able to operate in the 2.4 GHz and 5 GHz bands concurrently.

This test is performed with two stations, each associated to the APUT, but in different bands. Data is transmitted between the stations to verify that the APUT supports two BSSes in different bands concurrently and bridges between them.

Note: If the vendor indicates in Table 1 that the APUT does not support WPA2-Enterprise, then WPA2-Enterprise shall be replaced with WPA2-Personal, and the ASCII string “12345678” shall be used for the pass phrase.

Applicability: Optional. This test shall be executed only if the DUT declared support for concurrent dual band operation in Table 1.

References

Test case 4.2.19 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 31 defines the specific parameter values required for this test case.

Table 31. Concurrent dual band APUT test configuration

Parameter	Test bed STA1 value	Test bed STA2 value	APUT value
Test bed vendor	Intel200W	Broadcom 98	N/A
Security	WPA2-Enterprise running TLS	WPA2-Enterprise running TLS	WPA2-Enterprise running TLS
Supplicant/Server	N/A	N/A	HostAPD
AP control channel	36	6	6 and 36
Channel width	80 MHz	20 MHz	80 MHz
Spatial streams implemented	2	2	Default

Test procedure and expected results

Table 32 provides the specific test procedure and expected results for this test case.

Table 32. Concurrent dual band APUT test procedure and expected results

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 31. If DUT is MAP that supports only 1ss in both the bands then, configure STA1 to 1ss	Configure STA2 per Table 6 and Table 31. If DUT is MAP that supports only 1ss in both the bands then, configure STA2 to 1ss	Configure the APUT per Table 12 and Table 31.		
2			The APUT sends Beacon and Probe Response frames to STA1 and STA2.		SN: If DUT is MAP and supports only 1SS, then If the Beacon/Probe Response frames sent by the APUT in both 2.4 GHz, 5 GHz include the Tx and Rx MCS Map in the HE Capabilities Supported MCS Set field of HE Capabilities IE set to '11' in B0-B1 (no support of 1SS) then FAIL, else CONTINUE. Else If the Beacon and Probe Response frames sent by the APUT in both 2.4 GHz and 5 GHz include the Tx and Rx MCS Map in the HE Capabilities Supported MCS Set field of HE Capabilities element = 11 in B0-B1 or 11 in the bitmap indexes B2-B3 (no support of 1SS or 2 SS) then FAIL, else CONTINUE.
3	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1 and STA2.		If the association between the APUT and both STA1 and STA2 is successful, then CONTINUE else FAIL. SN: If DUT is MAP and support only 1SS, then, If the Association Response frames sent to STA1, STA2 include the APUT's Tx and Rx MCS Map in the HE Capabilities Supported MCS Set field of HE Capabilities IE set to '11' in B0-B1 (no support of 1SS) then FAIL, else CONTINUE. Else If the Association Response frames sent to STA1 and STA2 include the APUT's Tx and Rx MCS Map in the HE Capabilities Supported MCS Set field of HE Capabilities element = 11 in B0-B1 or 11 in the bitmap indexes B2-B3 (no support of 1SS or 2 SS) then FAIL, else CONTINUE. Else

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
4	Run script DT1-STA1-STA2.txt to STA2.				If DUT Is an AP or MAP that supports 2ss in both the bands then, If the throughput from STA1 to STA2 is greater than 471S4_2SS_24G, then CONTINUE else FAIL. Else STA1 to STA2 throughput is greater than 471S4_1SS_24G , then CONTINUE else FAIL. SN: If DUT Is an AP or MAP that supports 2ss in both the bands then, If the PPDUs transmitted by the APUT contain HE-SIG-A and if the BW bits of HE-SIG-A is 0 for 20 MHz operation and the NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 1 (2 spatial streams), then CONTINUE else FAIL. Else If the PPDUs transmitted by the APUT contain HE-SIG-A and if the BW bits of HE-SIG-A is 0 for 20 MHz operation and Nsts and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 0 (1 spatial streams) then CONTINUE else FAIL.
5		Run script DT2-STA2-STA1.txt to STA1.			If DUT Is an AP or MAP that supports 2ss in both the bands then, the throughput from STA2 to STA1 is greater than 471S5_2SS_5G, then CONTINUE else FAIL. Else STA2 to STA1 throughput is greater than 471S5_1SS_5G , then CONTINUE else FAIL SN: DUT Is an AP or MAP that supports 2ss in both the bands then, If the PPDUs transmitted by the APUT contain HE-SIG-A and if the BW bits of HE-SIG-A = 2 for 80 MHz operation and the NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 1 (2 spatial streams), then CONTINUE else FAIL. Else

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
					If the PPDUs transmitted by the APUT contain HE-SIG-A and if the BW bits of HE-SIG-A is 2 for 80 MHz operation and Nsts and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 0 (1 spatial streams) then CONTINUE else, FAIL
6	Run script HE-prereq-STA1-STA2-AP.txt to the APUT.	Run script HE-prereq-STA1-STA2-AP.txt to the APUT.			If DUT Is an AP or MAP that supports 2ss in both the bands then, If the throughput from STA1 to APUT > 471S6_2SS_5G and the throughput from STA2 to the APUT > 471S6_2SS_24G, then PASS else FAIL. Else If the throughput from STA1 to APUT > 471S6_1SS_5G _5GHzand throughput from STA2 to the APUT > 471S6_1SS_24G then CONTINUE else FAIL.

4.8 (Deleted)

4.9 (Deleted)

4.10 (Deleted)

4.11 (Deleted)

4.12 APUT A-MPDU aggregation tests

4.12.1 APUT receives A-MPDU aggregation with and without WPA2-Personal test

Objective

This test case verifies the Compressed Block Ack stream and A-MPDU aggregation traffic when the AP is the receiver, as well as the A-MPDU aggregation with and without WPA2-Personal security mode when the APUT is the receiver.

Applicability: Mandatory

References

Test case 4.2.29 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 33 defines the specific parameter values required for this test case.

Table 33. APUT receives A-MPDU aggregation with and without WPA2-Personal configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Broadcom98 (Open) Broadcom75 (WPA2-Personal)	N/A
Security	None and WPA2-Personal	None and WPA2-Personal
Encryption key	None and 12345678	None and 12345678
Channel width	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
AP control channel	N/A	36 in 5 GH 6 in 2.4 GHz

Test procedure and expected results

Table 34 provides the specific test procedure and expected results for this test case.

Table 34. APUT receives A-MPDU aggregation with and without WPA2-Personal procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, go to Step 1, else go to Step 12.				
1	Configure STA1 per Table 6 and. Table 33 in the 2.4 GHz band. Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	Configure the APUT per Table 12 and Table 33 in the 2.4 GHz band.		
2	If the APUT does not support Open security, go to Step 8 else go to Step 3.			
3		Configure the APUT with no security. The APUT starts sending Beacon and Probe Response frames to STA1.		
4	STA1 sends an Association Request frame to the APUT.	The APUT send an Association Response frame to STA1.		If STA1 and the APUT associate successfully, then CONTINUE else FAIL.
5	STA1 sends an ADDBA Request with buffer size ≤ 64 to the APUT.	The APUT sends an ADDBA Response frame to STA1.		
6	Run script HE1-STA1-AP-TID-0-30.txt.			If the measured uplink throughput is > 4121S6_TP_24G, then CONTINUE else FAIL.
7	STA1 disassociates from the APUT.			
8		Reconfigure the APUT security mode to WPA2-Personal. The APUT starts sending Beacon and Probe Response frames to STA1.		
9	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If STA1 and the APUT associate successfully, then CONTINUE else FAIL.
10	STA1 sends an ADDBA Request frame to the APUT with buffer size ≤ 64.	The APUT sends an ADDBA Response frame to STA1.		
11	Run script HE1-STA1-AP-TID-0-30.txt.			If the measured uplink throughput is > 4121S11_TP_24G then CONTINUE else FAIL.
If the APUT supports 5 GHz, then go to Step 12, else PASS.				
12	Configure STA1 per Table 6 and. Table 33 in the 5 GHz band. Configure STA1 to join the APUT's BSS in the 5 GHz band.	Configure the APUT per Table 12 and Table 33 in the 5 GHz band.		
13	Repeat Steps 2-11.			The verification in Steps 2-11 is the same except: • Measured uplink throughput is > 4121S13_6_TP_5G in Step 6

Step	Test bed STA1	APUT	Test bed validation	Expected result
				• Measured uplink throughput is > 4121S13_11_TP_5G in Step 11 If the verification in Steps 2-11 is successful, then PASS else FAIL.

4.13 APUT A-MSDU reception tests

4.13.1 APUT A-MSDU reception when AP is the receiver test

Objective

This test case verifies that the APUT correctly receives A-MSDUs in high efficiency single user PPDUs when the channel width is set to 20 MHz in 2.4 GHz and 80 MHz in 5 GHz band.

Applicability: Mandatory

References

Test case 4.2.30 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 35 defines the specific parameter values required for this test case.

Table 35. APUT A-MSDU reception when AP is the receiver configuration

Parameter	Test bed STA1 value	Test bed STA2 value	APUT value
Test bed vendor	Qualcomm	Intel200W	N/A
Security	WPA2-Personal	WPA2-Personal	WPA2-Personal
Encryption key	12345678	12345678	12345678
Bandwidth	20 MHz in 2.4 GHz	80 MHz in 5 GHz	20 MHz in 2.4 GHz 80 MHz in 5 GHz
AP Control Channel	N/A	N/A	36 in 5 GH 6 in 2.4 GHz
A-MSDU Aggregation Transmission	Yes	Yes	N/A
A-MPDU Aggregation TX	NO	NO	N/A

Test procedure and expected results

Table 36 provides the specific test procedure and expected results for this test case.

Table 36. APUT A-MSDU reception when AP is the receiver procedure and expected results

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 35.	Configure STA2 per Table 6 and Table 35.	Configure the APUT per Table 12 and Table 35.		
If the APUT supports 2.4 GHz, go to Step 2; otherwise go to Step 6.					
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.		The APUT starts sending Beacon and Probe Response frames.		
3	STA1 sends an Association Request frame to the APUT.		The APUT sends an Association Response frame to STA1.		SN: If the association between STA1 and the APUT is successful, then CONTINUE else FAIL.
4	Run script HE1-STA1-AP-90.txt from STA1 to APUT for 90 seconds.			SN: Verify that STA1's MPDUs are > 2346 and 20 MHz HE packets.	SN: If the APUT successfully receives the transmitted data, and the uplink throughput is greater than 4131S4_TP_24G then CONTINUE, else FAIL.
5	STA1 disassociates from the APUT.				
If the APUT supports 5 GHz, go to Step 6 otherwise PASS.					
6		Configure STA2 to join the APUT's BSS in the 5 GHz band.	The APUT starts sending Beacon and Probe Response frames.		
7		STA2 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		SN: If the association between STA2 and the APUT is successful, then CONTINUE else FAIL.
8		Run script HE1-STA2-AP-90.txt from STA2 to APUT for 90 seconds.		SN: Verify that STA2's MPDUs are > 2346 and 80 MHz HE packets.	SN: If the APUT successfully receives the transmitted data, and the uplink throughput is greater than 4131S8_TP_5G, then PASS else FAIL.

4.14 APUT overlapping BSS tests

4.14.1 APUT overlapping BSS at 2.4 GHz test

Objective

This test case verifies that the APUT that supports 24 GHz will interoperate with an overlapping BSS at 2.4 GHz. A 5 GHz only APUT skips this test.

Applicability: Mandatory, except for 5 GHz only APUT

References

Test case 4.2.31 [4]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA operating as 11n
- Test bed AP1: Wi-Fi CERTIFIED 6 AP operating as 11n
- Wireless Sniffer

Test configuration

Table 37 defines the parameter values for the devices in the test bed.

Table 37. APUT overlapping BSS at 2.4 GHz configuration

Parameter	Test bed STA1 value	Test bed STA2 value	Test bed AP1 value	APUT value
Test bed vendor	Intel200W	Broadcom75	Marvell	N/A
AP control channel	N/A	6	6	6
Supported channel width set	0 (20 MHz)	0 (20 MHz)	0 (20 MHz)	0 (20 MHz)

Test procedure and expected results

Table 38 defines the test procedures and expected results.

Table 38. APUT overlapping BSS at 2.4 GHz procedure and results

Step	Test bed STA1	APUT	Test bed STA2	Test bed AP1	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 37.	Configure the APUT per Table 12 and Table 37.	Configure STA2 to the default mode defined in [4]and Table 37.	Configure AP1 to the default mode defined in [4] and Table 37.		

Step	Test bed STA1	APUT	Test bed STA2	Test bed AP1	Test bed validation	Expected result
2		The APUT sends Beacon and Probe Response frames.		AP1 sends Beacon frames and Probe Response frames.		
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.	STA2 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to STA2.		
4		Run script HE1-APUT-STA1_STA2-60.txt to AP1.		Run script HE1-APUT-STA1_STA2-60.txt to AP1.		If the downlink throughput between the APUT and STA1 < 4141S4_DL1_TP_24G, then FAIL else CONTINUE. If the downlink throughput between AP1 and STA2 < 4141S4_DL2_TP_24G, then FAIL else PASS.

4.14.2 APUT overlapping BSS at 5 GHz test

Objective

This test case verifies that the APUT will interoperate with an overlapping BSS at 5 GHz. A 2.4 GHz only APUT skips this test.

Applicability: Mandatory, except for 2.4 GHz only APUT

References

Test case 4.2.32 [4]

Test environment

- APUT
- Test bed STA1 Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA operating as 802.11ac
- Test bed AP1: Wi-Fi CERTIFIED 6 AP operating as 802.11ac
- Wireless Sniffer

Test configuration

Table 39 defines the parameter values for the devices in the test bed.

Table 39. APUT overlapping BSS at 5 GHz configuration

Parameter	Test bed STA1 value	Test bed STA2 value	Test bed AP1 value	APUT value
Test bed vendor	Qualcomm	Broadcom75	Broadcom	N/A
AP control channel	N/A	N/A	36	36
Supported channel width set	0 (80 MHz)	0 (80 MHz)	0 (80 MHz)	0 (80 MHz)

Test procedure and expected results

Table 40 defines the test procedures and expected results.

Table 40. APUT overlapping BSS at 5 GHz procedure and results

Step	Test bedSTA1	APUT	Test bed STA2	Test bed AP1	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 39.	Configure APUT per Table 12 and Table 39.	Configure STA2 to the default mode defined in [3] and per Table 39.	Configure AP1 to the default mode defined in [3] and Table 39.		
2		The APUT sends Beacon and Probe Response frames.		AP1 sends Beacon and Probe Response frames to STA2.		

Step	Test bedSTA1	APUT	Test bed STA2	Test bed AP1	Test bed validation	Expected result
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.	STA2 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to STA2.		
4		Run script HE1-APUT-STA1_STA2-60.txt to AP1.		Run script HE1-APUT-STA1_STA2-60.txt to AP1.		If the downlink throughput from the APUT to STA1 is < 4142S4_DL1_TP_5G, then FAIL else CONTINUE. If the downlink throughput from AP1 to STA2 is < 4142S4_DL2_TP_5G, then FAIL else PASS.

4.15 (Deleted)

4.16 A-MPDU aggregation when the AP is the transmitter tests

4.16.1 A-MPDU aggregation when the AP is the transmitter test

Objective

This test case verifies A-MPDU aggregation when the APUT is the transmitter.

Applicability: Mandatory

References

Test case 4.2.40 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 41 defines the specific parameter values required for this test case.

Table 41. A-MPDU aggregation when the AP is the transmitter configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Broadcom98	N/A
Channel width	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz

Test procedure and expected results

Table 42 provides the specific test procedure and expected results for this test case.

Table 42. A-MPDU aggregation when the AP is the transmitter procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, go to Step 1, else go to Step 6.				
1	Configure STA1 per Table 6 and Table 41 in the 2.4 GHz band.	Configure the APUT per Table 12 and Table 41 in the 2.4 GHz band.		

Step	Test bed STA1	APUT	Test bed validation	Expected result
	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.			
2		The APUT sends Beacon and Probe Response frames to STA1.		
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		
4	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1. Note: the APUT may do this automatically after association or it may be triggered by the data traffic in Step 5.		
5		Run script HE1-AP-STA1-TID-0.txtto STA1.		If the measured throughput is more than 416S5_TP_24G, then CONTINUE, else FAIL. SN: If the APUT is using HE PPDUs that contain the HE-SIG-A field and STA1 responds with C-BA, then CONTINUE else FAIL.
If the APUT supports 5 GHz, then go to Step 6, else PASS.				
6	Configure STA1 per Table 6 and Table 41 in the 5 GHz band. Configure STA1 to join the APUT's BSS in the 5 GHz band.	Configure the APUT per Table 12 and Table 41 in the 5 GHz band.		
7	Repeat Steps 2-5.			The verification in Steps 2-5 is the same except: • Measured throughput is more than 416S7_TP_5G in Step 5 If the verification in Steps 2-5 is successful, then PASS else FAIL.

4.17 Ability to receive A-MPDU with A-MSDU tests

4.17.1 Ability to receive A-MPDU with A-MSDU test

Objective

The test verifies that the APUT is able to correctly receive A-MPDU with A-MSDU.

Applicability: Optional. This test shall be executed only if the DUT declared support for receiving A-MPDU with A-MSDU in Table 1.

References

Test case 4.2.49 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 43 defines the parameter values for the devices in the test bed.

Table 43. Ability to receive A-MPDU with A-MSDU configuration

Parameter	Test bed STA1 value	APUT value
Vendor	Broadcom98	N/A
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Channel width	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band

Test procedure and expected results

Table 44 defines the test procedures and expected results.

Table 44. Ability to receive A-MPDU with A-MSDU procedure and results

Step	Test bed STA1	APUT	Test bed validation	Expected results
1	Configure STA1 Table 6 and Table 43. Enable Tx A-MSDU.	Configure the APUT per Table 12 and Table 43. Configure the APUT to support A-MPDU with A-MSDU.		
If the APUT supports 2.4 GHz, go to Step 2; otherwise, go to Step 8.				

Step	Test bed STA1	APUT	Test bed validation	Expected results
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon frames.		
3	STA1 sends an Association Request frame to the APUT.			
4		The APUT sends an Association Response frame to STA1.		
5	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Response frame to STA1.		SN: If the ADDBA Response frame is sent from the APUT and it includes the Block Ack Parameter Set field with the A-MSDU Supported bit = 1, then CONTINUE else FAIL.
6	RUN: PING <APUT_IP_ADDR> SIZE=16384 COUNT=30			If no pings are received for the entire 30 seconds, then FAIL else CONTINUE. SN: If the HE PPDUs sent by STA1 contain the HE-SIG-A field with the Format field in HE-SIG-A1 (B0) =1 (HE SU PPDU), then CONTINUE else FAIL.
7	STA1 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 8 else PASS.				
8	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon frames to STA1.		
9	STA1 sends an Association Request frame to the APUT.			
10		The APUT sends an Association Response frame to STA1.		
11	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Response frame to STA1.		SN: If an ADDBA Response frame is sent from the APUT that includes the Block Ack Parameter Set field with the A-MSDU Supported bit = 1, then CONTINUE else FAIL.
12	RUN: PING <APUT_IP_ADDR> SIZE=16384 COUNT=30			If no ping are received for the entire 30 seconds, then FAIL else CONTINUE. SN: If at least one of the HE PPDUs sent by the STA1 contain the HE-SIG-A field with the Format field in HE-SIG-A1 (B0) =1 (HE SU PPDU), then PASS else FAIL.

4.18 HE SU preamble format and channel width where AP is the transmitter tests

4.18.1 HE SU preamble format and channel width where AP is the transmitter test

Objective

This test case verifies that the APUT transmits correctly formatted S-MPDUs in HE SU PPDUs with the high efficiency single user preamble format using different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Mandatory

References

Section 6.3.1.4 [1]

Section 27.3.4 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 45 defines the specific parameter values required for this test case.

Table 45. HE SU preamble format and channel width where AP is the transmitter configuration

Parameter	Test bed STA1 value	Test bed STA2 value	APUT value
Test bed vendor	Cypress	Intel200L	N/A
Bandwidth	20 MHz in 2.4 GHz	See test procedure	See test procedure
Preamble format	HE_SU	HE_SU	N/A

Test procedure and expected results

Table 46 provides the specific test procedure and expected results for this test case.

Table 46. HE SU preamble format and channel width where AP is the transmitter procedure and expected results

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
1	Configure STA1 Table 6 and Table 45 and to decline any	Configure STA2 Table 6 and Table 45 and to decline any	Configure the APUT per Table 12 and Table 45.		

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
	ADDBA Request frames from the APUT. Enable S-MPDU transmission..	ADDBA Request frames from the APUT. Enable S-MPDU transmission.			
If the APUT supports 2.4 GHz, go to Step 2; otherwise go to Step 7.					
2			Configure the APUT to 20 MHz BSS bandwidth mode in the 2.4 GHz band.		
3	STA1 sends an Probe Request frame to the APUT.		The APUT sends Beacon and Probe Response frames to STA1.		
4	STA1 sends an Association Request frame to the APUT.		The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
5			RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL, else CONTINUE. If there are more than 10% ping failures, then FAIL, else CONTINUE. SN: Verify the SU PPDU transmitted by the APUT has the following format: 1. SU PPDU contains a single MPDU and the EOF field = 1. 2. SU PPDU contains HE-SIG-A field with: a. Format field (B0) = 1 b. Bandwidth field (B19, B20) = 0 c. UL/DL field (B2) =0. 3. Ack Policy bits in QoS Control field are set to Normal Ack. If the above conditions are true, then CONTINUE else FAIL.
6	STA1 disassociate from the APUT.				
If the APUT supports 5 GHz, go to Step 7; otherwise PASS.					

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
7			Configure the APUT to 20 MHz BSS bandwidth mode in the 5 GHz band.		
8		STA2 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA2.		If the association between the APUT and STA2 is successful, then CONTINUE else FAIL.
9			RUN: PING <STA2_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the SU PPDU transmitted by the APUT has the following format: 1. SU PPDU contains a single MPDU and the EOF field = 1. 2. SU PPDU contains HE-SIG-A field with: a. Format field (B0) = 1 b. Bandwidth field (B19, B20) = 0 c. UL/DL field (B2) =0. 3. Ack Policy bits in QoS Control field are set to Normal Ack. If the above conditions are true, then CONTINUE else FAIL.
10		STA2 disassociates from the APUT.			
11			Configure the APUT to 40 MHz BSS bandwidth mode in the 5 GHz band.		
12		STA2 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA2.		If the association between the APUT and STA2 is successful, then CONTINUE else FAIL.
13			RUN: PING <STA2_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE.

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
					SN: Verify the SU PPDU transmitted by the APUT has the following format: 1. SU PPDU contains a single MPDU and the EOF field =1. 2. SU PPDU contains HE-SIG-A field with: a. Format field (B0) = 1 b. Bandwidth field (B19, B20) = 1 c. UL/DL field (B2) =0. 3. Ack Policy bits in QoS Control field are set to “Normal Ack”. If the above conditions are true, then CONTINUE else FAIL.
14		STA2 disassociates from the APUT.			
15			Configure the APUT to 80 MHz BSS bandwidth mode in the 5 GHz band.		
16		STA2 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA2.		If the association between the APUT and STA2 is successful, then CONTINUE else FAIL.
17			RUN: PING <STA2_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the SU PPDU transmitted by the APUT has the following format: 1. SU PPDU contains a single MPDU and the EOF field = 1. 2. SU PPDU contains HE-SIG-A field with: a. Format field (B0) = 1 b. Bandwidth field (B19, B20) = 2 c. UL/DL field (B2) =0.

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
					3. Ack Policy bits in QoS Control field are set to Normal Ack. If the above conditions are true, then PASS else FAIL.

4.19 HE SU preamble format and channel width where AP is the receiver tests

4.19.1 HE SU preamble format and channel width where AP is the receiver test

Objective

This test case verifies that the APUT correctly receives S-MPDUs in PPDUs using the high efficiency single user preamble format for different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Mandatory

References

Section 6.3.1.4 [1]

Section 27.3.4 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 47 defines the specific parameter values required for this test case.

Table 47. HE SU preamble format and channel width where AP is the receiver configuration

Parameter	Test bed STA1 value	Test bed STA2 value	APUT value
Test bed vendor	Intel200W	Broadcom98	N/A
Bandwidth	20 MHz in 2.4 GHz 80 MHz in 5 GHz	See test procedure	See test procedure
Number of spatial streams	1	1	N/A
Preamble format	HE_SU	HE_SU	N/A

Test procedure and expected results

Table 48 provides the specific test procedure and expected results for this test case.

Table 48. HE SU preamble format and channel width where AP is the receiver procedure and expected results

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
1	Configure STA1 Table 6 and Table 47 and to decline any ADDBA Request frames from the APUT. Enable S-MPDU transmission.	Configure STA2 Table 6 and Table 47 and to decline any ADDBA Request frames from the APUT. Enable S-MPDU transmission.	Configure the APUT per Table 12 and Table 47.		
If the APUT supports 2.4 GHz, go to Step 2; otherwise go to Step 7.					
2			Configure the APUT to 20 MHz BSS bandwidth mode in the 2.4 GHz band.		
3	STA1 sends a Probe Request frame to the APUT.		The APUT sends Beacon and Probe Response frames to STA1.		
4	STA1 sends an Association Request frame to the APUT.		The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
5	RUN: PING <APUT_IP_ADDR> SIZE=1000, COUNT=90				If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE.
6	STA1 disassociates from the APUT.				
If the APUT supports 5 GHz, go to Step 7 otherwise PASS.					
7			Configure APUT to 20MHz BSS bandwidth mode in the 5 GHz band.		
8		STA2 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA2.		If the association between the APUT and STA2 is successful, then CONTINUE else FAIL.
9		RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE.
10		STA2 disassociates from the APUT.			

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
11			Configure the APUT to 40 MHz BSS bandwidth mode in the 5 GHz band.		
12		STA2 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA2.		If the association between the APUT and STA2 is successful, then CONTINUE else FAIL.
13		RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE.
14		STA2 disassociates from the APUT.			
15			Configure the APUT to 80 MHz BSS bandwidth mode in the 5 GHz band.		
16		STA2 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA2.		If the association between the APUT and STA2 is successful, then CONTINUE else FAIL.
17		RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else PASS.

4.20 APUT uses LDPC when transmitting HE A-MPDU with MCS 0-7 tests

4.20.1 APUT uses LDPC when transmitting HE A-MPDU with MCS 0-7 test

Objective

This test case verifies that the APUT correctly transmits HE A-MPDU with LDPC and MCS 7.

Applicability: Mandatory for a 5 GHz APUT. Optional for a 2.4 GHz APUT and shall be executed only if the APUT declared support of LDPC for 2.4 GHz in Table 1.

References

Section 6.5.1.4 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 49 defines the specific parameter values required for this test case.

Table 49. APUT uses LDPC when transmitting HE A-MPDU with MCS 0-7 configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Marvell	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
Coding in payload for transmit	LDPC	LDPC
HE-MCS	Default	HE-MCS 7

Test procedure and expected results

Table 50 provides the specific test procedure and expected results for this test case.

Table 50. APUT uses LDPC when transmitting HE A-MPDU with MCS 0-7 procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 to Table 6 and Table 49.	Configure the APUT per Table 12 and Table 49.		
If the APUT supports 2.4 GHz, go to Step 2; otherwise, go to Step 7.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: If in the Beacon frame sent by the APUT, the LDPC Coding in Payload field (B13) within the HE PHY Capabilities Information field in the HE Capabilities element = 1, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: If in the Association Response frame sent by the APUT, the LDPC Coding in Payload field within the HE PHY Capabilities Information field in the HE Capabilities element = 1, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1.		
5		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs sent by the APUT contain the HE-SIG-A field with the following format: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19,B20) = 0 (20 MHz) 3. UL/DL field in HE-SIG-A1 (B2) = 0 (DL) 4. MCS field in HE-SIG-A1 (B3-B6)= 7 (MCS 7) 5. Coding field in HE-SIG-A2 (B7) = 1 (LDPC) If all the above conditions are true, then CONTINUE else FAIL.
6	STA1 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 7; else PASS.				
7	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends an Beacon and Probe Response frames to STA1.		SN: If in the Beacon sent by the APUT, the LDPC Coding in Payload field (B13) within the HE PHY Capabilities

Step	Test bed STA1	APUT	Test bed validation	Expected result
				Information field in the HE Capabilities element = 1, then CONTINUE else FAIL.
8	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If STA1 association fails, then FAIL, else CONTINUE. SN: If in the Association Response frame sent by the APUT, the LDPC Coding in Payload field within the HE PHY Capabilities Information field in the HE Capabilities element = 1, then CONTINUE else FAIL.
9	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1.		
10		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else, CONTINUE. If there are more than 10% ping failures, then FAIL else, CONTINUE. SN: Verify the HE PPDUs sent by the APUT contain HE-SIG-A field with the following format: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19,B20) = 2 (80 MHz) 3. UL/DL field in HE-SIG-A1 (B2) = 0 (DL) 4. MCS field in HE-SIG-A1 (B3-B6) = 7 (MCS 7) 5. Coding field in HE-SIG-A2 (B7) = 1 (LDPC) If all the above conditions are true, then PASS else FAIL.

4.21 APUT LDPC when receiving HE A-MPDU with MCS 0-7 tests

4.21.1 APUT LDPC when receiving HE A-MPDU with MCS 0-7 test

Objective

This test case verifies that the APUT correctly receives HE A-MPDU with LDPC with MCS 7.

Applicability: Mandatory for a 5 GHz APUT. Optional for a 2.4 GHz APUT and shall be executed only if the APUT declared support of LDPC for 2.4 GHz in Table 1.

References

Section 6.5.1.4 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 51 defines the specific parameter values required for this test case.

Table 51. APUT LDPC when receiving HE A-MPDU with MCS 0-7 configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Intel200L	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
Coding in payload for transmit	LDPC	Default
HE-MCS	HE-MCS 7	Default

Test procedure and expected results

Table 52 provides the specific test procedure and expected results for this test case.

Table 52. APUT LDPC when receiving HE A-MPDU with MCS 0-7 procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 Table 6 and Table 51.	Configure the APUT per Table 12 and Table 51.		
If the APUT supports 2.4 GHz, go to Step 2; otherwise go to Step 7.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: If in the Beacon frame sent by the APUT, the LDPC Coding in Payload field (B13) within the HE PHY Capabilities Information field in the HE Capabilities element = 1, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: If in the Association Response frame sent by the APUT, the LDPC Coding in Payload field within the HE PHY Capabilities Information field in the HE Capabilities element = 1, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Response frame to STA1.		
5	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else, CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE.
6	STA1 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 7 otherwise PASS.				
7	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: If in the Beacon frame sent by the APUT, the LDPC Coding in Payload field (B13) within the HE PHY Capabilities Information field in the HE Capabilities element = 1, then CONTINUE else FAIL.
8	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: If in the Association Response frame sent by the APUT, the LDPC Coding in Payload field within the HE PHY Capabilities Information field in the HE Capabilities element = 1, then CONTINUE else FAIL.

Step	Test bed STA1	APUT	Test bed validation	Expected result
9	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Response frame to STA1.		
10	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else PASS.

4.22 APUT uses BCC when transmitting HE A-MPDU with MCS 0-7 tests

4.22.1 APUT uses BCC when transmitting HE A-MPDU with MCS 0-7 test

Objective

This test case verifies that the APUT correctly transmits HE A-MPDU with BCC and MCS 7 on the 20 MHz channel.

Applicability: Mandatory

References

Section 6.3.1.8 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 53 defines the specific parameter values required for this test case.

Table 53. APUT uses BCC when transmitting HE A-MPDU with MCS 0-7 configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Marvell	N/A
Bandwidth	20MHz in 2.4 GHz 20 MHz in 5 GHz	20 MHz in 2.4 GHz 20 MHz in 5 GHz
Preamble format	HE_SU	HE_SU
Coding in payload for transmit		BCC
HE-MCS		HE-MCS 7

Test procedure and expected results

Table 54 provides the specific test procedure and expected results for this test case.

Table 54. APUT uses BCC when transmitting HE A-MPDU with MCS 0-7 procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 Table 6 and Table 53.	Configure the APUT per Table 12 and Table 53.		

Step	Test bed STA1	APUT	Test bed validation	Expected result
If the APUT supports 2.4 GHz, go to Step 2; otherwise, go to Step 7.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1.		
5		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE If there are more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs sent by the APUT contain HE-SIG-A field with the following format: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19, B20) = 0 (20 MHz) 3. UL/DL field in HE-SIG-A1 (B2) = 0 (DL) 4. MCS field in HE-SIG-A1 (B3-B6) = 7 (MCS 7) 5. Coding field in HE-SIG-A2 (B7) = 0 (BCC) If all the above conditions are true, then CONTINUE else FAIL.
6	STA1 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 7; else PASS.				
7	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
8	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
9	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1.		
10		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs sent by the APUT contain HE-SIG-A field with the following format:

Step	Test bed STA1	APUT	Test bed validation	Expected result
				1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19, B20) = 0 (20 MHz) 3. UL/DL field in HE-SIG-A1 (B2) = 0 (DL) 4. MCS field in HE-SIG-A1 (B3-B6) = 7 (MCS 7) 5. Coding field in HE-SIG-A2 (B7) = 0 (BCC) If all the above conditions are true, then PASS else FAIL.

4.23 APUT BCC receives HE A-MPDU with MCS 0-7 tests

4.23.1 APUT BCC receives HE A-MPDU with MCS 0-7 test

Objective

This test case verifies that the APUT correctly receives HE A-MPDU with BCC and MCS 7 on the 20 MHz channel.

Applicability: Mandatory

References

Section 6.3.1.8 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 55 defines the specific parameter values required for this test case.

Table 55. APUT BCC receives HE A-MPDU with MCS 0-7 configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Cypress	N/A
Bandwidth	20 MHz in 2.4 GHz 20 MHz in 5 GHz	20 MHz in 2.4 GHz 20 MHz in 5 GHz
Preamble format	HE_SU	HE_SU
Coding in payload for transmit	BCC	N/A
HE-MCS	HE-MCS 7	

Test procedure and expected results

Table 56 provides the specific test procedure and expected results for this test case.

Table 56. APUT BCC receives HE A-MPDU with MCS 0-7 procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 Table 6 and Table 55.	Configure the APUT per Table 12 and Table 55.		

Step	Test bed STA1	APUT	Test bed validation	Expected result
If the APUT supports 2.4 GHz, go to Step 2; else go to Step 7.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Response frame to STA1.		
5	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE.
6	STA1 disassociate from the APUT.			
If the APUT supports 5 GHz, then go to Step 7; otherwise PASS;				
7	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
8	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
9	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Response frame to STA1.		
10	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else PASS.

4.24 APUT SU MIMO with one and two spatial streams tests

4.24.1 APUT SU MIMO with one and two spatial streams test

Objective

This test case verifies that the APUT correctly implements single user MIMO with one and two spatial streams.

Applicability: Mandatory

References

Section 6.3.1.3 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 57 defines the specific parameter values required for this test case.

Table 57. APUT SU MIMO with one and two spatial streams test configuration

Parameter	Test bed STA1 value	APUT value
Vendor	Broadcom98	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Number of spatial streams	1, 2	N/A

Test procedure and expected results

Table 58 provides the specific test procedure and expected results.

Table 58. APUT SU MIMO with one and two spatial streams test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, then go to Step 1, else go to Step 12.				
1	Configure STA1 to Table 6 and Table 57. Configure STA1 in the 2.4 GHz band and 1 SS mode.			
2		The APUT sends Beacon frames		SN: If DUT is MAP and supports only 1SS, then If the Beacon/Probe Response frames sent by the APUT in both 2.4 GHz, 5 GHz include the Tx and Rx MCS Map in the HE Capabilities Supported MCS Set field of HE Capabilities IE set to ’11’ in B0-B1 (no support of 1SS) then FAIL, else CONTINUE. Else If the APUT’s Tx and Rx MCS Map in the HE Capabilities Supported MCS Set field of HE Capabilities element = 11 in B0-B1 or 11 in the bitmap indexes B2-B3 (no support of 1SS or 2 SS), then FAIL else CONTINUE.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		
4	Configure STA1 to transmit only 20 MHz, NSS = 1, HE-MCS= 7, GI=1.6µs.			
5	RUN: PING <PC_ENDPOINT_IP_ADDR> SIZE=1000 CONTINUOUS=YES			If more than 5 consecutive ping timeouts from STA1 occur, then FAIL else CONTINUE. If there are more than 10% of pings failures from STA1, then FAIL else CONTINUE.
6	STA1 disassociates from the APUT.			If DUT is MAP and supports 2ss then Continue to Step 7 else PASS
7	Configure STA1 to Table 6 and Table 57. Configure STA1 in the 2.4 GHz band and 2 SS mode.			
8		The APUT sends Beacon frames to STA1.		
9	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		
10	Configure STA1 to transmit only 20 MHz, NSS = 2, HE-MCS= 7, GI=1.6µs.			

Step	Test bed STA1	APUT	Test bed validation	Expected result
11	RUN: PING <PC_ENDPOINT_IP_ADDR> SIZE=1000 CONTINUOUS=YES			If more than 5 consecutive ping timeouts from STA1 occur, then FAIL else CONTINUE. If there are more than 10% of pings fail from STA1, then FAIL else CONTINUE.
If the APUT supports the 5 GHz band, then go to Step 12 else PASS.				
12	Configure STA1 to Table 6 and Table 57. Configure STA1 in the 5 GHz band and 1 SS mode.	Configure the APUT per Table 12 and Table 57.		
13	Repeat Steps 2-6.			If the verification in Steps 2-6 is successful. then CONTINUE else FAIL.
14	Configure STA1 to Table 6 and Table 57. Configure STA1 in the 5 GHz band and 2 SS mode.			
15	Repeat Steps 8-11.			If the verification in Steps 8-11 is successful. then PASS else FAIL.

4.25 APUT receives single TID compressed BA with 64 MSDUs, no fragmentation and channel widths tests

4.25.1 APUT receives single TID compressed BA with 64 MSDUs no fragmentation and channel widths test

Objective

This test case verifies that the APUT is appropriately supporting single TID A-MPDU reception with up to 64 MSDUs, and no fragmentation in HE SU PPDU with different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Mandatory

References

Section 6.3.1.22 [1]

Section 9.3.1.8.2 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 59 defines the specific parameter values required for this test case.

Table 59. APUT receives single TID compressed BA with 64 MSDUs no fragmentation and channel widths test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Broadcom75	N/A
Bandwidth	20 MHz in 2.4 GHz 20 MHz, 40 MHz, and 80 MHz in 5 GHz	20 MHz in 2.4 GHz 20 MHz, 40 MHz, and 80 MHz in 5 GHz
Preamble format	HE_SU	HE_SU
HE Capabilities: Fragmentation Support field	0	

Test procedure and expected results

Table 60 provides the specific test procedure and expected results for this test case.

Table 60. APUT receives single TID compressed BA with 64 MSDUs no fragmentation and channel widths test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 59.	Configure the APUT per Table 12 and Table 59.		
If the APUT supports 2.4 GHz, go to Step 2; else go to Step 7.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64	The APUT sends an ADDBA Response frame to STA1.		SN: Verify the ADDBA Response frame sent by the APUT has the following format 1. Buffer size ≤ 64 2. Dialog Token and TID fields match the values in the ADDBA Request frame If all the above conditions are true, then CONTINUE else FAIL.
5	Run script HE1-STA1-AP-60.txt to APUT.			SN: Verify that the APUT responds with BA Type = Compressed BlockAck (BA Type field B1-B4 in BA Control field = 2) with the following format for all BAs: The Fragment Number subfield (B0-B3) of the Block Ack Starting Sequence Control field within the BA Information field = 0 (Fragmentation Level 3 OFF and Maximum number of MSDUs acknowledged=64) If all the above conditions are true, then CONTINUE else FAIL.
6	STA1 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 7 else PASS.				
7	Configure STA1 to join the APUT's BSS in the 5 GHz band. Configure STA1's bandwidth to 20 MHz.	The APUT sends Beacon and Probe Response frames to STA1. Configure APUT to be in 20MHz BSS bandwidth mode.		
8	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
9	Repeat Steps 4-5.	Repeat Steps 4-5.		If the verification in Steps 4-5 is successful, then CONTINUE else FAIL.
10	Configure STA1's bandwidth to 40 MHz.	Configure the APUT to be in 40 MHz BSS bandwidth mode.		

Step	Test bed STA1	APUT	Test bed validation	Expected result
11	STA1 disassociates from the APUT. Repeat Steps 3-5.	Repeat Steps 3-5.		If the verification in Steps 3-5 is successful, then CONTINUE else FAIL.
12	Configure STA1's bandwidth to 80 MHz.	Configure the APUT to be in 80 MHz BSS bandwidth mode.		
13	STA1 disassociates from the APUT. Repeat Steps 3-5.	Repeat Steps 3-5.		If the verification in Steps 3-5 is successful, then PASS else FAIL.

4.26 APUT transmits single TID compressed BA with 64 MSDUs, no fragmentation and channel widths tests

4.26.1 APUT transmits single TID compressed BA with 64 MSDUs no fragmentation and channel widths test

Objective

This test case verifies that the APUT is appropriately supporting single TID A-MPDU transmission with up to 64 MSDUs, and no fragmentation in HE SU PPDU with different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Mandatory

References

Section [1]

Section 9.3.1.8.2 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 61 defines the specific parameter values required for this test case.

Table 61. APUT transmits single TID compressed BA with 64 MSDUs no fragmentation and channel widths test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Intel200W	N/A
Bandwidth	20 MHz in 2.4 GHz 20 MHz, 40 MHz, and 80 MHz in 5 GHz	20 MHz in 2.4 GHz 20 MHz, 40 MHz, and 80 MHz in 5 GHz
Preamble format	HE_SU	HE_SU
HE Capabilities: Fragmentation Support field	0	N/A

Test procedure and expected results

Table 62 provides the specific test procedure and expected results for this test case.

Table 62. APUT transmits single TID compressed BA with 64 MSDUs no fragmentation and channel widths test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 61.	Configure the APUT per Table 12 and Table 61.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: If the Dynamic Fragmentation Support subfield of the HE MAC Capabilities Information field in Beacon and Probe Response frames is set to a value between 0-3, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		SN: If the Dynamic Fragmentation Support subfield of the HE MAC Capabilities Information field in the Association Response frame is set to a value between 0-3, then CONTINUE else FAIL. If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1.		
5		Run script HE1-AP-STA1-TID-0.txt using to STA1.		SN: Verify the following conditions are true: 1. Fragment Number subfield within the Sequence Control field and the More Fragments subfield within the Frame Control field in the SU PPDUs sent by the APUT = 0 (no fragmentation) 2. SU PPDUs sent by the APUT contain HE-SIG-A with the following format: a. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) b. Bandwidth field in HE-SIG-A1 (B19, B20) = 0 (20 MHz) c. UL/DL field in HE-SIG-A1 (B2) = 0 (DL) If all the above conditions are true, then CONTINUE else FAIL.
6	STA1 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 7 else PASS.				
7	Configure STA1 to join APUT BSS on 5 GHz. Configure BW to 20 MHz.	The APUT sends Beacon and Probe Response frames to STA1. Configure APUT to be in 20 MHz BSS bandwidth mode.		SN: If the Dynamic Fragmentation Support subfield of the HE MAC Capabilities Information field in Beacon and Probe Response frames is set to a value between 0-3, then CONTINUE else FAIL.
8	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.

Step	Test bed STA1	APUT	Test bed validation	Expected result
9	Repeat Steps 4-6.	Repeat Steps 4-6.		If the verification in Steps 4-6 is successful, then CONTINUE else FAIL.
10	Configure STA1's bandwidth to 40 MHz.	Configure APUT to be in 40 MHz BSS bandwidth mode.		
11	Repeat Steps 3-6.	Repeat Steps 3-6.		The verification in Steps 3-6 is the same except: Bandwidth field in HE-SIG-A1 (B19-B20) = 1 (40 MHz) in Step 5 If the verification in Steps 3-6 is successful, then CONTINUE else FAIL.
12	Configure STA1's bandwidth to 80 MHz.	Configure the APUT to be in 80 MHz BSS bandwidth mode.		
13	Repeat Steps 3-6.	Repeat Steps 3-6.		The verification in Steps 3-6 is the same except: Bandwidth field in HE-SIG-A1 (B19-B20) = 2 (80 MHz) in Step 5 If the verification in Steps 3-6 is successful, then PASS else FAIL.

4.27 APUT receives HE Long Training field, and guard interval and packet extension tests

4.27.1 APUT receives HE-LTF, and GI and packet extension test

Objective

This test case verifies that the APUT correctly implements reception of high efficiency Long Training field and guard interval fields.

Applicability: Mandatory

References

Sections 6.3.1.11 and 6.3.1.7 [1]

Section 27.3.10.10 and 27.3.12 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 63 defines the specific parameter values required for this test case.

Table 63. APUT receives HE-LTF, and GI and packet extension test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Cypress	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
HE-LTF and GI	6.4µs LTF + 0.8µs GI 6.4µs LTF + 1.6µs GI 12.8µs LTF + 3.2 µs GI	

Test procedure and expected results

Table 64 provides the specific test procedure and expected results for this test case.

Table 64. APUT receives HE-LTF, and GI and packet extension test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 Table 6 and Table 63.	Configure the APUT per Table 12 and Table 63.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 12.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: Verify the following in the HE Capabilities element in the Beacon and Probe Response frames sent from the APUT: 1. PPE Threshold Present field in the HE PHY Capabilities Information field = 1 and the PPE Thresholds field is present in the HE Capabilities element, OR PPE Threshold Present field in the HE PHY Capabilities Information field = 0 and the PPE Thresholds field is not present in the HE Capabilities element. 2. PPE Thresholds field is not present in the HE Capabilities element, OR PPE Thresholds field is present in the HE Capabilities element, and the value of the PPET8 subfield is less than the value of the PPET16 subfield, except when the value of the PPET8 subfield is 7, for each NSS and RU combination for which PPET16 and PPET8 subfields are included in the PPET Threshold field. If all conditions above are true, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: Verify the following in the HE Capabilities element in the Association Response frame sent from the APUT: 1. PPE Threshold Present field in the HE PHY Capabilities Information field = 1 and the PPE Thresholds field is present in the HE Capabilities element, OR PPE Threshold Present field in the HE PHY Capabilities Information field = 0 and the PPE Thresholds field is not present in the HE Capabilities element. 2. PPE Thresholds field is not present in the HE Capabilities element, OR PPE Thresholds field is present in the HE Capabilities element, and the value of the PPET8 subfield is less than the value of the PPET16 subfield, except when the value of the PPET8 subfield is 7, for each NSS and RU combination for which PPET16 and PPET8 subfields are included in the PPET Threshold field. If all conditions above are true, then CONTINUE else FAIL.

Step	Test bed STA1	APUT	Test bed validation	Expected result
4	STA1 sends an ADDBA Request frame to the APUT.	The APUT sends an ADDBA Response frame to STA1.		
5	Configure STA1 to transmit HE PPDU using: • LTF=6.4µs • GI = 0.8µs			
6	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE.
7	Configure STA1 to transmit HE PPDU using: • LTF=6.4µs • GI = 1.6µs			
8	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL otherwise, CONTINUE.
9	Configure STA1 to transmit HE PPDU using: • LTF=12.8µs • GI = 3.2µs			
10	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE.
11	STA1 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 12 else PASS.				
12	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: Verify the following in the HE Capabilities element in the Beacon and Probe Response frames sent from the APUT: 1. PPE Threshold Present field in the HE PHY Capabilities Information field = 1 and the PPE Thresholds field is present in the HE Capabilities element, OR PPE Threshold Present field in the HE PHY Capabilities Information field = 0 and the PPE Thresholds field is not present in the HE Capabilities element. 2. PPE Thresholds field is not present in the HE Capabilities element,

Step	Test bed STA1	APUT	Test bed validation	Expected result
				OR PPE Thresholds field is present in the HE Capabilities element, and the value of the PPET8 subfield is less than the value of the PPET16 subfield, except when the value of the PPET8 subfield is 7, for each NSS and RU combination for which PPET16 and PPET8 subfields are included in the PPET Threshold field. If all conditions above are true, then CONTINUE else FAIL.
13	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: Verify the following in the HE Capabilities element in the Association Response frame sent from the APUT: 1. PPE Threshold Present field in the HE PHY Capabilities Information field = 1 and the PPE Thresholds field is present in the HE Capabilities element, OR PPE Threshold Present field in the HE PHY Capabilities Information field = 0 and the PPE Thresholds field is not present in the HE Capabilities element. 2. PPE Thresholds field is not present in the HE Capabilities element, OR PPE Thresholds field is present in the HE Capabilities element, and the value of the PPET8 subfield is less than the value of the PPET16 subfield, except when the value of the PPET8 subfield is 7, for each NSS and RU combination for which PPET16 and PPET8 subfields are included in the PPET Threshold field. If all conditions above are true, then CONTINUE else FAIL.
14	STA1 sends an ADDBA Request frame to the APUT.	The APUT sends an ADDBA Response frame to STA1.		
15	Configure STA1 to transmit HE PPDU using: • LTF=6.4µs • GI = 0.8µs			
16	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE.
17	Configure STA1 to transmit HE PPDU using: • LTF=6.4µs • GI = 1.6µs			

Step	Test bed STA1	APUT	Test bed validation	Expected result
18	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE.
19	Configure STA1 to transmit HE PPDU using: • LTF=12.8µs • GI = 3.2µs			
20	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else PASS.
21	STA1 disassociates from the APUT.			

4.28 APUT transmits HE Long Training field and guard interval tests

4.28.1 APUT transmits HE-LTF and GI test

Objective

This test case verifies that the APUT correctly transmits high efficiency Long Training field and guard interval fields.

Applicability: Mandatory

References

Sections 6.3.1.11 [1]

Section 27.3.10.10 [7]

Test environment

- APUT
- Test bed Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 65 defines the specific parameter values required for this test case.

Table 65. APUT transmits HE-LTF and GI test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Broadcom75	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
HE-LTF and GI	N/A	6.4µs LTF + 0.8µs GI 6.4µs LTF + 1.6µs GI 12.8µs LTF + 3.2 µs GI

Test procedure and expected results

Table 66 provides the specific test procedure and expected results for this test case.

Table 66. APUT transmits HE-LTF and GI test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 Table 6 and Table 65.	Configure the APUT per Table 12 and Table 65.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 12.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1.		
5		Configure the APUT to transmit HE PPDU using: • LTF=6.4µs • GI = 0.8µs		
6		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the APUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19, B20) = 0 (20 MHz) 3. LTF+GI field in HE-SIG-A1 (B21, B22) = 1 (LTF = 6.4µs and GI = 0.8µs) If all the above conditions are true, then CONTINUE else FAIL.
7		Configure the APUT to transmit HE PPDU using: • LTF=6.4µs • GI = 1.6µs		
8		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the APUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19, B20) = 0 (20 MHz) 3. LTF+GI field in HE-SIG-A1 (B21, B22) = 2 (LTF = 6.4µs and GI = 1.6µs)

Step	Test bed STA1	APUT	Test bed validation	Expected result
				If all the above conditions are true, then CONTINUE else FAIL.
9		Configure the APUT to transmit HE PPDU using: • LTF=12.8µs • GI = 3.2µs		
10		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the APUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19, B20) = 0 (20 MHz) 3. LTF+GI field in HE-SIG-A1 (B21, B22) = 3 (LTF = 12.8µs and GI = 3.2µs) If all the above conditions are true, then CONTINUE else FAIL.
11	STA1 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 12 else PASS.				
12	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
13	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
14	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1.		
15		Configure the APUT to transmit HE PPDU using: • LTF=6.4µs • GI = 0.8µs		
16		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the STAUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19, B20) = 2 (80 MHz) 3. LTF+GI field in HE-SIG-A1 (B21, B22) = 1 (LTF = 6.4µs and GI = 0.8µs)

Step	Test bed STA1	APUT	Test bed validation	Expected result
				If all the above conditions are true, then CONTINUE, else FAIL.
17		Configure the APUT to transmit HE PPDU using: • LTF=6.4µs • GI = 1.6µs		
18		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the STAUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19, B20) = 2 (80 MHz) 3. LTF+GI field in HE-SIG-A1 (B21, B22) = 2 (LTF = 6.4µs and GI = 1.6µs) If all the above conditions are true, then CONTINUE, else FAIL.
19		Configure the APUT to transmit HE PPDU using: • LTF=12.8µs • GI = 3.2µs		
20		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the STAUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19, B20) = 2 (80 MHz) 3. LTF+GI field in HE-SIG-A1 (B21, B22) = 3 (LTF = 12.8µs and GI = 3.2µs) If all the above conditions are true, then PASS else FAIL.
21	STA1 disassociates from the APUT.			

4.29 APUT DL OFDMA tests

4.29.1 APUT DL OFDMA test

Objective

This test case verifies that the APUT correctly transmits DL OFDMA packets and receives acknowledgement from the test bed STA.

Applicability: If the APUT declared primary device category as AP in Table 1, then it is Mandatory**.**

If the APUT declared primary device category as Mobile AP in Table 1 , then it is Optional**.**

References

Section 6.3.1.1 [1]

Section 26.5.1.1 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 67 defines the specific parameter values required for this test case.

Table 67. APUT DL OFDMA configuration

Parameter	APUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed STA4 value
Test bed vendor	N/A	Broadcom98	Broadcom75	Intel200L	Intel200W
AP control channel	36 in 5 GHz 6 in 2.4 GHz	N/A	N/A	N/A	N/A
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	HE_MU(DL OFDMA)	N/A	N/A	N/A	N/A
Number of users in each OFDMA transmission	4	N/A	N/A	N/A	N/A

Test procedure and expected results

Table 68 provides the specific test procedure and expected results for this test case.

Table 68. APUT DL OFDMA procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 67.	Configure STA2 per Table 6 and Table 67.	Configure STA3 per Table 6 and Table 67.	Configure STA4 per Table 6 and Table 67.	Configure the APUT per Table 12 and Table 67.		
If the APUT supports 2.4 GHz go to Step 2, otherwise go to Step 7.							
2					Configure the APUT to the 2.4 GHz band. The APUT sends Beacon and Probe Response frames to the STAs.		
3	Configure STA1 to join the APUT's BSS in the 2.4 GHz band..	Configure STA2 to join the APUT's BSS in the 2.4 GHz band..	Configure STA3 to join the APUT's BSS in the 2.4 GHz band.	Configure STA4 to join the APUT's BSS in the 2.4 GHz band..			
4	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
5	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1, STA2, STA3, STA4.		
6	.	.			Run script HE1-DLOFDMA-APUT to STA1, STA2, STA3, STA4. APUT transmits DL OFDMA PPDU to STA1, STA2, STA3 and STA4		SN: Verify the following conditions are true:. 1. Sequentially capture at least 2500 packets for each STAAID and verify that in 4291S6_STAID_24G% of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A = 0

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							c. BW bits of HE-SIG-A= 0 2. At least 80% of all MU PPDUs' HE-SIG-B common content indicates allocation to ≥ 4 RUs a. If the RU Allocation subfield contains indices with y and z values then those values = 0 3. APUT sets Ack Policy to BlockAck on a PPDU to a STA and the receiving STA sends C-BA with non-zero bitmap after receiving BAR. 4. APUT sets Ack Policy to Normal/Implicit Ack on a PPDU to a STA and the receiving STA sends C-BA with non-zero bitmap 5. Aggregate throughput is > 4291S6_ATP_24G 6. Throughput of each STA > 4291S6_STA_TP_24G If all the conditions above are true, then CONTINUE else FAIL.
If the APUT supports 5 GHz, go to Step 7 else PASS.							
7					Configure the APUT to the 5 GHz band. The APUT sends Beacon and Probe Response frames to the STAs.		
8	Configure STA1 to join APUT's BSS in the 5 GHz band.	Configure STA2 to join APUT's BSS in the 5 GHz band.	Configure STA3 to join APUT's BSS in the 5 GHz band.	Configure STA4 to join APUT's BSS in the 5 GHz band.			
9	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If the association between the APUT and STA1, STA2, STA3, and STA4 is

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							successful, then CONTINUE else FAIL.
10	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1, STA2, STA3, STA4.		
11					Run script HE1-DLOFDMA-APUT.txt to the all STAs. APUT transmits DL OFDMA PPDU to STA1, STA2, STA3 and STA4		SN: Verify the following conditions are true: 1. Sequentially capture at least 10000 PPDUs for each STAAID and verify that in 4291S11_STAID_5G% of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A = 0 c. BW bits of HE-SIG-A = 2 d. HE-SIG-B common content indicates allocation to ≥ 4 RUs 2. At least 80% of all MU PPDUs' HE-SIG-B common content indicates allocation to ≥ 4 RUs a. If the RU Allocation subfield contains indices with y and z values then those values = 0 3. APUT sets Ack Policy to Block Ack on a PPDU to a STA and that Such STA sends C-BA with non-zero bitmap after receiving BAR. 4. APUT sets Ack Policy to Normal/Implicit Ack on a PPDU to a STA And that STA sends C-BA with non-zero bitmap

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							5. Aggregate throughput is more than 4291S11_ATP_5G 6. Throughput of each STA > 4291S11_STA_TP_5G If all the conditions above are true, then PASS else FAIL.

4.30 APUT DL OFDMA PHY tests

4.30.1 APUT DL OFDMA PHY test

Objective

This test case verifies that the APUT transmits DL OFDMA packets with correct PHY parameters.

Applicability: If the APUT declared primary device category as AP in Table 1, then it is Mandatory

If the APUT declared primary device category as Mobile AP in Table 1 , then it is Optional

References

Section 6.3.1.1 [1]

Section 27.3 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 69 defines the specific parameter value required for this test case.

Table 69. APUT DL OFDMA PHY test configuration

Parameter	APUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed STA4 value
Test bed vendor	N/A	Intel200W	Broadcom75	Intel200L	Qualcomm
AP control channel	36 in 5 GHz 6 in 2.4 GHz	N/A	N/A	N/A	N/A
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	HE_MU (DL OFDMA)	N/A	N/A	N/A	N/A
HE_LTF+GI	6.4µs LTF, 0.8µs GI 6.4µs LTF, 1.6µs 12.8µs LTF, 3.2µs GI	N/A	N/A	N/A	N/A

Number of users in each OFDMA transmission	4	N/A	N/A	N/A	N/A

Test procedure and expected results

Table 70 provides the specific test procedure and expected results for this test case.

Table 70. APUT DL OFDMA PHY test procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 69.	Configure STA2 per Table 6 and Table 69.	Configure STA3 per Table 6 and Table 69.	Configure STA4 per Table 6 and Table 69.	Configure the APUT per Table 12 and Table 69.		
If the APUT supports 2.4 GHz go to Step 2, else go to Step 14.							
2					Configure the APUT to the 2.4 GHz band. The APUT sends Beacon and Probe Response frames to the STAs.		
3	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	Configure STA2 to join the APUT's BSS in the 2.4 GHz band.	Configure STA3 to join the APUT's BSS in the 2.4 GHz band.	Configure STA4 to join the APUT's BSS in the 2.4 GHz band.			
4	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to the STAs.		If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL
5	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to the STAs.		
6					Configure the APUT to transmit using DL OFDMA, with 1 spatial stream, LTF=6.4µs, GI=0.8µs.		
7	.				Run script HE1-DLOFDMA-APUT.txt to		SN: Verify the following conditions are true: 1. HE PPDUs transmitted by the APUT are DL OFDMA.

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
					STA1, STA2, STA3, STA4. APUT transmits DL OFDMA PPDU to STA1, STA2, STA3 and STA4		2. Sequentially capture at least 2500 packets for each STAAID and verify that in 4301S7_STAID_24G% of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A = 0 c. Bandwidth field in HE-SIG- (B15-B17) = 0 (20 MHz) d. LTF+GI field in HE-SIG- (B23-B24) = 1 (LTF = 6.4µs and GI = 0.8µs) 3. At least 80% of all MU PPDUs' HE-SIG-B common content indicates allocation to ≥ 4 RUs a. If the RU Allocation subfield contains indices with y and z values then those values = 0 4. Percent of MU packets is > 4301S7_MU_24G % 5. Aggregate throughput is > 4301S7_ATP_24G. 6. Throughput of each STA > 4301S7_STA_TP_24G If all the above conditions are true, then CONTINUE, else FAIL.
8					Configure the APUT to transmit using DL OFDMA, with 1 spatial stream, LTF=6.4 µs, GI=1.6 µs.		
9	.				Run script HE1-DLOFDMA-APUT.txt to all the STAs. APUT transmits DL OFDMA PPDU to STA1, STA2, STA3 and STA4		SN: Verify the following conditions are true: 1. HE PPDUs transmitted by the APUT are DL OFDMA. 2. Sequentially capture at least 10000 packets for each STAAID and verify that in 4301S9_STAID_24G % of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A = 0 c. Bandwidth field in HE-SIG-A1 (B15-B17)= 0 (20 MHz) d. LTF+GI field in HE-SIG-A1 (B23-B24)= 2 (LTF = 6.4µs and GI = 1.6µs)

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							3. At least 80% of all MU PPDUs' HE-SIG-B common content indicates allocation to ≥ 4 RUs a. If the RU Allocation subfield contains indices with y and z values then those values = 0 4. Percent of MU packets is > 4301S9_MU_24G % 5. Aggregate throughput is > 4301S9_ATP_24G 6. Throughput of each STA > 4301S9_STA_TP_24G If all the above conditions are true, then CONTINUE else FAIL.
10	Disassociate STA1, STA2, STA3 and STA4 from APUT						
11	Configure STA1 to use 1 SS Repeat Steps 4 to 5	Configure STA2 to use 1 SS Repeat Steps 4 to 5	Configure STA3 to use 2 SS Repeat Steps 4 to 5	Configure STA4 to use 2 SS Repeat Steps 4 to 5	Repeat Steps 4 to 5		If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL
12					If DUT is Mobile AP and supports only 1SS, Configure the APUT to transmit using DL OFDMA, with 1 spatial stream to STA1, STA2, STA3 and STA4 LTF=12.8µs, GI=3.2µs. else Configure the APUT to transmit using DL OFDMA, with 1 spatial stream to STA1 and STA2 and 2 spatial stream to STA3 and STA4 LTF=12.8µs, GI=3.2µs.		
13		.			Run script HE1-DLOFDMA-APUT.txt to the STAs. APUT transmits DL OFDMA PPDU to STA1, STA2, STA3 and STA4		If DUT is Mobile AP and support 1SS only, SN: Verify the following conditions are true: 7. 1. HE PPDUs transmitted by the APUT are DL-OFDMA. 8. 2. APUT transmits 1SS to STA1, STA2, STA3 and STA4.

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							9. 3. Sequentially capture at least 10000 packets for each STAID and verify that in 4301S11_STAID_24G% of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A is set to 0 c. Bandwidth field in HE-SIG-A1 (B15-B17)= 0 (20 MHz) d. LTF+GI field in HE-SIG-A1 (B23-B24) = 3 (LTF = 12.8µs and GI = 3.2µs) e. HE-SIG-B common content indicates allocation to ≥ 4 RUs 10. If the RU Allocation subfield contains indices with y and z values then those values are set to 0 11. Percent of MU packets is > 4301S11_MU_24G% 12. Aggregate throughput is > 4301S11_ATP_24G 13. Throughput of each STA > 4301S11_STA_TP_24G Else SN: Verify the following conditions are true: 1. APUT transmits 1SS to STA1 and STA2,and transmits 2SS to STA3 and STA4. 2. Sequentially capture at least 10000 packets for each STAAID and verify that in 4301S11_STAID_24G% of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A = 0 c. Bandwidth field in HE-SIG-A1 (B15-B17)= 0 (20 MHz) d. LTF+GI field in HE-SIG-A1 (B23-B24) = 3 (LTF = 12.8µs and GI = 3.2µs) e. HE-SIG-B common content indicates allocation to ≥ 4 RUs 3. If the RU Allocation subfield contains indices with y and z values then those values = 0 4. Percent of MU packets is > 4301S11_MU_24G%

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							5. Aggregate throughput is > 4301S11_ATP_24G 6. Throughput of each STA > 4301S11_STA_TP_24G for 1SS STA, >4301S11_STA_TP_2SS_24G for 2SS STA If all the above conditions are true, then CONTINUE else FAIL.
If the APUT supports 5 GHz go to Step 14, else PASS.							
14					Configure the APUT to the 5 GHz band. The APUT sends Beacon and Probe Response frames to the STAs.		
15	Configure STA1 to join the APUT's BSS in the 5 GHz band.	Configure STA2 to join the APUT's BSS in the 5 GHz band.	Configure STA3 to join the APUT's BSS in the 5 GHz band.	Configure STA4 to join the APUT's BSS in the 5 GHz band.			
16	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to the STAs.		If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL
17	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to the STAs with Buffer Size ≤ 64.		
18					Configure the APUT to transmit using DL OFDMA, with 1 spatial stream, LTF=6.4µs, GI=0.8µs.		
19			.		Run script HE1-DLOFDMA-APUT.txt to the STAs.		SN: Verify the following conditions are true: 1. HE PPDUs transmitted by the APUT are DL OFDMA. 2. Sequentially capture at least 10000 packets for each STAAID and verify that in 4301S17_STAID_5G% of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU)

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							b. SIGB Compression field in HE-SIG-A = 0 c. Bandwidth field in HE-SIG-A1 (B15-B17)= 2 (80 MHz) d. LTF+GI field in HE-SIG-A1 (B23-B24)) = 1 (LTF = 6.4µs and GI = 0.8µs) e. HE-SIG-B common content indicates allocation to ≥ 4 RUs 3. If the RU Allocation subfield contains indices with y and z values then those values = 0 4. Percent of MU packets is > 4301S17_MU_5G% 5. Aggregate throughput is > 4301S17_ATP_5G 6. Throughput of each STA > 4301S17_STA_TP_5G If all the above conditions are true, then CONTINUE else FAIL.
20					Configure the APUT to transmit using DL OFDMA, with 1 spatial stream, LTF=6.4µs, GI=1.6µs.		
21				.	Run script HE1-DLOFDMA-APUT.txt to the STAs.		SN: Verify the following conditions are true: 1. HE PPDUs transmitted by the APUT are DL OFDMA. 2. Sequentially capture at least 10,000 packets for each STAAID and verify that in 4301S19_STAID_5G% of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A = 0 c. Bandwidth field in HE-SIG-A1 (B15-B17)= 2 (80 MHz) d. LTF+GI field in HE-SIG-A1 (B23-B24) =2 (LTF = 6.4µs and GI = 1.6µs) e. HE-SIG-B common content indicates allocation to ≥ 4 RUs 3. If the RU Allocation subfield contains indices with y and z values then those values = 0

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							4. Percent of MU packets is ≥ 4301S19_MU_5G% 5. Aggregate throughput is ≥ 4301S19_ATP_5G 6. Throughput of each STA ≥ 4301S19_STA_TP_5G If all the above conditions are true, then CONTINUE else FAIL.
22	Disassociate STA1, STA2, STA3 and STA4 from APUT						
23	Configure STA1 to use 1 SS Repeat Steps 4 to 5	Configure STA2 to use 1 SS Repeat Steps 4 to 5	Configure STA3 to use 2 SS Repeat Steps 4 to 5	Configure STA4 to use 2 SS Repeat Steps 4 to 5	Repeat Steps 4 to 5		If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL
24					If the DUT is MAP and suppprts only 1SS, then Configure the APUT to transmit using DL OFDMA, with 1 spatial stream to STA1, STA2, STA3 and and STA4, LTF=12.8µs, GI=3.2µs Else Configure the APUT to transmit using DL OFDMA, with 1 spatial stream to STA1 and STA2 and 2 spatial streams to STA3 and STA4, LTF=12.8µs, GI=3.2µs.		
25	.				Run script HE1-DLOFDMA-APUT.txt to the STAs.		SN: Verify the following conditions are true: If the DUT is MAP and supports only 1SS 1. HE PPDUs transmitted by the APUT are DL-OFDMA. 2. APUT transmits 1SS to STA1, STA2, STA3 and STA4. 3. Sequentially capture at least 10000 packets for each STAID and verify that in 4301S21_STAID_5G % of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU)

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							b. SIGB Compression field in HE-SIG-A is set to 0 c. Bandwidth field in HE-SIG-A1 (B15-B17)= 0 (20 MHz) d. LTF+GI field in HE-SIG-A1 (B23-B24) = 3 (LTF = 12.8µs and GI = 3.2µs) e. HE-SIG-B common content indicates allocation to ≥ 4 RUs 4. If the RU Allocation subfield contains indices with y and z values then those values are set to 0 5. Percent of MU packets is > 4301S21_MU_5G % 6. Aggregate throughput is ≥4301S21_ATP_5G 7. Throughput of each STA ≥4301S21_STA_TP_5G for 1SS STA, ≥4301S21_STA_TP_2SS_5G for 2SS STA If all the above conditions are true, then CONTINUE else FAIL. Else 1. HE PPDUs transmitted by the APUT are DL OFDMA. 2. Sequentially capture at least 10000 packets for each STAAID and verify that in 4301S21_STAID_5G% of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A = 0 c. SIG-A1 (B15-B17)= 2 (80 MHz) d. LTF+GI field in HE-SIG-A1 (B23-B24))=3 (LTF = 12.8µs and GI = 3.2µs) e. HE-SIG-B common content indicates allocation to ≥ 4 RUs 3. If the RU Allocation subfield contains indices with y and z values then those values = 0 4. Percent of MU packets is > 4301S21_MU_5G% 5. Aggregate throughput is > 4301S21_ATP_5G 6. If the throughput of each STA

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							> 4301S21_STA_TP_5G for 1SS STA, >4301S21_STA_TP_2SS_5G for 2SS STA If all the above conditions are true, then PASS else FAIL.

4.31 APUT transmits MCS 8-9 tests

4.31.1 APUT transmits MCS 8-9 test

Objective

This test case verifies that the APUT correctly transmits MCS 8-9 with both BCC and LDPC coding, and with 1 or 2 spatial streams.

Applicability: Optional. This test shall be executed only if the APUT declared support for MCS 8-9 in Table 1.

References

Section 6.4.1.4 [1]

Test environment

- APUT
- Test bed STA1:Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 71 defines the specific parameter values required for this test case.

Table 71. APUT transmits MCS 8-9 test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Marvell	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
LDPC Coding in Payload in 2.4 GHz	Disabled	N/A
Max HE-MCS for 1 SS subfield in Rx HE-MCS Map ≤ 80 MHz field	1	Default

Test procedure and expected results

Table 72 provides the specific test procedure and expected results for this test case.

Table 72. APUT transmits MCS 8-9 test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 71. Configure STA1 to use 1 spatial stream.	Configure the APUT per Table 12 and Table 71.		
If the APUT supports 2.4 GHz, go to Step 2, else go to Step 10.				

2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN:
				If DUT is a MAP and support only 1SS then
				If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon / Probe Response frame is set to 1 or 2, then CONTINUE else FAIL.
				Else
				If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon and Probe Response frames are set to 1 or 2, then CONTINUE else FAIL.

3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If STA1 association fails, then FAIL else CONTINUE.
				SN:
				If DUT is a MAP and support only 1SS then
				If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame is set to 1 or 2, then CONTINUE else FAIL.
				Else
				If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame are set to 1 or 2, then CONTINUE else FAIL.

4	STA1 sends an ADDBA Response frame to the APUT.	The APUT sends an ADDBA Request frame to STA1.		
5		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If no more than 5 consecutive ping timeouts occur, then CONTINUE, else FAIL If no more than 10% ping failures, then CONTINUE; otherwise, FAIL. SN: Verify the PPDUs transmitted by the APUT carrying the ping request have the following format: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. MCS field in HE-SIG-A1 (B3-B6) = 9

Step	Test bed STA1	APUT	Test bed validation	Expected result
				3. Bandwidth field in HE-SIG-A1 (B19-B20) = 0 (20 MHz) 4. Coding field in HE-SIG-A2 (B7) = 0 (BCC) 5. NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25)= 0 (1 spatial stream) If all of the above conditions are true, then CONTINUE else FAIL.
6	STA1 disassociates from the APUT.			If the DUT is MAP and supports only 1SS, then PASS else CONTINUE
7	Reconfigure STA1 to use 2 spatial streams. Set Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field to 1.			
8		Repeat Steps 3- 5.		The verification in Steps 3-5 is the same except: NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25)= 1 (2 spatial stream) in Step 5 If the verification in Steps 3-5 is successful. then CONTINUE else FAIL.
9	STA1 disassociate from the APUT.			
If the APUT supports 5 GHz, go to Step 10 else PASS.				
10	Configure STA1 to use 1 spatial stream.			

11	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN:
				If the DUT is MAP and supports only 1SS, then
				If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon / Probe Response frame is set to 1 or 2, then CONTINUE else FAIL.
				Else
				If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within the HE Capabilities element in the Beacon and Probe Response frames are set to 1 or 2, then CONTINUE else FAIL.

12	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL SN: If the DUT is MAP and supports only 1SS, then

Step	Test bed STA1	APUT	Test bed validation	Expected result
				If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame is set to 1 or 2, then CONTINUE else FAIL. Else If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within the HE Capabilities element in the Association Response frame are set to 1 or 2, then CONTINUE else FAIL.
13	STA1 sends an ADDBA Response frame to the APUT.	The APUT sends an ADDBA Request frame to STA1.		
14		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL If no more than 10% ping failures, then CONTINUE else FAIL. SN: Verify the PPDUs transmitted by the APUT carrying the ping request have the following format: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. MCS field in HE-SIG-A1 (B3-B6) = 9 3. Bandwidth field in HE-SIG-A1 (B19-B20) = 2 (80 MHz) 4. Coding field in HE-SIG-A2 (B7) = 1 (LDPC) 5. NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25)= 0 (1 spatial stream) If all the above conditions are true, then CONTINUE else FAIL.
15	STA1 disassociate from the APUT.			If the DUT is MAP and supports only 1SS, then PASS else CONTINUE
16	Reconfigure STA1 to use 2 spatial streams. Set Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field to 1.			
17	Repeat Steps 12-14.			The verification in Steps 12-14 is the same except: NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 1 (2 spatial streams) in Step 14 If the verification in Steps 12-14 is successful, then PASS else FAIL.

4.32 APUT receives MCS 8-9 tests

4.32.1 APUT receives MCS 8-9 test

Objective

This test case verifies that the APUT correctly receives MCS 8-9 with both BCC and LDPC coding, and with 1 or 2 spatial streams.

Applicability: Optional. This test shall be executed only if the APUT declared support for MCS 8-9 in Table 1.

References

Section 6.4.1.4 [1]

Test environment

- APUT
- Test bed STA1:Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 73 defines the specific parameter values required for this test case.

Table 73. APUT receives MCS 8-9 test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Cypress	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
HE-MCS	HE-MCS 9	Default
LDPC Coding in Payload in 2.4 GHz	Disabled	N/A

Test procedure and expected results

Table 74 provides the specific test procedure and expected results for this test case.

Table 74. APUT receives MCS 8-9 test procedure and expected results

Step	Test bed TA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 73. Configure STA1 to use 1 spatial stream.	Configure the APUT per Table 12 and Table 73.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 10.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon / Probe Response frame is set to 1 or 2, then CONTINUE else FAIL. Else If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon and Probe Response frames are set to 1 or 2, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: if the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame is set to 1 or 2, then CONTINUE else FAIL. Else If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame are set to 1 or 2, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT.	The APUT sends an ADDBA Response frame to STA1.		
5	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL.
6	STA1 disassociates from the APUT.			If the DUT is MAP and supports only 1SS, then PASS else CONTINUE
7	Reconfigure STA1 to use 2 spatial streams.			
8	Repeat Steps 3-5.			If the verification in Step 5 is successful, then CONTINUE else FAIL.

Step	Test bed TA1	APUT	Test bed validation	Expected result
9	STA1 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 10 else PASS.				
10	Configure STA1 to transmit 1 spatial stream.			

11	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN:
				If the DUT is MAP and supports only 1SS, Then
				Else
				If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon / Probe Response frame is set to 1 or 2, then CONTINUE else FAIL.
				Else
				If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon and Probe Response frames are set to 1 or 2, then CONTINUE else FAIL.

12	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: If the DUT is MAP and supports only 1SS, then If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame is set to 1 or 2, then CONTINUE else FAIL. If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame are set to 1 or 2, then CONTINUE else FAIL.
13	STA1 sends an ADDBA Request frame to the APUT.	The APUT sends an ADDBA Response frame to STA1.		
14	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL.
15	STA1 disassociates from the APUT.			If DUT is a MAP and supports only 1ss then PASS else CONTINUE
16	Reconfigure STA1 to use 2 spatial streams.			
17	Repeat Steps 12-14.			If the verification in Step 14 is successful, then PASS else FAIL..

4.33 APUT transmits MCS 10-11 tests

4.33.1 APUT transmits MCS 10-11 test

Objective

This test case verifies that the APUT correctly transmits MCS 10-11 with LDPC coding, and with one or two spatial streams.

Applicability: Optional. This test shall be executed only if the APUT declared support for MCS 10-11 in Table 1.

References

Section 6.4.1.5 [1]

Test environment

- APUT
- Test bed STA1:Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 75 defines the specific parameter values required for this test case.

Table 75. APUT transmits MCS 10-11 test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Qualcomm	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
LDPC Coding in Payload in 2.4 GHz	Enabled	N/A
Max HE-MCS for 1 SS subfield, Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field	2	Default

Test procedure and expected results

Table 76 provides the specific test procedure and expected results for this test case.

Table 76. APUT transmits MCS 10-11 test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1per Table 6 and Table 75. Configure STA1 to use 1 spatial stream.	Configure the APUT per Table 12 and Table 75.		
If the APUT supports 2.4 GHz, go to Step 2, else go to Step 10.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon / Probe Response frame is set to 2, then CONTINUE else FAIL. Else If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon and Probe Response frames = 2, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame is set to 2, then CONTINUE else FAIL. Else If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame = 2, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1.		
5		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL. SN: Verify the PPDUs transmitted by the APUT carried in the ping request have the following format: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. MCS field in HE-SIG-A1 (B3-B6) = 11

Step	Test bed STA1	APUT	Test bed validation	Expected result
				3. Bandwidth field in HE-SIG-A1 (B19-B20) = 0 (20 MHz) 4. Coding field in HE-SIG-A2 (B7) = 1 (LDPC) 5. NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 0 (1 spatial stream) If all the above conditions are true, then CONTINUE else FAIL.
6	STA1 disassociates from the APUT.			If the DUT is MAP and supports only 1SS, then PASS else CONTINUE
7	Reconfigure STA1 to use 2 spatial streams.			
8		Repeat Steps 3 5.		The verification in Steps 3.5 is the same except: NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 1 (2 spatial streams) If the verification in Steps 3-5 is successful, then CONTINUE else FAIL.
9	STA1 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 10 else PASS.				
10	Configure STA1 to use 1 spatial stream.			
11	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: If DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon / Probe Response frame is set to 2, then CONTINUE else FAIL. Else If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon frame = 2, then CONTINUE else FAIL.
12	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame is set to 2, then CONTINUE else FAIL. Else If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within HE

Step	Test bed STA1	APUT	Test bed validation	Expected result
				Capabilities element in the Association Response frame = 2, then CONTINUE else FAIL.
13	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1.		
14		RUN: PING <STA1_IP_ADDR> SIZE=1000 COUNT=90		If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL. SN: Verify the PPDUs transmitted by the APUT carried in the ping request have the following format: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. MCS field in HE-SIG-A1 (B3-B6) = 11 3. Bandwidth field in HE-SIG-A1 (B19-B20) = 2 (80 MHz) 4. Coding field in HE-SIG-A2 (B7) = 1 (LDPC) 5. NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 0 (1 spatial stream) If all the above conditions are true, then CONTINUE else FAIL.
15	STA1 disassociates from the APUT.			If the DUT is MAP and supports 1SS only then PASS, else CONTINUE
16	Reconfigure STA1 to use 2 spatial streams.			
17		Repeat Steps 12-14.		The verification in Steps 12-14 is the same except: NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 1 (2 spatial streams) in Steps 5 and 14 If the verification in Steps 12-14 is successful, then PASS else FAIL.

4.34 APUT receives MCS 10-11 tests

4.34.1 APUT receives MCS 10-11 test

Objective

This test case verifies that the APUT correctly receives MCS 10-11 with LDPC coding, and with one or two spatial streams.

Applicability: Optional. This test shall be executed only if the APUT declared support for MCS 10-11 in Table 1.

References

Section 6.4.1.5 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 77 defines the specific parameter values required for this test case.

Table 77. APUT receives MCS 10-11 test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Intel200W for 2.4 GHz Qualcomm for 5 GHz	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz, 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
HE-MCS	HE-MCS 11	Default
LDPC Coding in Payload in 2.4 GHz	Enabled	Default

Test procedure and expected results

Table 78 provides the specific test procedure and expected results for this test case.

Table 78. APUT receives MCS 10-11 test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 77. Configure STA1 to use 1 spatial stream.	Configure the APUT per Table 12 and Table 77.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 10.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon / Probe Response frame is set to 2, then CONTINUE else FAIL. Else If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon and Probe Response frames = 2, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If STA1 association fails, then FAIL else CONTINUE. SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame is set to 2, then CONTINUE else FAIL. Else If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame = 2, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT.	The APUT sends an ADDBA Response frame to STA1.		
5	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else, FAIL.
6	STA1 disassociates from the APUT.			If DUT is MAP and supports only 1SS, then PASS else CONTINUE
7	Reconfigure STA1 to use 2 spatial streams.			
8	Repeat Steps 3-5.			If the verification in Steps 3- 5 is successful, then CONTINUE else FAIL.

Step	Test bed STA1	APUT	Test bed validation	Expected result
9	STA1 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 10, else PASS.				
10	Configure STA1 to transmit 1 spatial stream.			
11	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon / Probe Response frame is set to 2, then CONTINUE else FAIL. Else If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon and Probe Response frame = 2, then CONTINUE., else FAIL.
12	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame is set to 2, then CONTINUE else FAIL. Else If both of the Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame = 2, then CONTINUE, else FAIL.
13	STA1 sends an ADDBA Request frame to the APUT.	The APUT sends an ADDBA Response frame to STA1.		
14	RUN: PING <APUT_IP_ADDR> SIZE=1000 COUNT=90			If no more than 5 consecutive ping timeouts occur, then CONTINUE, else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL.
15	STA1 disassociates from the APUT.			If DUT is MAP and supports only 1SS, then PASS else CONTINUE
16	Reconfigure STA1 to use 2 spatial streams.			
17	Repeat Steps 12-14.			If the verification in Steps 12-14 is successful, then PASS else FAIL.

4.35 APUT transmits single user beamforming as the beamformer tests

4.35.1 APUT transmits SU beamforming as the beamformer with Sounding Dimension ≤ 4 test

Objective

This test case verifies that the APUT correctly transmits HE NDPA/NDP and receives non-trigger-based SU full BW sounding feedback with dimension less than or equal to four.

Applicability: Optional if the maximum number of spatial streams the APUT can transmit is less than 4 in Table 1. Mandatory if the maximum number of spatial streams the APUT can transmit is greater than or equal to 4 in Table 1.

References

Section 6.5.1.2 and 6.5.1.14 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 79 defines the specific parameter values required for this test case.

Table 79. APUT transmits SU beamforming as the beamformer with Sounding Dimension ≤ 4 test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Intel200L for 2.4 GHz Qualcomm for 5 GHz	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	20 MHz in 2.4 GHz 80 MHz in 5 GHz	20 MHz in 2.4 GHz 80 MHz in 5 GHz
Beamformee STS ≤ 80 MHz subfield in HE PHY Capabilities Information field	3	N/A
Transmit data with SU beamforming	N/A	Enabled

Test procedure and expected results

Table 80 provides the specific test procedure and expected results for this test case.

Table 80. APUT transmits SU beamforming as the beamformer with Sounding Dimension ≤ 4 test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 79.	Configure APUT per Table 12 and Table 79.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		SN: Verify the following in the HE PHY Capabilities Information field in the Beacon and Probe Response frames: 1. SU Beamformer subfield (B31) = 1 2. Number of Sounding Dimensions ≤ 80 MHz subfield (B40:B42) is not set to 0 If all the conditions above are true, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.	SN: Verify the following in the HE PHY Capabilities Information field in the Association Request frame: • SU Beamformee STS ≤ 80MHz (B34:36) ≥ 3	If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: Verify the following in the HE PHY Capabilities Information field in the Association Response frame: 1. SU Beamformer subfield (B31) = 1 2. Number of Sounding Dimensions ≤ 80 MHz subfield (B40:B42) is not set to 0 If all the conditions above are true, then CONTINUE else FAIL.
4		Configure the APUT to disable trigger-based sounding for SU feedback. RUN: PING <STA1_IP_ADDR> COUNT=90 Note that the APUT is expected to initiate sounding protocol against STA1.	SN: Verify the following a. STA1 transmits a HE Compressed Beamforming and CQI frame as the frame that follows the HE NDP transmitted by APUT. b. The HE MIMO Control field in the HE Compressed Beamforming and CQI frame transmitted by STA1 has the following format: ▪ BW = 0 (20 MHz) ▪ Nc Index (B0:B2) ≤ Nr Index (B3:B5) ▪ Nr Index (B3:B5) ≥ 1	If the ping is successful within 90 seconds, then CONTINUE else FAIL. SN: Verify the following conditions are true: 1. APUT transmits HE NDP Announcement frame followed by an HE NDP with the following format: a. NDP Announcement frame: ▪ RA field is set to STA1's MAC address ▪ Note: For non-HT frames, the TA field has Individual/Group bit = 1 (bandwidth signaling TA) ▪ B1 of the Sounding Dialog Token field = 1 (HE NDP Announcement frame) 2. Only a Single STA Info subfield is present with: ▪ AID11 (B0:B10) = STA1's AID 11 ▪ RU Start Index (B11:B17) = 0 ▪ RU End Index (B18:B24) = 8 (Full BW at 20 MHz) ▪ Feedback Type and Ng (B25:B26) = 0 ▪ Disambiguation (B27) = 1 ▪ Codebook Size (B28) = 0 (reserved for SU) ▪ Nc (B29:B31) = 0 (reserved for SU) 3. Verify that the APUT transmits NDP frame using HE SU PPDU format, and verify that the HE-SIG-A fields are set to:

Step	Test bed STA1	APUT	Test bed validation	Expected result
				a. Bandwidth subfield (B19:B20) = 0 (20 MHz) b. GI+LTF Size subfield (B21:B22) = 1 (2x HE-LTF and 0.8 µs GI) or 2 (2x HE-LTF and 1.6 µs GI) c. 1 ≤ NSTS And Midamble Periodicity (B23:B25) subfield ≤ 3 d. BSS_COLOR is set to the value indicated in the BSS Color subfield of the HE Operation element transmitted by the APUT 4. TxBF subfield (B10) of HE-SIG-A2 in at least one HE SU PPDU transmitted by the APUT = 1 after STA1 transmits an HE Compressed Beamforming and CQI frame. 5. Ping request in a PPDU with TxBF = 1 is successful after STA1 transmits the HE Compressed Beamforming and CQI frame. If all the conditions above are true, then CONTINUE else FAIL.
5	Disassociate STA1 from the APUT.			
6	If the APUT supports 5 GHz, go to Step 7 else PASS.			
7	Configure STA1 to join the APUT's BSS in the 5 GHz band.	Configure the APUT to operate in 80 MHz channel bandwidth in the 5 GHz band. The APUT sends Beacon and Probe Response frames to STA1.		SN: Verify the following in the HE PHY Capabilities Information field in the Beacon and Probe Response frames: 1. SU Beamformer subfield (B31) = 1 2. Number of Sounding Dimensions ≤ 80 MHz subfield (B40:B42) is not set to 0 If all the conditions above are true, then CONTINUE else FAIL.
8	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.	SN: Verify the following in the HE PHY Capabilities Information field in the Association Request frame: • SU Beamformee STS ≤ 80MHz (B34:36) is ≥ 3	If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: Verify the following in the HE PHY Capabilities Information field in the Association Response frame: 1. SU Beamformer subfield (B31) = 1 2. Number of Sounding Dimensions ≤ 80 MHz subfield (B40:B42) is not set to 0 If all the above conditions are true, then CONTINUE else FAIL.
9		Configure the APUT to disable trigger-based sounding for SU feedback. RUN: PING <STA1_IP_ADDR> COUNT=90 Note that the APUT is expected to initiate sounding	SN: Verify the following a. STA1 transmits a HE Compressed Beamforming and CQI frame as the frame that follows the HE NDP transmitted by APUT. b. The HE MIMO Control field in the HE Compressed Beamforming and CQI frame transmitted by	If the ping is successful within 90 seconds, then CONTINUE else FAIL. SN: Verify the following conditions are true: 1. APUT transmits HE NDP Announcement frame followed by an HE NDP with the following format: a. NDP Announcement frame: ▪ RA field is set to STA1’s MAC address ▪ If the NDP Announcement frame was transmitted using the non-HT/non-HT duplicate format, then the Individual/Group bit of the TA field = 1 (Signaling TA) ▪ B1 of the Sounding Dialog Token field = 1 (HE NDP Announcement frame)

Step	Test bed STA1	APUT	Test bed validation	Expected result
		protocol against STA1.	STA1 has the following format: ▪ BW=2 (80 MHz) ▪ Nc Index (B0:B2) ≤ Nr Index (B3:B5) ▪ Nr Index (B3:B5) ≥ 1	2. Only a Single STA Info subfield is present with: ▪ AID11 (B0:B10) = STA1's AID 11 ▪ RU Start Index (B11:B17) = 0 ▪ RU End Index (B18:B24) = 36 (Full BW at 80 MHz) ▪ Feedback Type and Ng (B25:B26) = 0 ▪ Disambiguation (B27) = 1 ▪ Codebook Size (B28) = 0 (reserved for SU) ▪ Nc (B29:B31) = 0 (reserved for SU) 3. Verify that the APUT transmits NDP frame using HE SU PPDU format,and verify that the HE-SIG-A fields are set to: a. Bandwidth subfield (B19:B20) = 2 (80 MHz in the HE NDP) b. GI+LTF Size subfield (B21:B22) = 1 (2x HE-LTF and 0.8 µs GI) or 2 (2x HE-LTF and 1.6 µs GI) c. 1 ≤ NSTS And Midamble Periodicity (B23:B25) subfield ≤ 3 d. BSS_COLOR is set to the value indicated in the BSS Color subfield of the HE Operation element transmitted by the APUT 4. TxBF subfield (B10) of HE-SIG-A2 in at least one HE SU PPDU transmitted by the APUT = after STA1 transmits an HE Compressed Beamforming and CQI frame. 5. Ping request in a PPDU with TxBF = 1 is successful after STA1 transmits the HE Compressed Beamforming and CQI frame. If all the conditions are above true, then PASS else FAIL.

4.35.2 APUT transmits SU beamforming as the beamformer with sounding dimension of 8 test

Objective

This test case verifies that the APUT correctly transmits HE NDPA/NDP and receives non-trigger-based SU full BW sounding feedback with dimension 8 in the 5 GHz band.

Applicability: Optional. This test shall be executed only if the APUT declared support for sounding dimension of 8 in Table 1.

References

Section 6.5.1.2 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 81 defines the specific parameter values required for this test case.

Table 81. APUT transmits SU beamforming as the beamformer with sounding dimension of 8 test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Intel200W	N/A
Bandwidth	80 MHz in 5 GHz	80 MHz in 5 GHz
AP control channel	N/A	36 in 5 GHz
Beamformee STS ≤ 80 MHz subfield in HE PHY Capabilities Information field	7	N/A
Transmit data with SU beamforming	NA	Enabled

Test procedure and expected results

Table 82 provides the specific test procedure and expected results for this test case.

Table 82. APUT transmits SU beamforming as the beamformer with sounding dimension of 8 test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 81.	Configure APUT per Table 12 and Table 81.		

Step	Test bed STA1	APUT	Test bed validation	Expected result
2	Disassociate STA1 from the APUT.			
3	Configure STA1 to join the APUT's BSS in the 5 GHz band.	Configure the APUT to operate in 80 MHz channel bandwidth in the 5 GHz band. The APUT sends Beacon and Probe Response frames to STA1.		SN: Verify the following in the HE PHY Capabilities Information field in the Beacon and Probe Response frames: 1. SU Beamformer subfield (B31) = 1. 2. Number of Sounding Dimensions ≤ 80 MHz subfield (B40:B42) = 7. If all the conditions above are true, then CONTINUE else FAIL.
4	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.	SN: Verify the following in the HE PHY Capabilities Information field in the Association Request frame: • SU Beamformee STS ≤ 80MHz (B34:36) is ≥ 3	If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: Verify the following in the HE PHY Capabilities Information field in the Association Response frame: 1. SU Beamformer subfield (B31) = 1 2. Number of Sounding Dimensions ≤ 80 MHz subfield (B40:B42) is set to 7 If all the conditions above are true, then CONTINUE else FAIL.
5		Configure the APUT to disable trigger-based sounding for SU feedback. RUN: PING <STA1_IP_ADDR> COUNT=90 Note that the APUT is expected to initiate sounding protocol against STA1.	SN: Verify the following a. STA1 transmits a HE Compressed Beamforming and CQI frame as the frame that follows the HE NDP transmitted by APUT. b. The HE MIMO Control field in the HE Compressed Beamforming and CQI frame transmitted by STA1 has the following format: ▪ BW=2 (80 MHz) ▪ Nc Index (B0:B2) ≤ Nr Index (B3:B5) ▪ Nr Index (B3:B5) = 7	If the ping is successful within 90 seconds, then CONTINUE else FAIL. SN: Verify the following conditions are true: 1. APUT transmits HE NDP Announcement frame followed by an HE NDP with the following format: a. NDP Announcement frame: ▪ RA field is set to STA1's MAC address ▪ If the NDP Announcement frame was transmitted using the non-HT/non-HT duplicate format, then the Individual/Group bit of the TA field = 1 (Signaling TA) ▪ B1 of the Sounding Dialog Token field = 1 (HE NDP Announcement frame) 2. Only a single STA Info subfield is present with: ▪ AID11 (B0:B10) = STA1's AID 11 ▪ RU Start Index (B11:B17) = 0 ▪ RU End Index (B18:B24) = 36 (Full BW at 80 MHz) ▪ Feedback Type and Ng (B25:B26) = 0 ▪ Disambiguation (B27) = 1

Step	Test bed STA1	APUT	Test bed validation	Expected result
				▪ Codebook Size (B28) = 0 (reserved for SU) ▪ Nc (B29:B31) = 0 (reserved for SU) 3. Verify that the APUT transmits NDP frame using HE SU PPDU format,and verify that the HE-SIG-A fields are set to: a. Bandwidth subfield (B19:B20) = 2 (80 MHz) b. GI+LTF Size subfield (B21:B22) = 1 (2x HE-LTF and 0.8 µs GI) or 2 (2x HE-LTF and 1.6 µs GI) c. NSTS And Midamble Periodicity (B23:B25) subfield = 7 d. BSS_COLOR is set to the value indicated in the BSS Color subfield of the HE Operation element transmitted by the APUT 4. TxBF subfield (B10) of HE-SIG-A2 in at least one HE SU PPDU transmitted by the APUT = 1 after STA1 transmits an HE Compressed Beamforming and CQI frame. 5. Ping request in a PPDU with TxBF = 1 is successful after STA1 transmits the HE Compressed Beamforming and CQI frame. If all the conditions above are true, then PASS else FAIL.
6	Disassociate STA1 from the APUT.			

4.35.3 APUT transmits SU beamforming as the beamformer at 160 MHz test

Objective

This test case verifies that the APUT correctly transmits HE NDPA/NDP and receives non-trigger-based SU full BW sounding feedback.

Applicability: Optional. This test shall be executed only if the APUT declared support for 160 MHz in Table 1.

References

Section 6.5.1.2 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 83 defines the specific parameter values required for this test case.

Table 83. APUT transmits SU beamforming as the beamformer at 160 MHz test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Marvell	N/A
Bandwidth	160 MHz in 5 GHz	160 MHz in 5 GHz
AP control channel	N/A	36 in 5 GHz
Beamformee STS > 80 MHz subfield in HE PHY Capabilities Information field when operating in the 5 GHz band	3	N/A
Transmit data with SU beamforming	N/A	Enabled

Test procedure and expected results

Table 84 provides the specific test procedure and expected results for this test case.

Table 84. APUT transmits SU beamforming as the beamformer at 160 MHz test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 83.	Configure APUT per Table 12 and Table 83.		
2	Configure STA1 to join the APUT's BSS in the 5 GHz band.	Configure the APUT to operate in 80 MHz channel bandwidth in 5 GHz band.		SN:

Step	Test bed STA1	APUT	Test bed validation	Expected result
		The APUT sends Beacon and Probe Response frames to STA1.		Verify the following in the HE PHY Capabilities Information field in the Beacon and Probe Response frames: 1. SU Beamformer subfield (B31) = 1. 2. Number of Sounding Dimensions > 80 MHz subfield (B40:B42) is not set to 0. If all the conditions above are true, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.	SN: Verify the following in the HE PHY Capabilities Information field in the Association Request frame: 1. SU Beamformee STS > 160 MHz 2. (B37:39) is set to ≥ 3	If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: Verify the following in the HE PHY Capabilities Information field in the Association Response frame: 1. SU Beamformer subfield (B31) = 1 2. Number of Sounding Dimensions > 80 MHz subfield (B40:B42) is not set to 0 If all the conditions above are true, then CONTINUE else FAIL.
4		Configure the APUT to disable trigger-based sounding for SU feedback. RUN: PING <STA1_IP_ADDR> COUNT=90 Note that the APUT is expected to initiate sounding protocol against STA1.	a. STA1 transmits a HE Compressed Beamforming and CQI frame as the frame that follows the HE NDP transmitted by APUT. b. The HE MIMO Control field in the HE Compressed Beamforming and CQI frame transmitted by STA1 has the following format: ▪ BW = 3 (160 MHz) ▪ Nc Index (B0:B2) ≤ Nr Index (B3:B5) ▪ Nr Index (B3:B5) ≥ 1	If the ping is successful within 90 seconds, then CONTINUE, else FAIL. SN: Verify the following conditions are true: 3. APUT transmits HE NDP Announcement frame followed by an HE NDP with the following format: a. NDP Announcement frame: ▪ RA field is set to STA1's MAC address ▪ If the NDP Announcement frame was transmitted using the non-HT/non-HT duplicate format, then the Individual/Group bit of the TA field = 1 (Signaling TA) ▪ B1 of the Sounding Dialog Token field = 1 (HE NDP Announcement frame) 4. Only a Single STA Info subfield is present with: ▪ AID11 (B0:B10) = STA1's AID 11 ▪ RU Start Index (B11:B17) = 0 ▪ RU End Index (B18:B24) = 73 (Full BW at 160 MHz) ▪ Feedback Type and Ng (B25:B26) = 0 ▪ Disambiguation (B27) = 1 ▪ Codebook Size (B28) = 0 (reserved for SU) ▪ Nc (B29:B31) = 0 (reserved for SU)

Step	Test bed STA1	APUT	Test bed validation	Expected result
				5. Verify that the APUT transmits NDP frame using HE SU PPDU format,and verify that the HE-SIG-A fields are set to: a. Bandwidth subfield (B19:B20) = 0 (20 MHz) b. GI+LTF Size subfield (B21:B22) = 1 (2x HE-LTF and 0.8 µs GI) or 2 (2x HE-LTF and 1.6 µs GI) c. 1 ≤ NSTS And Midamble Periodicity (B23:B25) subfield ≤ 3 d. BSS_COLOR is set to the value indicated in the BSS Color subfield of the HE Operation element transmitted by the APUT 6. TxBF subfield (B10) of HE-SIG-A2 in at least one HE SU PPDU transmitted by the APUT = 1 after STA1 transmits an HE Compressed Beamforming and CQI frame. 7. Ping request in a PPDU with TxBF = 1 is successful after STA1 transmits the HE Compressed Beamforming and CQI frame. If all the conditions above are true, then PASS else FAIL.
5	Disassociate STA1 from the APUT.			

4.36 APUT transmits MCS 8-9 in MU PPDU tests

4.36.1 APUT transmits MCS 8-9 in MU PPDU test

Objective

This test case verifies that the APUT correctly transmits MCS 8-9 in MU PPDUs.

Applicability: Optional. This test shall be executed only if the DUT declared support for MCS 8-9 in Table 1.

References

6.4.1.4 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 85 defines the specific parameter values required for this test case.

Table 85. APUT transmits MCS 8-9 in MU PPDU test configuration

Parameter	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed STA4 value	APUT value
Test bed vendor	Marvell	Broadcom75	Intel200W	Qualcomm	N/A
AP control channel	N/A	N/A	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	N/A	N/A	N/A	N/A	HE_MU (DL OFDMA)
Number of users in each OFDMA transmission	N/A	N/A	N/A	N/A	4
LDPC Coding in Payload in 2.4 GHz	Disabled	Disabled	Disabled	Disabled	N/A
Max HE-MCS for 1 SS subfield and Max HE-	1	1	1	1	Default

Parameter	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed STA4 value	APUT value
MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field					

Test procedure and expected results

Table 86 provides the specific test procedure and expected results for this test case.

Table 86. APUT transmits MCS 8-9 in MU PPDU test procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 85. Configure STA1 to use 1 SS.	Configure STA2 per Table 6 and Table 85 Configure STA2 to use 1 SS.	Configure STA3 per Table 6 and Table 85. Configure STA3 to use 1 SS.	Configure STA4 per Table 6 and Table 85. Configure STA4 to use 1 SS.	Configure the APUT per Table 12 and Table 85. Configure the APUT to transmit using DL OFDMA.		
If the APUT supports 2.4 GHz, go to Step 2, else go to Step 12.							
2					Configure the APUT to the 2.4 GHz band. The APUT sends Beacon and Probe Response frames to the STAs.		SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon / Probe Response frame is set to 1 or 2, then CONTINUE else FAIL. Else If both of Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon and Probe Response framea = 1 or 2, then CONTINUE else FAIL.
3	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	Configure STA2 to join the APUT's BSS in the 2.4 GHz band.	Configure STA3 to join the APUT's BSS in the 2.4 GHz band.	Configure STA4 to join the APUT's BSS in the 2.4 GHz band.			

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
4	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to the STAs.		If any one of the STA(s) association fails, then FAIL else CONTINUE. SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame is set to 1 or 2, then CONTINUE else FAIL. Else If both of Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame = 1 or 2, then CONTINUE else FAIL.
5	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	ADDBA Response frame to the APUT with Buffer Size ≤ 64.	ADDBA Response frame to the APUT with Buffer Size ≤ 64.	ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to the STAs.		
6					Configure the APUT to transmit using DL OFDMA. Run script HE1-DLOFDMA-APUT.txt to the STAs.		Verify that the throughput is > 4361S6_TP_1SS_24G. Verify that Aggregate throughput is >4361S6_ATP_1SS_24G SN: Verify the HE PPDUs transmitted by the APUT contains: 1. HE-SIG-A1, Bandwidth field (B19, B20) = 0 (20 MHz) 2. At least 4361S6_MU_1SS_24G% of captured HE PPDUs are MU PPDUs. 3. RU Allocation subfield in the HE-SIG-B common content indicates allocation to 4 users in at least 80% of MU PPDUs. 4. Verifythat the MCS subfield (B15-B18) is set to 9. In each one of

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							the 4 User fields andNSTS subfield (B11-B13) is set to 0 (1 SS) If all the conditions above are true, then CONTINUE else FAIL.
7	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			If the DUT is MAP and supports only 1SS, then PASS else CONTINUE
8	Reconfigure STA1 to use 2 SS.	Reconfigure STA2 to use 2 SS.	Reconfigure STA3 to use 2 SS.	Reconfigure STA4 to use 2 SS.			
9	Repeat Steps 3-5.	Repeat Steps 3-5.	Repeat Steps 3-5.	Repeat Steps 3-5.	Repeat Steps 3-5.		If the verification in Steps 3-5 is successful, then CONTINUE else FAIL.
10					Configure the APUT to transmit using DL OFDMA. Run script HE1-DLOFDMA-APUT.txt to the STAs.		Verify that the throughput is > 4361S10_TP_2SS_24G. Verify that Aggregate throughput is >4361S10_ATP_2SS_24G. SN: Verify the HE PPDUs transmitted by the APUT contains: 1. HE-SIG-A1, Bandwidth field (B19, B20) = 0 (20 MHz) 2. At least 4361S10_MU_2SS_24G% of captured HE PPDUs are MU PPDUs. 3. RU Allocation subfield in the HE-SIG-B common content indicates allocation to 4 users in at least 4361S10_MU_2SS_24G% of MU PPDUs. 4. Verifythat the HE-MCS subfield (B15-B18) = 9 in each of the 4 User fields, and NSTS subfield (B11-B13) = 1 (2 SS) If all the conditions above are true, then CONTINUE else FAIL.
11	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 12, else PASS.							
12	Configure STA1 to use 1 SS.	Configure STA2 to use 1 SS.	Configure STA3 to use 1 SS.	Configure STA4 to use 1 SS.	Configure the APUT to the 5 GHz band.		SN: If both of Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
					The APUT sends Beacon and Probe Response frames to the STAs.		subfield in Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon and Probe Response frames = 1 or 2, then CONTINUE else FAIL.
13	Configure STA1 to join the APUT BSS in the 5 GHz band.	Configure STA2 to join the APUT BSS in the 5 GHz band.	Configure STA3 to join the APUT BSS in the 5 GHz band.	Configure STA4 to join the APUT BSS in the 5 GHz band.			
14	Repeat Steps 4-5.	Repeat Steps 4-5.	Repeat Steps 4-5.	Repeat Steps 4-5.	Repeat Steps 4-5.		If the verification in Steps 4-5 is successful, then CONTINUE else FAIL.
15					Configure the APUT to transmit using DL OFDMA. Run script HE1-DLOFDMA-APUT.txt to the STAs.		Verify that the throughput is > 4361S15_TP_1SS_5G. Verify that Aggregate throughput is >4361S15_ATP_1SS_5G SN: Verify the HE PPDUs transmitted by the APUT contains: 1. HE-SIG-A1, Bandwidth field (B19, B20) = 2 (80 MHz) 2. At least 4361S15_MU_1SS_5G% of captured HE PPDUs are MU PPDUs. 3. RU Allocation subfield in the HE-SIG-B common content indicates allocation to 4 users in at least 4361S15_MU_1SS_5G% of MU PPDUs. 4. Verifythat the HE-MCS subfield (B15-B18) = 9 in each one of the 4 User fields, and NSTS subfield (B11-B13) = 0 (1 SS) If all the conditions above are true, then CONTINUE else FAIL.
16	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			
17	Reconfigure STA1 to use 2 SS.	Reconfigure STA2 to use 2 SS.	Reconfigure STA3 to use 2 SS.	Reconfigure STA1 to use 2 SS.			
18	Configure STA1 to join the APUT BSS in the 5 GHz band.	Configure STA2 to join the APUT BSS in the 5 GHz band.	Configure STA3 to join the APUT BSS in the 5 GHz band.	Configure STA4 to join the APUT BSS in the 5 GHz band.			

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
19	Repeat Steps 4-5.	Repeat Steps 4-5.	Repeat Steps 4-5.	Repeat Steps 4-5.	Repeat Steps 4-5.		If the verification in Steps 4-5 is successful, then CONTINUE else FAIL.
20					Configure the APUT to transmit using DL OFDMA. Run script HE1-DLOFDMA-APUT.txt to the STAs.		Verify that the throughput is > 4361S20_TP_2SS_5G. Verify that Aggregate throughput is >4361S20_ATP_2SS_5G SN: Verify the HE PPDUs transmitted by the APUT contains: 1. HE-SIG-A1, Bandwidth field (B19, B20) = 0 (20 MHz) 2. At least 4361S20_MU_2SS_5G% of captured HE PPDUs are MU PPDUs. 3. RU Allocation subfield in the HE-SIG-B common content indicates allocation to 4 users in at least 4361S20_MU_2SS_5G% of MU PPDUs. 4. Verifythat the HE-MCS subfield (B15-B18) = 9 in each one of the 4 User fields, and NSTS subfield (B11-B13) = 1 (2 SS) If all the conditions above are true, then PASS else FAIL.
21	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			

4.37 APUT transmits MCS 10-11 in MU PPDU tests

4.37.1 APUT transmits MCS 10-11 in MU PPDU test

Objective

This test case verifies that the APUT correctly transmits MCS 10-11 in MU PPDUs in the 5 GHz band.

Applicability: Optional. This test shall be executed only if the APUT declared support for MCS 10-11 in Table 1.

References

6.4.1.5 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 87 defines the specific parameter values required for this test case.

Table 87. APUT transmits MCS 10-11 in MU PPDU test configuration

Parameter	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed STA4 value	APUT value
Test bed vendor	Broadcom98	Cypress	Intel200W	Marvell	N/A
AP control channel	N/A	N/A	N/A	N/A	36 in 5 GHz
Bandwidth	80 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz
PPDU format	N/A	N/A	N/A	N/A	HE_MU (DL OFDMA)
Number of users in each OFDMA transmission	N/A	N/A	N/A	N/A	4
Max HE-MCS for 1 SS subfield, Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field	2	2	2	2	N/A

Test procedure and expected results

Table 88 provides the specific test procedure and expected results for this test case.

Table 88. APUT transmits MCS 10-11 in MU PPDU test procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 87. Configure STA1 to use 1 SS.	Configure STA2 per Table 6 and Table 87. Configure STA2 to use 1 SS.	Configure STA3 per Table 6 and Table 87. Configure STA3 to use 1 SS.	Configure STA4 per Table 6 and Table 87. Configure STA4 to use 1 SS.	Configure APUT per Table 12 and Table 87. Configure the APUT to transmit using DL OFDMA.		
2					Configure the APUT to the 5 GHz band. The APUT sends Beacon and Probe Response frames to the STAs.		SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon / Probe Response frame is set to 2, then CONTINUE else FAIL. Else If both of Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon and Probe Response frames = 2, then CONTINUE else FAIL.
3	Configure STA1 to join the APUT's BSS in the 5 GHz band.	Configure STA2 to join the APUT's BSS in the 5 GHz band.	Configure STA3 to join the APUT's BSS in the 5 GHz band.	Configure STA4 to join the APUT's BSS in the 5 GHz band.			
4	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to the STAs.		If any one of the STA(s) association with the APUT fails, then FAIL else CONTINUE. SN: If the DUT is MAP and supports only 1SS, If the Max HE-MCS for 1 SS subfield in the Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							Association Response frame is set to 2, then CONTINUE else FAIL. Else If both of Max HE-MCS for 1 SS subfield and Max HE-MCS for 2 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Response frame = 2, then CONTINUE else FAIL.
5	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to the STAs.		
6					Configure the APUT to transmit using DL OFDMA. Run script HE1-DLOFDMA-APUT.txt to the STAs.		Verify that the throughput is > 4371S6_1SS_TP_5G. Verify that the aggregate throughput is >4371S6_1SS_ATP_5G SN: Verify the HE PPDUs transmitted by the APUT contains: 1. HE-SIG-A1, Bandwidth field (B19, B20) = 2 (80 MHz) 2. At least 4371S6_1SS_MU_5G% of captured HE PPDUs are MU PPDUs. 3. At least 80% of MU all PPDUs have the RU Allocation subfield in the HE-SIG-B common content indicating allocation set to 4 users 4. DL MU transmission to each STA and check that the HE-MCS subfield (B15-B18) = 11. 5. In each one of the 4 User fields, NSTS subfield (B11-B13) = 0 (1 SS) If all the conditions above are true, then CONTINUE else FAIL.
7	STA1 disassociate s from the APUT.	STA2 disassociate s from the APUT.	STA3 disassociate s from the APUT.	STA4 disassociates from the APUT.			If the DUT is MAP and supports only 1SS, then PASS else CONTINUE
8	Reconfigure STA1 to use 2 SS.	Reconfigure STA2 to use 2 SS.	Reconfigure STA3 to use 2 SS.	Reconfigure STA4 to use 2 SS.			

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
9	Repeat Steps 2-5.	Repeat Steps 2-5.	Repeat Steps 2-5.	Repeat Steps 2-5.	Repeat Steps 2-5.		If the verification in Steps 2-5 is successful, then CONTINUE else FAIL.
10					Configure the APUT to transmit using DL OFDMA. Run script HE1-DLOFDMA-APUT.txt to the STAs.		Verify that the throughput is > 4371S10_2SS_TP_5G. Verify that the aggregate throughput is >4371S10_2SS_ATP_5G SN: Verify the HE PPDUs transmitted by the APUT contains: 1. HE-SIG-A1, Bandwidth field (B19, B20) = 2 (80 MHz) 2. At least 4371S10_2SS_MU_5G% of captured HE PPDUs are MU PPDUs. 3. At least 50% of MU PPDU packets have RU Allocation subfield in the HE-SIG-B common content indicating allocation set to 4 users. 4. DL MU transmission to each STA and check that the HE-MCS subfield (B15-B18) = 11. 5. In each one of the 4 or 2 User fields, NSTS subfield (B11-B13) = 1 (2 SS) If all the conditions above are true, then PASS else FAIL.
11	STA1 disassociate s from the APUT.	STA2 disassociate s from the APUT.	STA3 disassociate s from the APUT.	STA4 disassociates from the APUT.			

4.38 APUT transmits 160 MHz PPDU tests

4.38.1 APUT transmits 160 MHz PPDU test

Objective

This test case tests that the APUT correctly transmits HE PPDUs in the 160 MHz bandwidth.

Applicability: Optional. This test shall be executed only if the APUT declared support for 160 MHz bandwidth in Table 1.

References

Section 6..4.1.7 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 89 defines the specific parameter values required for this test case.

Table 89. APUT transmits 160 MHz PPDU configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Intel200L	N/A
AP control channel	N/A	36 in 5 GHz
Channel bandwidth	160 MHz in 5 GHz	160 MHz in 5 GHz
Preamble format	HE_SU	HE_SU

Test procedure and expected results

Table 90 provides the specific test procedure and expected results for this test case.

Table 90. APUT transmits 160 MHz PPDU procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 89.	Configure per Table 12 and Table 89.		
2	Configure STA1 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to STA1.		SN: Verify the following conditions are true: 1. B2 of the Channel Width Set in HE PHY Capabilities Information field within HE Capabilities element in the

Step	Test bed STA1	APUT	Test bed validation	Expected result
				Beacon and Probe Response frames transmitted by the APUT = 1 (support for a 160 MHz width). 2. Beacon and Probe Response frames transmitted by the APUT contains the VHT Capabilities element, verify that the Maximum NSS defined by Rx VHT-MCS Map field and Extended NSS BW Support field in the VHT Capabilities element at 160 MHz is not more than the maximum NSS defined by its Rx HE-MCS Map For 160 MHz field in the HE Capabilities element at 160 MHz. 3. VHT Operation element is present in Beacon and Probe Response frames transmitted by the APUT, and VHT Operation Information Present subfield in HE Operation element = 0, OR VHT Operation element is not present in Beacon/Probe Response frames transmitted by the APUT, and VHT Operation Information Present subfield in HE Operation element = 1. 4. STA Channel Width field in HT Operation element = 1, and Channel Width field in VHT Operation Information field = 1. 5. Either C1 or C2 is true in the Beacon and Probe Response frames transmitted by the APUT: C1: • Supported Channel Width subfield in VHT Capabilities element = 1 and the Extended NSS BW Support field VHT Capabilities element is not equal to 3, or the Supported Channel Width Subfield in VHT Capabilities element = 2 and the Extended NSS BW Support field VHT Capabilities element is not equal to 3 • In VHT Operation Information field (carried in either VHT Operation Element or HE Operation Element) Channel Center Frequency Segment 0 subfield = 42 and Channel Center Frequency Segment 1 subfield = 50 • Channel Center Frequency Segment 2 subfield in HT Operation element = 0 C2: • Supported Channel Width Subfield in VHT Capabilities element = 0 • Extended NSS BW support subfield in VHT Capabilities element > 0 • In VHT Operation Information field (carried in either VHT Operation Element or HE Operation Element) Channel Center Frequency Segment 0 subfield = 42, and Channel Center Frequency Segment 1 subfield = 0

Step	Test bed STA1	APUT	Test bed validation	Expected result
				• Channel Center Frequency Segment 2 subfield in HT Operation element = 50 If all the conditions above are true, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Response frame to the APUT.	The APUT sends an ADDBA Request frame to STA1.		
5		Run: PING <STA1_IP_ADDR> SIZE = 1000 COUNT = 90		If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL. SN: If the PPDUs transmitted by the APUT contain the HE-SIG-A field with the Bandwidth field (B19-B20) = 3 (160 MHz), then PASS else FAIL.

4.39 APUT receives 160 MHz PPDU tests

4.39.1 APUT receives 160 MHz PPDU test

Objective

This test case verifies that the APUT correctly receives HE PPDUs in the 160 MHz bandwidth.

Applicability: Optional. This test shall be executed only if the APUT declared support for 160 MHz bandwidth in Table 1.

References

6..4.1.7 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 91 defines the specific parameter values required for this test case.

Table 91. APUT receives 160 MHz PPDU configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Marvell	N/A
AP control channel	N/A	36 in 5 GHz
Channel bandwidth	160 MHz in 5 GHz	160 MHz in 5 GHz
Preamble format	HE_SU	HE_SU

Test procedure and expected results

Table 92 provides the specific test procedure and expected results for this test case.

Table 92. APUT receives 160 MHz PPDU procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 91.	Configure the APUT per Table 12 and Table 91.		
2	Configure STA1 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to STA1.		SN: Verify the following conditions are true: 1. B1 and B2 of the Channel Width Set in HE PHY Capabilities Information field within HE Capabilities

Step	Test bed STA1	APUT	Test bed validation	Expected result
				element in Beacon and Probe Response frames transmitted by the APUT = 1 (support for a 160 MHz width). 2. VHT Operation element is present in Beacon and Probe Response frames transmitted by the APUT, and VHT Operation Information Present subfield in HE Operation element = 0, OR VHT Operation element is not present in Beacon/Probe Response frames transmitted by the APUT, and VHT Operation Information Present subfield in HE Operation element = 1. 3. STA Channel Width field in HT Operation element is set to 1, and Channel Width field in VHT Operation Information field = 1 4. Either C1 or C2 is true in the Beacon and Probe Response frames transmitted by the APUT: C1: 5. Supported Channel Width subfield in VHT Capabilities element = 1 and the Extended NSS BW Support field in the VHT Capabilities element is not equal to 3, or the Supported Channel Width subfield in the VHT Capabilities element = 2 and the Extended NSS BW Support field in the VHT Capabilities element not equal to 3 6. In VHT Operation Information field (carried in either VHT Operation Element or HE Operation Element) Channel Center Frequency Segment 0 subfield = 42 and Channel Center Frequency Segment 1 subfield = 50 7. Channel Center Frequency Segment 2 subfield in HT Operation element = 0 C2: 8. Supported Channel Width Subfield in VHT Capabilities element = 0 9. Extended NSS BW support subfield in VHT Capabilities element > 0 10. In VHT Operation Information field (carried in either VHT Operation Element or HE Operation Element) Channel Center Frequency Segment 0 subfield = 42, and Channel Center Frequency Segment 1 subfield = 0 11. Channel Center Frequency Segment 2 subfield in HT Operation element= 50 If all the conditions above are true, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT.	The APUT sends an ADDBA Response frame to STA1.		

Step	Test bed STA1	APUT	Test bed validation	Expected result
5	Configure STA1 to transmit 160 MHz PPDUs. Run: PING <APUT_IP_ADDR> SIZE = 1000 COUNT = 90			If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then PASS else FAIL.

4.40 AP UL OFDMA PHY tests

Objective

This test case verifies that the APUT correctly receives UL OFDMA packets with correct PHY parameters.

Applicability: If the APUT declared primary device category as AP in Table 1 **,**Test cases 4.40.1, 4.40.2, 4.40.4, and 4.40.5 are Mandatory. Test case 4.40.3 is Conditional and shall be mandatory only if the APUT declared support for LDPC in Table 1.

If the APUT declared primary device category as Mobile AP in Table 1**,** Test cases 4.40.1, 4.40.2, 4.40.4, and 4.40.5 are Conditional Mandatory if iTWT is supported. 4.40.3 is Conditional and shall be mandatory only if the APUT declared support for LDPC in Table 1.

References

Section 6.3.1.2 [1]

Section 26.5.3 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 93 defines the specific parameter values required for this test case.

Table 93. AP UL OFDMA PHY test configuration

Parameter	APUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed STA4 value
Test bed vendor (4.40.1)	N/A	Cypress	Intel200W	Broadcom98	Qualcomm
Test bed vendor (4.40.2)	N/A	Broadcom75	Intel200W	Cypress	Intel200L
Test bed vendor (4.40.3)	N/A	Qualcomm	Broadcom75	Cypress	Intel200L
Test bed vendor (4.40.4)	N/A	Marvell	Broadcom75	Intel200L	Qualcomm
Test bed vendor (4.40.5)	N/A	Qualcomm	Intel200L	Broadcom75	Broadcom98
AP Control Channel	36 in 5 GHz 6 in 2.4 GHz	N/A	N/A	N/A	N/A
Bandwidth	80 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz

	20 MHz in 2.4 GHz	20 MHz in 2.4 GHz	20 MHz in 2.4 GHz	20 MHz in 2.4 GHz	20 MHz in 2.4 GHz
PPDU Format	Rx HE_TRIG (UL OFDMA)	N/A	N/A	N/A	N/A
Number of spatial streams	Default	2/1	2/1	2/1	2/1
MU functionality	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA
Coding in payload for transmit	N/A	BCC/LDPC	BCC/LDPC	BCC/DPC	BCC/LDPC
Testbed STA included in the test (Yes or No)	NA	Yes	If DUT is MAP, then NO Else YES	If DUT is MAP, then NO Else YES	If DUT is MAP, then NO Else YES

4.40.1 APUT UL OFDMA at 2.4 GHz using one spatial streams BCC coding test

Test procedure and expected results

Table 94 provides the specific test procedure and expected results for this test case.

Table 94. APUT UL OFDMA at 2.4 GHz using one spatial streams BCC coding procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 93. Configure for MU EDCA override as per Table 7.	Configure STA2 per Table 6 and Table 93. Configure for MU EDCA override as per Table 7.	Configure STA3 per Table 6 and Table 93. Configure for MU EDCA override as per Table 7.	Configure STA4 per Table 6 and Table 93. Configure for MU EDCA override as per Table 7.	Configure the APUT per Table 12 and Table 93. Configure the APUT to receive using UL OFDMA.		
2	Configure STA1 to use 1 spatial stream.	Configure STA2 to use 1 spatial stream.	Configure STA3 to use 1 spatial stream.	Configure STA4 to use 1 spatial stream.	Configure the APUT to the 2.4 GHz band. The APUT sends Beacon and Probe Response frames to the STAs.		
3	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.			
4	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If DUT is MAP, If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. Else If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
5	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA with Request frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends ADDBA Response frames to the STAs.		SN: If each of the APUT ADDBA Response frames Buffer Size is ≤ 64, then CONTINUE else FAIL.
6					If DUT is MAP, Configure the APUT to transmit Trigger frames in Non-HT, or		

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
					HE SU PPDU format to solicit TB PPDU from STA1 Else Configure the APUT to transmit Trigger frames in Non-HT, or HE SU PPDU format to solicit TB PPDU from STA1, STA2, STA3 and STA4.		
7	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt.			SN: Verify that the following conditions are true: 1. If DUT is MAP, APUT transmits Basic Trigger to solicit frames from STA1, and the RA is STA1 MAC address Else APUT transmits Basic Trigger to solicit frames from STA1, STA2, STA3 and STA4 and the RA is broadcast as a MAC address 2. Trigger Common Info Field contains: a. Trigger Type = 0 (Basic) b. UL BW = 0 (20 MHz) c. UL Length > 0 d. GI+LTF = 1 or 2 e. AP Tx Power is one of 0-60 f. MU-MIMO LTF Mode=0 g. UL STBC=0 h. Doppler=0 i. More TF= 0 3. If DUT is MAP, then all Trigger frames have STA1 user info filed with AID12= STA1's AID and Else Sequentially capture at least 1000 Trigger frames and ensure that 95% have four Trigger User Info fields containing:

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							a. AID12 = STA1's AID, STA2's AID, STA3's AID, STA4's AID b. UL MCS = 7 c. UL FEC Coding type = 0 (BCC) d. UL DCM = 0 e. SS Allocation /RA-RU Information set to: ▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 0 f. UL Target RSSI is one of 0-90 and 127 g. TID aggregation Limit = 1 h. Number of HE-LTF Symbols And Midamble Periodicity ≤ 4 4. If the DUT is MAP, then STA1 throughput ≥4401S7_STA_TP_24G Else Aggregated throughput is ≥ 4401S7_ATP_24G and Throughput of each STA ≥ 4401S7_STA_TP_24G /4*(1 - 4401S7_DELTA_24G) If all the above conditions are true, then PASS else FAIL.
8	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			

4.40.2 APUT UL OFDMA at 2.4 GHz using two spatial streams BCC coding test

Test procedure and expected results

Table 95 provides the specific test procedure and expected results for this test case.

Table 95. APUT UL OFDMA at 2.4 GHz using two spatial streams BCC coding procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 to use 2 spatial streams. Configure for MU EDCA override as per Table 7	Configure STA2 to use 2 spatial streams. Configure for MU EDCA override as per Table 7.	Configure STA3 to use 2 spatial streams. Configure for MU EDCA override as per Table 7	Configure STA4 to use 2 spatial streams. Configure for MU EDCA override as per Table 7	Configure the APUT to receive using UL OFDMA.		
2	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.			
3	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If DUT is MAP, If the association between the APUT and STA1, is successful, then CONTINUE else FAIL. Else If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Response frame to STA1, STA2, STA3, STA4.		
5					If DUT is MAP, Configure the APUT to transmit Trigger frames in in Non-HT, or HE SU PPDU format to solicit TB PPDU from STA1, Else Configure the APUT to transmit Trigger frames in in Non-HT,		

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
					or HE SU PPDU format to solicit TB PPDU from STA1, STA2, STA3 and STA4.		
6	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt to STAUT.	Run script HE1-ULOFDMA-APUT.txt.			SN: If the verification is the same as Step 7 of 4.40.1 except: 1. If DUT is MAP, Trigger frame has STA1 user info filed with : Else Sequentially capture at least 1000 Trigger frames and ensure that 95% have four Trigger User Info fields with: a. SS Allocation/RA-RU Information set to: ▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 1 b. Number of HE-LTF Symbols And Midamble Periodicity != 0 2. If DUT is MAP, throughput of STA is ≥4402S6_STA_TP_24G Else Throughput of each STA ≥ 4402S6_STA_TP_24G / 4*(1 - 4402S6_DELTA_24G) then CONTINUE else FAIL.
7	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			If DUT is MAP, then PASS else CONTINUE
8	Configure STA1 to use 2 spatial streams.	Configure STA2 to use 1 spatial stream.	Configure STA3 to use 2 spatial streams.	Configure STA4 to use 1 spatial stream.			

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
9	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.			
10	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
11	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤= 64.	STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends ADDBA Response frames to STA1, STA2, STA3, STA4 with Buffer Size ≤ 64.		
12					Configure the APUT to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STA4.		
13	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txtto STAUT.	Run script HE1-ULOFDMA-APUT.txt.			SN: If the verification is the same as Step 7 of 4.40.1 except: 1. Sequentially capture at least 1000 Trigger frames and ensure that 95% have four Trigger User Info fields with: a. SS Allocation /RA-RU Information for STA2 and STA4 set to: ▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 0 b. SS Allocation /RA-RU Information for STA1 and STA3 ▪ Starting Spatial Stream = 0

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							▪ Number of Spatial Streams = 1 c. Number of HE-LTF Symbols And Midamble Periodicity != 0 2. Check aggregated throughput is > 4402S13_ATP_24G then CONTINUE else FAIL.
14	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			If all conditions above are true, then PASS else FAIL.

4.40.3 APUT UL OFDMA at 2.4 GHz using two spatial streams LDPC coding test

Test procedure and expected results

Table 96 provides the specific test procedure and expected results for this test case.

Table 96. APUT UL OFDMA at 2.4 GHz using two spatial streams LDPC coding procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 to use 2 spatial streams. Configure Coding to LDPC. Configure for MU EDCA override as per Table 7.	Configure STA2 to use 2 spatial streams. Configure Coding to LDPC. Configure for MU EDCA override as per Table 7.	Configure STA3 to use 2 spatial streams. Configure Coding to LDPC. Configure for MU EDCA override as per Table 7.	Configure STA4 to use 2 spatial streams. Configure Coding to LDPC. Configure for MU EDCA override as per Table 7.	Configure APUT to receive using UL OFDMA. Configure the APUT to use LDPC.		
2					If DUT is MAP, Configure the APUT to transmit Trigger frames in in Non-HT, or HE SU PPDU format to solicit TB PPDU from STA1, Else Configure the APUT to transmit Trigger frames in in Non-HT, or HE SU PPDU format to solicit TB PPDU from STA1, STA2, STA3 and STA4.		
3	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt to STAUT.	Run script HE1-ULOFDMA-APUT.txt.			SN: If the verification is the same as Step 7 of 4.40.1 except: 1. If DUT is MAP, Trigger frame has user info field for STA1 with: Else Sequentially capture at least 1000 Trigger frames and ensure that 95% have four Trigger User Info fields with:

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							a. SS Allocation /RA-RU Information set to: ▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 1 b. UL FEC Coding type = 1 (LDPC) c. Number of HE-LTF Symbols And Midamble Periodicity != 0 2. If DUT is MAP,STA1 througput is ≥ 4403S3_STA_TP_24G Else Aggregated Throughput is ≥ 4403S3_ATP_24G and If throughput of each STA ≥ 4403S3_STA_TP_24G / 4*(1 - 4403S3_DELTA_24G). then PASS else FAIL.

4.40.4 APUT ULOFDMA at 5 GHz using one spatial stream LDPC coding test

Test procedure and expected results

Table 97 provides the specific test procedure and expected results for this test case.

Table 97. APUT ULOFDMA at 5 GHz using one spatial stream procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 to use 1 spatial stream. Configure for MU EDCA override as per Table 7.	Configure STA2 to use 1 spatial stream. Configure for MU EDCA override as per Table 7.	Configure STA3 to use 1 spatial stream. Configure for MU EDCA override as per Table 7.	Configure STA4 to use 1 spatial stream. Configure for MU EDCA override as per Table 7.	Configure APUT to the 5 GHz band. The APUT sends Beacon and Probe Response frames to the STAs.		
2	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.			
3	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If the DUT is MAP, , If the association between the APUT and STA1 is successful, then CONTINUE else FAIL Else If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends ADDBA Response frames to the STAs.		SN: If each of the APUT ADDBA Response frames Buffer Size is ≤ 64, then CONTINUE else FAIL.
5					If DUT is MAP, Configure the APUT to transmit Trigger frames in Non-HT, Non-HT duplicate, or HE SU PPDU format to solicit TB PPDU from STA1 Else Configure the APUT to transmit Trigger		

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
					frames in Non-HT, Non-HT duplicate, or HE SU PPDU format to solicit TB PPDU from STA1, STA2, STA3 and STA4.		
6	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt.			SN: Verify that the following conditions are true: 1. If the DUT is MAP, APUT transmits Basic Trigger to solicit frames from STA1, using RA as the STA1 MAC address Else APUT transmits Basic Trigger to solicit frames from STA1, STA2, STA3 and STA4 using RA as the broadcast MAC address 2. Trigger Common Info Field contains: a. Trigger Type = 0 (Basic) b. UL BW = 2 (80 MHz) c. UL Length > 0 d. GI+LTF = 1 or 2 e. AP Tx Power is one of 0-60 f. MU-MIMO LTF Mode=0 g. UL STBC=0 h. Doppler=0 i. More TF = 0 3. If DUT is MAP, Trigger frame has User info field with: Else Sequentially capture at least 1000 Trigger frames and ensure that 95% have four Trigger User Info fields with: a. AID12 = STA1's AID(Only STA1 AID if DUT is MAP), STA2's AID, STA3's AID, STA4's AID

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							b. UL MCS is MCS 7 c. UL FEC Coding type = 1 (LDPC) d. UL DCM = 0 e. SS Allocation /RA-RU Information set to: ▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 0 f. UL Target RSSI is one of 0-90 and 127 g. TID aggregation Limit = 1 h. Number of HE-LTF Symbols And Midamble Periodicity ≤ 4 4. Verify that there is an RU allocation in all the 20 MHz channels used to send the Trigger frame 5. Verify PE Disambiguity subfield within the UL Packet Extension subfield is valid per [7] 6. If DUT is a MAP, STA1 throughput is ≥4404S6_STA_TP_5G Else Aggregate throughput is ≥ 4404S6_ATP_5G and Throughput of each STA ≥4404S6_STA_TP_5G / 4*(1 - 4404S6_DELTA_5G) If all the above conditions are true, then PASS, else FAIL.
7	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			

4.40.5 APUT UL OFDMA at 5 GHz using two spatial streams LDPC coding test

Test procedure and expected results

Table 98 provides the specific test procedure and expected results for this test case.

Table 98. APUT UL OFDMA at 5 GHz using two spatial streams LDPC coding procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 to use 2 spatial streams. Configure for MU EDCA override as per Table 7.	Configure STA2 to use 2 spatial streams. Configure for MU EDCA override as per Table 7.	Configure STA3 to use 2 spatial streams. Configure for MU EDCA override as per Table 7.	Configure STA4 to use 2 spatial streams. Configure for MU EDCA override as per Table 7.	Configure the APUT to receive using UL OFDMA.		
2	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.			
3	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If the DUT is Mobile AP, If the association between the APUT and STA1 is successful, then CONTINUE else FAIL Else If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	If the DUT is MAP, then The APUT sends ADDBA Response frames to STA1with Buffer Size ≤ 64 Else The APUT sends ADDBA Response frames to STA1, STA2, STA3, STA4 with Buffer Size ≤ 64.		
5					If the DUT is MAP, Configure the APUT to transmit Trigger frames in Non-HT, Non-HT duplicate or		

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
					HE SU PPDU format to solicit TB PPDU from STA1 Else Configure the APUT to transmit Trigger frames in Non-HT, Non-HT duplicate or HE SU PPDU format to solicit TB PPDU from STA1, STA2, STA3 and STA4.		
6	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT to STAUT.txt.	Run script HE1-ULOFDMA-APUT.txt.			SN: If the verification is the same as Step 6 of 4.40.1 except: 1. If the DUT is MAP, Trigger frame has user info field with : Else Sequentially capture at least 1000 Trigger frames and ensure that 95% have four Trigger User Info fields with: a. SS Allocation /RA-RU Information set to: ▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 1 b. Number of HE-LTF Symbols And Midamble Periodicity != 0 2. If DUT is MAP, STA1 throughput ≥4405S6_STA_TP_5G else Throughput of each STA ≥ 4405S6_STA_TP_5G /

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							4*(1 - 4405S6_DELTA_5G) then CONTINUE else FAIL.
7	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			If the DUT is MAP then PASS else CONTINUE
8	Configure STA1 to use 2 spatial streams.	Configure STA2 to use 1 spatial stream.	Configure STA3 to use 2 spatial streams.	Configure STA4 to use 1 spatial stream.			
9	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.			
10	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
11	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends ADDBA Response frames to STA1, STA2, STA3, STA4 with Buffer Size ≤ 64.		
12					Configure the APUT to transmit Trigger frames in Non-HT, Non-HT duplicate or HE SU PPDU format to solicit TB PPDU from STA1, STA2, STA3 and STA4.		
13	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt.	Run script HE1-ULOFDMA-APUT.txt to STAUT.	Run script HE1-ULOFDMA-APUT.txt.			SN: If the verification is the same as Step 6 of 4.40.1 except: 1. Sequentially capture at least 1000 Trigger frames and ensure that 95% have four Trigger User Info fields with: a. SS Allocation /RA-RU Information for STA2 and STA4 set to:

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 1 b. SS Allocation /RA-RU Information for STA1 and STA3 set to: ▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 0 c. Number of HE-LTF Symbols And Midamble Periodicity != 0 2. Aggregate throughput is > 4405S13_ATP_5G then CONTINUE else FAIL.
14	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			
15							If all conditions above are true, then PASS else FAIL.

4.41 APUT basic high efficiency UL MU frame exchange sequence tests

Objective

This test case verifies that the APUT correctly generates Basic Trigger frames to solicit A-MPDUs from STA1 to STA4, and M-BA to acknowledge the received frames in TB PPDU.

Applicability: If the APUT declared primary device category as AP in Table 1, then Mandatory.

If the APUT declared primary device category as Mobile AP in Table 1 ,then Conditional Mandatory if iTWT is supported

References

Section 6.3.1.2 [1]

Section 26.5.3 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 99 defines the specific parameter values required for this test case.

Table 99. APUT basic high efficiency UL MU frame exchange sequence test configuration

Parameter	APUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed STA4 value
Test bed vendor (4.41.1)	N/A	Cypress	Broadcom75	Intel200L	Marvell
Test bed vendor (4.41.2)	N/A	Cypress	Broadcom98	Intel200W	Qualcomm
AP control channel	36 in 5 GHz 6 in 2.4 GHz	N/A	N/A	N/A	N/A
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
MU functionality	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA
Acknowledgment	Configure APUT to transmit M-BA in SU PPDU as the response of frames in TB PPDU	NA	NA	NA	NA

Testbed STA included in the test (Yes or No)	NA	Yes	If DUT is MAP, then NO else YES	If DUT is MAP, then NO else YES	If DUT is MAP, then NO else YES

4.41.1 Basic HE UL MU frame exchange sequence for 2.4 GHz, 20 MHz test

Table 100 provides the specific test procedure and expected results for this test case.

Table 100. Basic HE UL MU frame exchange sequence for 2.4 GHz, 20 MHz procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 99. Configure for MU EDCA override as per Table 7.	Configure STA2 per Table 6 and Table 99. Configure for MU EDCA override as per Table 7.	Configure STA3 per Table 6 and Table 99. Configure for MU EDCA override as per Table 7.	Configure STA4 per Table 6 and Table 99. Configure for MU EDCA override as per Table 7.	Configure the APUT per Table 12 and Table 99.		
2	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to the STAs.		
3	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to the APUT.		If DUT is MAP, If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.. Else If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Response frame to the STAs.		
5	Run script HE1-ULOFDMA-APUT.txt to APUT using AC_BE.	Run script HE1-ULOFDMA-APUT.txt to APUT using AC_BE.	Run script HE1-ULOFDMA-APUT.txt to APUT using AC_BE.	Run script HE1-ULOFDMA-APUT.txt to APUT using AC_BE.			
6					If DUT is MAP, then Configure the APUT to transmit Trigger frames in in Non-HT, or HE SU PPDU format to solicit TB PPDU from STA1 else		SN: Verify the following conditions are true: 1. If the DUT is MAP, APUT transmits Basic Trigger frame in SU PPDU to solicit TB PPDU from STA1 Else

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
					Configure the APUT to transmit Trigger frames in in Non-HT, or HE SU PPDU format to solicit TB PPDU from STA1, STA2, STA3 and STA4.		APUT transmits Basic Trigger frame in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STA4. 2. Trigger frame Common Info fields set as follows. a. Trigger Type = 0 (Basic) b. Length = non-zero value c. More TF = 0 d. CS Required =1 e. BW = 0 (20 MHz) f. GI+LTF = 1 or 2 g. MU-MIMO LTF Mode = 0 h. STBC = 0 i. AP Tx Power = one of 0-60 j. Doppler=0 3. If DUT is MAP, all Trigger frames from APUT contain Trigger user info field containing STA1 AID with Else Sequentially capture at least 1000 Trigger frames and ensure that 95% have four Trigger User Info fields containing AIDs from STA1, STA2, STA3 and STA4 with: a. Target RSSI = one of 0-90 and 127 b. Valid RU allocation for STA1-4 in the RU allocation subfield. c. TID Aggregation Limit (Trigger Dependent User Info) = 1. 4. If DUT is MAP, APUT transmits M-BA in SU PPDU after HE TB PPDU, and RA is STA1 MAC address Else

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							APUT transmits M-BA in SU PPDU after HE TB PPDU, and RA is broadcast MAC address 5. AID setting matches the AID setting in the previously received Trigger frame from the four STA's(or STA1 only if DUT is MAP) AID, and Ack Type (AID TID Info subfield) = 0 6. If DUT is MAP, STA1 throughput ≥ 4411S6_STA_TP_24G Else Aggregate throughput from four STAs ≥ 4411S6_STA_ATP_24G and Throughput of each STA ≥ 4411S6_STA_TP_24G If all conditions are true, then CONTINUE else FAIL.
7	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			PASS

4.41.2 Basic HE UL MU frame exchange sequence for 5 GHz, 80 MHz test

Table 101 provides the specific test procedure and expected results for this test case.

Table 101. Basic HE UL MU frame exchange sequence for 5 GHz, 80 MHz procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 100. Configure for MU EDCA override as per Table 7.	Configure STA2 per Table 6 and Table 100. Configure for MU EDCA override as per Table 7.	Configure STA3 per Table 6 and Table 100. Configure for MU EDCA override as per Table 7.	Configure STA4 per Table 6 and Table 100. Configure for MU EDCA override as per Table 7.	Configure the APUT per Table 12 and Table 100.		
2	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to the STAs.		
3	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If DUT is MAP, then If the association between the APUT and STA1 is successful, then CONTINUE else FAIL Else If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends ADDBA Response frames to the STAs.		
5	Run script HE1-ULOFDMA-APUT.txt to APUT using AC_BE.	Run script HE1-ULOFDMA-APUT.txt to APUT using AC_BE.	Run script HE1-ULOFDMA-APUT.txt to APUT using AC_BE.	Run script HE1-ULOFDMA-APUT.txt to APUT using AC_BE.			
6					If DUT is MAP, then Configure the APUT to transmit Trigger frames in Non-HT, Non-HT duplicate, or HE SU PPDU format		SN: Verify that the following conditions are true: 1. If DUT is MAP, APUT transmits Basic Trigger frame in SU PPDU to solicit TB PPDU from STA1 Else

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
					to solicit TB PPDU from STA1 Else Configure the APUT to transmit Trigger frames in Non-HT, Non-HT duplicate, or HE SU PPDU format to solicit TB PPDU from STA1, STA2, STA3 and STA4.		APUT transmits Basic Trigger frame in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STA4. 2. Common Info field in the Trigger frame includes Trigger Type = 0 (Basic) with format: a. Length = non-zero value b. More TF = 0 c. CS Required =1 d. BW = 2 (80 MHz) e. GI+LTF = 1 or 2 f. MU-MIMO LTF Mode = 0 g. STBC = 0 h. AP Tx Power = one of 0-60 i. Doppler=0 3. If DUT is MAP, APUT transmits all Trigger frames STA1 user info filed with: Else Sequentially capture at least 1000 Trigger frames and ensure that 95% have four Trigger User Info fields containing AIDs of STA1, STA2, STA3 and STA4 with: a. Target RSSI = one of 0-90 and 127 b. A valid RU allocation for STA1-4 in the RU allocation subfield. c. TID Aggregation Limit (Trigger Dependent Info) = 1. If all conditions are true, then CONTINUE else FAIL.
5							SN: Verify the following conditions are true: 1. If DUT is MAP, Verify that the APUT transmits M-BA in SU PPDU after HE TB PPDU using the RA as the STA1 MAC address Else

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							Verify that the APUT transmits M-BA in SU PPDU after HE TB PPDU using the RA as the broadcast MAC address 2. AID setting matches the AID setting in the previously received Trigger frame from the four STA's AID(STA1 AID if DUT is MAP) with Ack Type (AID TID Info subfield) = 0 3. If DUT is MAP, STA1 throughput ≥ 4412S6_STA_TP_5G Else Aggregate throughput from four STAs ≥ 4412S6_STA_ATP_5G andThroughput of each STA ≥ 4412S6_STA_TP_5G If all conditions are true, then PASS else FAIL.
6	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			

4.42 (Deleted)

4.43 APUT Trigger frame MAC padding tests

4.43.1 APUT Trigger frame MAC padding test

Objective

This test case verifies that the APUT correctly generates MAC padding in a Trigger frame as per associated STA capability limits.

Applicability: If the APUT declared primary device category as AP in Table 1, then Mandatory.

If the APUT declared primary device category as Mobile AP in Table 1 ,then Conditional Mandatory if iTWT is supported

References

Section 6.3.1.15

Section 26.5.3.2.3 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 102 defines the specific parameter values required for this test case.

Table 102. APUT Trigger frame MAC padding test configuration

Parameter	APUT value	Test bed STA1 value	Test bed STA2 value
Test bed vendor	N/A	Qualcomm	Broadcom75
AP control channel	36 in 5 GHz 6 in 2.4 GHz	N/A	N/A
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	N/A	N/A
PPDU format	Rx HE_TRIG (UL OFDMA)	N/A	N/A
MU functionality	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA
Testbed STA included in the test (Yes or No)	NA	Yes	If DUT is Mobile AP, NO else YES

Test procedure and expected results

Table 103 provides the specific test procedure and expected results for this test case.

Table 103. APUT Trigger frame MAC padding test procedure and expected results

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
1	If the APUT supports 2.4 GHz, go to Step 2 else go to Step 16.			
2	Configure the APUT per Table 12 and Table 102.	Configure STA1, STA2 per Table 6 and Table 102. Additionally, configure STA1, STA2 for: 1. Operation in 2.4 GHz. 2. MU EDCA override as per Table 7. 3. Trigger frame MAC padding duration to 16 µsec		
3	The APUT sends Beacon and Probe Response frames to the STAs.	Configure STA1, STA2 to join the APUT's BSS.		
4	The APUT sends Association Response frames to the STAs.	STA1, STA2 send an Association Request frame to the APUT.	SN: If DUT is MAP, Verify that STA1 has set the Trigger Frame MAC Padding Duration subfield to value 2 (16 µs) in the HE MAC Capabilities Information field of the HE Capabilities element in the Association Request frame. Else Verify that STA1 and STA2 set the Trigger frame MAC Padding Duration subfield to value 2 (16 µs) in the HE MAC Capabilities Information field of the HE Capabilities element in the Association Request frame.	IF DUT is MAP, the association between the APUT and STA1 is successful, then CONTINUE, else FAIL. Else If the association between the APUT and both STA1 and STA2 is successful, then CONTINUE else FAIL. Capture the AID values for each associated STA.
5	The APUT sends ADDBA Response frames to the STAs.	STA1 and STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.		
6	Configure the APUT to transmit Trigger frames using non-HT PPDU format.			
7		At STA1 and STA2, run script HE1-ULOFDMA-APUT-STA1-STA2.txt to the APUT using AC_BE.		SN: If any of the Trigger frames is sent in PPDU formats other than non-HT PPDU, then FAIL else CONTINUE. SN: Verify that the APUT transmits Trigger frames.

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
				1. If DUT is MAP, A Trigger frame is identified with the User Info fields containing an AID field value corresponding to the AID value indicated in the association response of STA1 in Step 4. Else A Trigger frame is identified with at least one of the User Info fields containing an AID field value corresponding to the AID value indicated in the Association Response frame for any of STA1, STA2 of Step 4. 2. If the AID field of the User Info field in a Trigger frame has a value corresponding to the AID value indicated in the Association Response frame for either STA1 or STA2 of Step 4, then at least 4*N_DBPS bits are present in the PSDU after the last bit of the User Info field addressed to that STA, where N_DBPS is 24, 36, 48, 72, 96, 144, 192 and 216 bits for rate in L-SIG of 6, 9, 12, 18, 24, 36, 48 and 54 Mbps, respectively. 3. Trigger frame is sent in a non-HT or non-HT duplicate PPDU without CCK If all the above conditions are true, then CONTINUE else FAIL.
8	The APUT stops transmitting Trigger frames.	Disassociate STA1, STA2 from the APUT.		If DUT is MAP then PASS Else CONTINUE
9		Reconfigure STA1, STA2 per Table 6 and Table 102. Configure the Trigger frame MAC Padding Duration subfield for each STA to the following values: • STA1 = 0 µsec • STA2 = 16 µsec		
10	The APUT sends Association Response frames to the STAs.	STA1 and STA2 send an Association Request frame to the APUT.	SN: Verify that STA1 sets the Trigger frame MAC Padding Duration subfield to value 0 (0 µs) in the HE MAC Capabilities Information field of the HE Capabilities element in the Association Request frame. SN: Verify that STA2 set the Trigger frame MAC Padding Duration subfield to value 2 (16 µs) in the HE MAC Capabilities Information field of	If the association between the APUT and both STA1 and STA2 is successful, then CONTINUE else FAIL. Capture the AID values for each associated STA.

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
			the HE Capabilities element in the Association Request frame.	
11	The APUT sends ADDBA Response frames to the STAs.	STA1 and STA2 send an ADDBA Request frame to the APUT with Buffer Size ≤ 64.		
12	Configure the APUT to transmit Trigger frames using non-HT PPDU format.			
13		At STA1 and STA2, run script HE1-ULOFDMA-APUT-STA1-STA2.txt to the APUT using AC_BE.		SN: If any of the Trigger frames is sent in PPDU formats other than non-HT PPDU, then FAIL else CONTINUE. SN: Verify that the APUT transmits Trigger frames. 1. A Trigger frame is identified with at least one of the User Info fields containing an AID field value corresponding to the AID value indicated in the Association Response frame for any of STA1 or STA2 of Step 10. 2. If the AID field of the User Info field in a Trigger frame has a value corresponding to the AID value indicated in the Association Response frame for STA2 of Step 10, then at least 4*N_DBPS bits are present in the PSDU after the last bit of the User Info field addressed to that STA, where N_DBPS is 24, 36, 48, 72, 96, 144, 192 and 216 bits for rate in L-SIG of 6, 9, 12, 18, 24, 36, 48 and 54 Mbps, respectively. If all the above conditions are met, then CONTINUE else FAIL.
14	The APUT stops transmitting Trigger frames.	Disassociate STA1, STA2 from the APUT.		
15	If the APUT supports 5 GHz, go to Step 16 otherwise PASS.			
16	Configure the APUT per Table 12 and Table 102.	Configure STA1, STA2 per Table 6 and Table 102. Additionally configure STA1, STA2 for: 3. Operation in 5 GHz 4. MU EDCA override as per Table 9 with Trigger frame MAC padding duration for each STA set to 16 µsec.		
17	The APUT sends Beacon and Probe Response frames to STA1 and STA2.	Configure STA1, STA2 to join the APUT's BSS.		

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
18	The APUT sends Association Response frames to STA1 and STA2.	STA1, STA2 send an Association Request frame to the APUT.	SN: If DUT is MAP, Verify that STA1 has set the Trigger Frame MAC Padding Duration subfield to value 2 (16 µs) in the HE MAC Capabilities Information field of the HE Capabilities element in the Association Request frame. Else Verify that STA1 and STA2 set the Trigger frame MAC Padding Duration subfield to value 2 (16 µs) in the HE MAC Capabilities Information field of the HE Capabilities element in the Association Request frame.	IF DUT is MAP, the association between the APUT and STA1 is successful, then CONTINUE, else FAIL. Else If the association between the APUT and both STA1 and STA2 is successful, then CONTINUE else FAIL. Capture the AID values for each associated STA.
19	The APUT sends ADDBA Response frames to the STAs.	STA1 and STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.		
20	Configure the APUT to transmit Trigger frames using non-HT or non-HT duplicate PPDU format.			
21		At STA1 and STA2, run script HE1-ULOFDMA-APUT-STA1-STA2.txt to the APUT using AC_BE.		SN: If any of the Trigger frames is sent in PPDU formats other than non-HT or non-HT duplicate PPDU, then FAIL else CONTINUE. (NOTE: Sniffer shows both non-HT and non-HT duplicate PPDUs as non-HT PPDUs.) SN: Verify that the APUT transmits Trigger frames. 1. If DUT is MAP, A Trigger frame is identified with the User Info fields containing an AID field value corresponding to the AID value indicated in the association response of STA1 in Step 4. Else A Trigger frame is identified with at least one of the User Info fields containing an AID field value corresponding to the AID value indicated in the Association Response frame for any of STA1, STA2 of Step 18. 2. If the AID field of the User Info field in a Trigger frame has a value corresponding to the AID value indicated in the Association Response frame for either STA1 or STA2 of Step 18, then at least 4*N_DBPS bits are present in the PSDU after the last bit of the User Info field addressed to that STA, where N_DBPS is 24, 36, 48, 72, 96, 144, 192 and

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
				216 bits for rate in L-SIG of 6, 9, 12, 18, 24, 36, 48 and 54 Mbps, respectively. 3. Trigger frame is sent in a non-HT or non-HT duplicate PPDU without CCK If all the conditions above are true, then CONTINUE else FAIL.
22	The APUT stops transmitting Trigger frames.	Disassociate STA1, STA2 from the APUT.		IF DUT is MAP, then PASS else CONTINUE
23		Reconfigure STA1, STA2 per Table 6 and Table 102. Configure the Trigger frame MAC Padding Duration subfield for each STA to the following values: • STA1 = 0 µsec • STA2 = 16 µsec		
24	The APUT sends Association Response frames to STA1 and STA2.	STA1 and STA2 send an Association Request frame to the APUT.	SN: Verify that STA1 sets the Trigger frame MAC Padding Duration subfield to value 0 (0 µs) in the HE MAC Capabilities Information field of the HE Capabilities element in the Association Request frame. SN: Verify that STA2 set the Trigger frame MAC Padding Duration subfield to value 2 (16 µs) in the HE MAC Capabilities Information field of the HE Capabilities element in the Association Request frame.	If the association between the APUT and both STA1 and STA2 is successful, then CONTINUE, else FAIL. Capture the AID values for each associated STA.
25	The APUT sends ADDBA Response frames to the STAs.	STA1 and STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.		
26	Configure the APUT to transmit Trigger frames using non-HT or non-HT duplicate PPDU format.			
27		At STA1, run script HE1-ULOFDMA-APUT-STA1-STA2.txt to the APUT using AC_BE. At STA2, run script HE1-ULOFDMA-APUT-STA1-STA2.txt to the APUT using AC_BE.		SN: If any of the Trigger frames is sent in PPDU formats other than non-HT or non-HT duplicate PPDU, then FAIL else CONTINUE. (NOTE: Sniffer shows both non-HT and non-HT duplicate PPDUs as non-HT PPDUs.) SN: Verify that the AP transmits Trigger frames. 1. A Trigger frame is identified with at least one of the User Info fields containing an AID field value corresponding to the AID value

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
				indicated in the Association Response frame for any of STA1 or STA2 of Step 24. 2. If the AID field of the User Info field in a Trigger frame has a value corresponding to the AID value indicated in the Association Response frame for STA2 of Step 24, then at least 4*N_DBPS bits are present in the PSDU after the last bit of the User Info field addressed to that STA, where N_DBPS is 24, 36, 48, 72, 96, 144, 192 and 216 bits for rate in L-SIG of 6, 9, 12, 18, 24, 36, 48 and 54 Mbps, respectively. If all the above conditions are met, then PASS else FAIL.

4.44 APUT DL OFDMA 160 MHz PHY tests

4.44.1 APUT DL OFDMA 160 MHz PHY test

Objective

This test case verifies that the APUT correctly transmits DL OFDMA packets with correct PHY parameters at 160 MHz.

Applicability: Optional. This test shall be executed only if the APUT declared support for 160 MHz bandwidth in Table 1.

References

Section 6.3.1.1 and 6..4.1.7 [1]

Section 27.3 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 104 defines the specific parameter values required for this test case.

Table 104. APUT DL OFDMA 160 MHz PHY test configuration

Parameter	APUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed STA4 value
Test bed vendor	N/A	Intel200W	Intel200L	Intel200W	Marvell
AP control channel	36 in 5 GHz 6 in 2.4 GHz	N/A	N/A	N/A	N/A
Bandwidth	160 MHz in 5 GHz	160 MHz in 5 GHz	160 MHz in 5 GHz	160 MHz in 5 GHz	160 MHz in 5 GHz
PPDU format	HE_MU (DL OFDMA)	N/A	N/A	N/A	N/A
HE_LTF+GI	6.4µs LTF, 0.8µs GI 6.4µs LTF, 1.6µs 12.8µs LTF, 3.2µs GI	N/A	N/A	N/A	N/A
Number of users in each OFDMA transmission	4	N/A	N/A	N/A	N/A

Test procedure and expected results

Table 105 provides the specific test procedure and expected results for this test case.

Table 105. APUT DL OFDMA 160 MHz PHY test procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 104.	Configure STA2 per Table 6 and Table 104.	Configure STA3 per Table 6 and Table 104.	Configure STA4 per Table 6 and Table 104.	Configure the APUT per Table 12 and Table 104.		
2					Configure the APUT to 5 GHz. The APUT sends Beacon and Probe Response frames to the STAs.		
3	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.			
4	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
5	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1, STA2, STA3, STA4.		
6					Configure the APUT to transmit using DL OFDMA, with LTF=6.4µs, GI=0.8µs.		
7					Run script HE1-DLOFDMA-APUT.txt to the STAs.		SN: Verify the following conditions are true. 1. Verify that the APUT transmits DL OFDMA to STA1, STA2, STA3 and STA4. 2. Sequentially capture at least 10000 packets for each STAAID and verify that in 4441S7_STAID_5G% of the packets:

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A = 0 c. Bandwidth field in HE-SIG-A1 (B15-B17) = 3 (160 MHz) d. LTF+GI field in HE-SIG-A1 (B23-B24) = 1 (LTF = 6.4µs and GI = 0.8µs) e. HE-SIG-B common content indicates allocation to ≥ 4 RU f. RU Allocation subfield contains indexes with y and z values and the values are 0 3. Percent of MU packets is > 4441S7_MU_5G%. 4. Aggregated Throughput is > 4441S7_ATP_5G. 5. Throughput of each STA > 4441S7_STA_TP_5G If all the above conditions are true, then CONTINUE else FAIL.
8					Configure the APUT to transmit using DL OFDMA, with LTF=6.4µs, GI=1.6µs.		
9					Run script HE1-DLOFDMA-APUT.txt to the STAs.		SN: Verify the following conditions are true. 1. Verify that the APUT transmits DL OFDMA to STA1, STA2, STA3 and STA4. 2. Sequentially capture at least 10,000 packets for each STAAID and verify that in 4441S9_STAID_5G% of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A = 0

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							c. Bandwidth field in HE-SIG-A1 (B15-B17)= 3 (160 MHz) d. LTF+GI field in HE-SIG-A1 (B23-B24)= 2 (LTF = 6.4µs and GI = 1.6µs) e. HE-SIG-B common content indicates allocation to ≥ 4 RUs f. RU Allocation subfield contains indexes with y and z values and the values are 0. 3. Percent of MU packets is > 4441S9_MU_5G%. 4. Aggregated Throughput is > 4441S9_ATP_5G. a. Throughput of each STA > 4441S9_STA_TP_5G If all the above conditions are true, then PASS else FAIL.
10					Configure the APUT to transmit using DL OFDMA, with LTF=12.8µs, GI=3.2µs.		
11					Run script HE1-DLOFDMA-APUT.txt to the STAs.		SN: Verify the following conditions are true. 5. Verify that the APUT transmits DL OFDMA to STA1, STA2, STA3 and STA4Sequentially capture at least 10000 packets for each STAAID and verify that in 4441S11_STAID_5G% of the packets: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A = 0 c. Bandwidth field in HE-SIG-A1 (B15-B17) = 3 (160 MHz) d. LTF+GI field in HE-SIG-A1 (B23-B24) = 3 (LTF = 12.8µs and GI = 3.2µs)

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							e. HE-SIG-B common content indicates allocation to ≥ 4 RUs f. RU Allocation subfield contains indexes with y and z values and the values are 0. 6. Percent of MU packets is > 4441S11_MU_5G%. 7. Aggregated Throughput is > 4441S11_ATP_5G, else FAIL. 8. Throughput of each STA > 4441S11_STA_TP_5G If all the above conditions are true, then PASS else FAIL.

4.45 APUT DL MU MU-BAR for C-BA tests

4.45.1 APUT DL MU MU-BAR for C-BA test

Objective

This test case verifies that the APUT correctly generates a DL MU PPDU containing QoS Data frames with Ack Policy fields set to 11, and a separate MU-BAR to solicit each STA's C-BA response in the HE TB PPDU.

Applicability: Optional. This test shall be executed only if the APUT declared support for MU-BAR Trigger frames in Table 1.

References

Section 6.4.1.8 [1]

Section 9.3.1.22.4 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 106 defines the specific parameter values required for this test case.

Table 106. APUT DL MU MU-BAR for C-BA test configuration

Parameter	APUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed STA4 value
Test bed vendor	N/A	Qualcomm	Cypress	Intel200L	Broadcom75
AP control channel	36 in 5 GHz 6 in 2.4 GHz	N/A	N/A	N/A	N/A
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	HE_MU (DL OFDMA)	N/A	N/A	N/A	N/A
Number of users in each OFDMA transmission	4	N/A	N/A	N/A	N/A

Test procedure and expected results

Table 107 provides the specific test procedure and expected results for this test case.

Table 107. APUT DL MU MU-BAR for C-BA test procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 104.	Configure STA2 per Table 6 and Table 104.	Configure STA3 per Table 6 and Table 104.	Configure STA4 per Table 6 and Table 104.	Configure the APUT per Table 12 and Table 104. Configure APUT to transmit DL OFDMA.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 8.							
2	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to the STAs.		
3	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1, STA2, STA3, STA4.		
5					Configure the APUT to send MPDU(s) in HE MU PPDU with Ack Policy set to Block Ack and to send MU-BAR Trigger frame after HE MU PPDU		
6					Run script HE1-DLOFDMA-APUT.txt to STA1, STA2, STA3 and STA4 using AC_BE.		SN: Verify the following conditions are true. 1. Verify that the APUT transmits HE MU PPDU to STA1, STA2, STA3 and STA4. 2. APUT transmits HE-SIG-B to the STAs with 4 User Info

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							fields in at least 80% of the MU PPDUs. 3. APUT transmits ≥ 4451S6_MUBAR_24G% MU-BAR to solicit C-BA from STA1, STA2, STA3 and STA4 with four User Info fields related to STA1, STA2, STA3 and STA4: a. RA is broadcast MAC address b. Trigger Type = 2 c. More TF = 0 d. CS Required = 0 e. UL BW = 0 f. AP Tx Power is one of 0-60 g. Doppler = 0 h. UL STBC=0 i. UL Spatial Reuse = 0 j. UL Target RSSI is one of 0-90 and 127 k. TID Info is 0 or 3 l. BA Type = 2 and all four users have Block Ack in Ack Policy subfield. 4. Total downlink throughput is more than 4451S6_DLTP_24G. 5. Downlink throughput to STA1, STA2, STA3 and STA4 respectively is more than 4451S6_STA_DLTP_24G. If all the above conditions are true, then CONTINUE else FAIL.
7	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 8 else PASS.							
8	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to the STAs.		

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
9	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		
10	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1, STA2, STA3, STA4.		
11					Configure the APUT to send MPDU(s) in HE MU PPDU with Ack Policy set to Block Ack and to send MU-BAR Trigger frame after HE MU PPDU		
12					Run script HE1-DLOFDMA-APUT.txt to STA1, STA2, STA3 and STA4 using AC_BE.		SN: Verify the following conditions are true. 1. APUT transmits HE MU PPDU to STA1, STA2, STA3 and STA4 with four User Info fields in HE-SIG-B 2. APUT transmits ≥ 4451S12_MUBAR_5G% MU-BAR to solicit C-BA from STA1, STA2, STA3 and STA4 with 4 User Info fields related to STA1, STA2, STA3 and STA4: a. RA is broadcast MAC address b. Trigger Type = 2 c. More TF = 0 d. CS Required = 0 e. UL BW = 2 f. AP Tx Power is one of 0-60 g. Doppler = 0 h. UL STBC=0 i. UL Spatial Reuse = 0 j. UL Target RSSI is one of 0-90 and 127

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							k. TID Info = 0 or 3 l. BA Type = 2 m. For each 20 MHz channel there is at least one RU allocation and all four uses have Block Ack in Ack Policy subfield. 3. Total downlink throughput is more than 4451S12_DLTP_5G. 4. Downlink throughput to STA1, STA2, STA3 and STA4 respectively is more than 4451S12_STA_DLTP_5G. If all the above conditions are true, then PASS else FAIL.

4.46 APUT M-BA with Ack Type subfield set to 1 and TID 0 to 7 for Ack context solicited by S-MPDU tests

4.46.1 APUT M-BA with Ack Type subfield set to 1 and TID 0 to 7 and 15 for Ack context solicited by S-MPDU test

Objective

This test case verifies that the APUT correctly generates M-BA with Ack Type set to one when S-MPDU is received in HE TB PPDU.

Applicability: If the APUT declared primary device category as AP in Table 1, then Mandatory.

If the APUT declared primary device category as Mobile AP in Table 1 ,then Conditional Mandatory if iTWT is supported

References

Section 6.3.1.21 [1]

Section 9.3.1.8.7 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 108 defines the specific parameter values required for this test case.

Table 108. APUT M-BA with Ack Type subfield set to 1 and TID 0 to 7 and 15 for Ack context solicited by S-MPDU test configuration

Parameter	APUT value	Test bed STA1 value	Test bed STA2 value
Test bed vendor	N/A	Qualcomm	Intel200L
AP control channel	36 in 5 GHz 6 in 2.4 GHz	N/A	N/A
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
A-MPDU aggregation	N/A	Disable. Do not send ADDBA Request frames	Enable
MU functionality	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA
Testbed STA included in the test (Yes or No)	NA	Yes	If DUT is Mobile AP, then NO else YES

Test procedure and expected results

Table 109 provides the specific test procedure and expected results for this test case.

Table 109. APUT M-BA with Ack Type subfield set to 1 and TID 0 to 7 and 15 for Ack context solicited by S-MPDU test procedure and expected results

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 108. Enable S-MPDU format. Configure STA1 for MU EDCA override as per Table 7.	Configure STA2 per Table 6 and Table 108 Configure STA2 for MU EDCA override as per Table 7..	Configure the APUT per Table 12 and Table 108.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 10.					
2	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to the STAs.		
3	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If the DUT is MAP then, if the assocation between the APUT and STA1 is successful, then CONTINUE else FAIL Else If the associations between the APUT and STA1 and STA2 are successful, then CONTINUE else FAIL.
4			Configure the APUT to transmit M-BA in SU PPDU after receiving HE TB PPDU. Note: M-BA implies Basic Trigger to solicit HE TB PPDU from the STAs.		
5		STA2 sends an ADDBA Request frame with Buffer Size ≤ 64 to the APUT.	The APUT sends an ADDBA Response frame to STA2.		SN: If the DUT is MAP, then CONTINUE else If the BA agreement setup is successful then CONTINUE else FAIL.
6	Generate UDP traffic from STA1 covering AC_BE by running HE1-STA1_STA2-APUT-60.txt.	Generate UDP traffic from STA2 covering AC_BE by running HE1-STA1_STA2-APUT-60.txt.			SN: Verify the following conditions are true: 1. If the DUT is a MAP then APUT transmits all M-BAs with the Ack Type of Per AID TID Info subfield for STA1 (AID11 being STA1's AID) is 1 in the AID TID Info field Else APUT transmits ≥ 4461S6_MBA_24G% M-BA with the

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
					Ack Type of Per AID TID Info subfield for STA1 (AID11 being STA1's AID) is 1 in the AID TID Info field. 2. TID in Per AID TID Info field ≤ 7. If all the conditions above are true, then CONTINUE else FAIL.
7	Configure STA1 to transmit Action frames in HE TB PPDU.				
8	STA1 transmits 100 Action frames to the APUT.	RUN: PING <AP_IP_ADDR> CONTINUOUS=YES SIZE=1000			SN: If the APUT transmits ≥4461S8_MBA_24G% M-BA with the Ack Type of Per AID TID Info for STA1 (AID11 being STA1's AID) is 1 and TID of Per AID TID Info for STA1 is 15 in the AID TID Info field, then CONTINUE else FAIL.
9	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 10 else PASS.					
10	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to the STAs.		
11	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		If the DUT is MAP, then if the associations between the APUT and STA1 is successful, then CONTINUE else FAIL Else If the associations between the APUT and STA1 and STA2 are successful, then CONTINUE else FAIL.
12			Configure the APUT to transmit M-BA in SU PPDU after receiving HE TB PPDU. Note: M-BA implies Basic Trigger to solicit HE TB PPDU from the STAs.		
13		STA2 sends an ADDBA Request frame with Buffer Size ≤ 64 to the APUT.	The APUT sends an ADDBA Response frame to STA2.		

Step	Test bed STA1	Test bed STA2	APUT	Test bed validation	Expected result
14	Generate UDP UL traffic from STA1 covering AC_BE by running HE1-STA1_STA2-APUT-60.txt.	Generate UDP traffic from STA2 covering AC_BE by running HE1-STA1_STA2-APUT-60.txt.			SN: Verify the following conditions are true: 1. If the DUT is MAP, then APUT transmits all M-BAs with Ack Type of Per AID TID Info for STA1 (AID11 being STA1's AID) is 1 in the Per AID TID Info field Else APUT transmits ≥ 4461S14_MBA_5G% M-BA with Ack Type of Per AID TID Info for STA1 (AID11 being STA1's AID) is 1 in the Per AID TID Info field. 2. TID in Per AID TID Info field ≤ 7. If all the conditions above are true, then CONTINUE else FAIL.
15	Configure STA1 to transmit Action frames in HE TB PPDU.				
16	STA1 transmits 100 Action frames to the APUT.	RUN: PING <AP_IP_ADDR> CONTINUOUS=YES SIZE=1000			SN: 1. If the DUT is MAP, then APUT transmits all M-BAs with Ack Type of Per AID TID Info for STA1 (AID11 being STA1's AID) is 1 and TID of Per AID TID Info for STA1 is 15 in the Per AID TID Info field 2. Else APUT transmits ≥ 4461S16_MBA_5G% M-BA with Ack Type of Per AID TID Info for STA1 (AID11 being STA1's AID) is 1 and TID of Per AID TID Info for STA1 is 15 in the Per AID TID Info field, then PASS else FAIL.

4.47 APUT receives SU MIMO with two spatial streams and 160 MHz PPDU tests

4.47.1 APUT receives SU MIMO with two spatial streams and 160 MHz PPDU test

Objective

This test case verifies that the APUT correctly receives HE SU PPDUs using SU MIMO with 2 SS in a 160 MHz bandwidth.

Applicability: Optional. This test shall be executed only if the APUT declared support for 160 MHz bandwidth in Table 1.

References

Section 6.3.1.3 and 6..4.1.7 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 110 defines the specific parameter values required for this test case.

Table 110. APUT receives SU MIMO with two spatial streams and 160 MHz PPDU test configuration

Parameter	Test bed STA1 values	APUT values
Test bed vendor	Intel200W	N/A
AP control channel	N/A	36 in 5 GHz
Channel bandwidth	160 MHz in 5 GHz	160 MHz in 5 GHz
Preamble format	HE_SU	HE_SU
Number of SS for transmitting	2	N/A

Test procedure and expected results

Table 111 provides the specific test procedure and expected results for this test case.

Table 111. APUT receives SU MIMO with two spatial streams and 160 MHz PPDU test procedure and expected results

Step	Test bedSTA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 110.	Configure the APUT per Table 12 and Table 110.		

Step	Test bedSTA1	APUT	Test bed validation	Expected result
2	Configure STA1 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to STA1.		SN: Verify the following conditions are true: 1. APUT's Rx HE-MCS Map 160 MHz subfield within the Supported HE-MCS and NSS Set field of HE Capabilities element has the following format: a. Max HE-MCS for 1SS subfield (B0:B1) is not set to 3 b. Max HE-MCS for 2 SS subfield (B2:B3) is not set to 3 c. Bit 2 of the Channel Width Set in HE PHY Capabilities Information field within HE Capabilities element in the Beacon and Probe Response frame transmitted by the APUT = 1 (support for a 160 MHz width). 2. Beacon and Probe Response frames transmitted by the APUT contains VHT Capabilities element and Maximum NSS defined by the Rx VHT-MCS Map field and the Extended NSS BW Support field in the VHT Capabilities element at 160 MHz is not more than the maximum NSS defined by its Rx HE-MCS Map For 160 MHz field in the HE Capabilities element at 160 MHz. 3. One of the following conditions is true: a. VHT Operation element is not present in Beacon and Probe Response frames transmitted by the APUT, and VHT Operation Information Present subfield in HE Operation element = 1 b. VHT Operation element is present in Beacon and Probe Response frames transmitted by the APUT, and VHT Operation Information Present subfield in HE Operation element = 0. 4. STA Channel Width field in HT Operation element = 1, and Chanel Width field in VHT Operation Information field = 1. 5. 160 MHz center frequency signaling check: verify C1 or C2 is true in the Beacon and Probe Response frames transmitted by the APUT: C1: 1. Supported Channel Width Subfield in the VHT Capabilities element = 1 or 2 and the Extended NSS BW Support field in the VHT Capabilities element is not equal to 3, or the Supported Channel Width Subfield in the VHT Capabilities element = 2 and the Extended NSS BW Support field in the VHT Capabilities element is not equal to 3 2. In VHT Operation Information field (carried in either VHT Operation Element or HE Operation Element) Channel Center Frequency Segment 0 subfield = 42 and Channel Center Frequency Segment 1 subfield = 50 3. Channel Center Frequency Segment 2 subfield in HT Operation element = 0 C2: 1. Supported Channel Width Subfield in VHT Capabilities element = 0

Step	Test bedSTA1	APUT	Test bed validation	Expected result
				2. Extended NSS BW support subfield in VHT Capabilities element > 0 3. In VHT Operation Information field (carried in either VHT Operation Element or HE Operation Element) Channel Center Frequency Segment 0 subfield = 42, and Channel Center Frequency Segment 1 subfield = 0 4. Channel Center Frequency Segment 2 subfield in HT Operation element = 50 If all the above conditions are true, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If STA1 association succeeds, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT.	The APUT sends an ADDBA Response frame to STA1.		
5	Run: PING <APUT_IP_ADDR> SIZE = 1000 COUNT = 90			If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then PASS else FAIL.

4.48 APUT transmits SU MIMO with two spatial streams and 160 MHz PPDU tests

4.48.1 APUT transmits SU MIMO with two spatial streams and 160 MHz PPDU test

Objective

This test case verifies that the APUT correctly transmits HE PPDUs using SU MIMO with 2 SS in the 160 MHz bandwidth.

Applicability: Optional. This test shall be executed only if the APUT declared support for 160 MHz bandwidth in Table 1.

References

Section 6.3.1.3 and 6..4.1.7 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 112 defines the specific parameter values required for this test case.

Table 112. APUT transmits SU MIMO with two spatial streams and 160 MHz PPDU test configuration

Parameter	Test bed STA1 values	APUT values
Test bed vendor	Intel200L	N/A
AP control channel	N/A	36 in 5 GHz
Channel bandwidth	160 MHz in 5 GHz	160 MHz in 5 GHz
Preamble format	HE_SU	HE_SU
Number of SS for receiving	2	N/A

Test procedure and expected results

Table 113 provides the specific test procedure and expected results for this test case.

Table 113. APUT transmits SU MIMO with two spatial streams and 160 MHz PPDU test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 112.	Configure the APUT per Table 12 and Table 112.		

Step	Test bed STA1	APUT	Test bed validation	Expected result
2	Configure STA1 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to STA1.		SN: Verify the following conditions are true: 1. APUT's Tx HE-MCS Map 160 MHz subfield within the Supported HE-MCS and NSS Set field of HE Capabilities element has the following format: a. Max HE-MCS for 1SS subfield (B0:B1) is not set to 3 b. Max HE-MCS for 2 SS subfield (B2:B3) is not set to 3 2. Bit 2 of the Channel Width Set in HE PHY Capabilities Information field within HE Capabilities element in Beacon and Probe Response frames transmitted by the APUT = 1 (support for a 160 MHz width) 3. Beacon and Probe Response frames transmitted by the APUT contains VHT Capabilities element, and the Maximum NSS defined by Rx VHT-MCS Map field and Extended NSS BW Support field in the VHT Capabilities element at 160 MHz is not more than the maximum NSS defined by its Rx HE-MCS Map For 160 MHz field in the HE Capabilities element at 160 MHz. 4. One of the following conditions is true: a. VHT Operation element is not present in Beacon and Probe Response frames transmitted by the APUT, and VHT Operation Information Present subfield in HE Operation element = 1 b. VHT Operation element is present in Beacon and Probe Response frames transmitted by the APUT, and VHT Operation Information Present subfield in HE Operation element = 0. 5. STA Channel Width field in HT Operation element = 1, and Chanel Width field in VHT Operation Information field = 1. 6. 160 MHz center frequency signaling check: Verify that either C1 or C2 is true in the Beacon and Probe Response frames transmitted by the APUT C1: 1. Supported Channel Width Subfield in the VHT Capabilities element = 1 and the Extended NSS BW Support field in the VHT Capabilities element is not equal to 3, or the Supported Channel Width Subfield in the VHT Capabilities element = 2 and the Extended NSS BW Support field in the VHT Capabilities element is not equal to 3 In VHT Operation Information field (carried in either VHT Operation Element, or HE Operation Element) Channel Center Frequency Segment 0 subfield = 42 and Channel Center Frequency Segment 1 subfield = 50 C2: 1. Supported Channel Width Subfield in VHT Capabilities element = 0 2. Extended NSS BW support subfield in VHT Capabilities element > 0 3. In VHT Operation Information field (carried in either VHT Operation Element or HE Operation Element) Channel

Step	Test bed STA1	APUT	Test bed validation	Expected result
				Center Frequency Segment 0 subfield = 42, and Channel Center Frequency Segment 1 subfield = 0 4. Channel Center Frequency Segment 2 subfield in HT Operation element = 50 If all the above conditions are true, then CONTINUE else FAIL.
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If STA1 association succeeds, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Response frame to the APUT.	The APUT sends an ADDBA Request frame to STA1.		
5		Run: PING <STA1_IP_ADDR> SIZE = 1000 COUNT = 90		Verify the following conditions are true: 1. No more than 5 consecutive ping timeouts occur. 2. No more than 10% ping failures. 3. SN: HE SU PPDUs transmitted by APUT contain HE-SIG-A field with the following format: a. Bandwidth field (B19-B20) = 3 (160 MHz) b. NSTS and Midamble Periodicity (B23-B25) =1 (2 SS) If all the above conditions are true, then PASS else FAIL.

4.49 APUT HE BSR in UL OFDMA tests

4.49.1 APUT HE BSR in UL OFDMA test

Objective

This test case verifies that the APUT correctly transmits BSRP and receives a Buffer Status Report in HE TB PPDU from HE STAs in QoS Null frames.

Applicability: Optional. This test case shall be executed only if the APUT declared support for BSRP transmission in Table 1.

References

Section 6.4.1.10 and 6.3.1.26 [1]

Section 9.3.1.22.6 and 26.5.3.6 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 114 defines the specific parameter values required for this test case.

Table 114. APUT HE BSR in UL OFDMA test configuration

Parameter	Test bed STA1-4 value	APUT value
Test bed vendor	Marvell, Broadcom75, Broadcom98, Intel200L	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Channel bandwidth	20 MHz in 2.4 GHz 80 MHz in 5 GHz	20 MHz in 2.4 GHz 80 MHz in 5 GHz
MU functionality	Enable UL OFDMA	Enable UL OFDMA
PPDU Format	N/A	Rx HE_TRIG (UL OFDMA)
Testbed STA included in the test (Yes or No)	If DUT is MAP, then only STA1 is used else all 4 STAs are used	N/A

Note: If the APUT declared primary device category as Mobile AP in Table 1, then generate UDP UL traffic from STA covering AC_VI in step 9, 14 and AC_VO in step 10,15.

Test procedure and expected results

Table 115 provides the specific test procedure and expected results for this test case.

Table 115. APUT HE BSR in UL OFDMA test procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 114.	Configure STA2 per Table 6 and Table 114.	Configure STA3 per Table 6 and Table 114.	Configure STA4 per Table 6 and Table 114.	Configure the APUT per Table 12 and Table 114. Enable BSRP Trigger frame for UL MU OFDMA.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 11.							
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	Configure STA2 to join the APUT's BSS in the 2.4 GHz band.	Configure STA3 to join the APUT's BSS in the 2.4 GHz band.	Configure STA4 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to the STAs.		
3	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1-STA4.		If association between the APUT and all the STAs are successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT with Buffer size ≤ 64.	STA2 sends an ADDBA Request frame to the APUT.with Buffer size ≤ 64	STA3 sends an ADDBA Request frame to the APUT. with Buffer size ≤ 64	STA4 sends an ADDBA Request frame to the APUT with Buffer size ≤ 64.	The APUT sends an ADDBA Response frame to STA1-STA4.		
5	Generate UDP UL traffic from STA1 covering AC_BE by running HE1-ULOFDMA-APUT-BE.txt.	Generate UDP UL traffic from STA2 covering AC_BE by running HE1-ULOFDMA-APUT-BE.txt.	Generate UDP UL traffic from STA3 covering AC_BE by running HE1-ULOFDMA-APUT-BE.txt.	Generate UDP UL traffic from STA4 covering AC_BE by running HE1-ULOFDMA-APUT-BE.txt.			
6					Configure the APUT to send BSRP Trigger frames to the STAs.		SN: Verify the following conditions are true (at least one for each traffic profile change): 1. APUT sent Trigger frame in S-MPDU or non-A-MPDU with the following format: a. Trigger frame contains exactly one User Info field that has AID12 subfield set for each of the STAs AID values, and a valid RU allocation for the STAs in the RU allocation subfield. 2. Common Info field contains:

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							a. Trigger Type subfield (B0:B3) = 4 (Trigger frame Variant = BSRP) b. UL BW subfield (B18:B19) = 0 (20 MHz) c. UL Length subfield (B4:B15)> 0 d. More TF subfield (B16) = 0 e. MU-MIMO LTF Mode subfield (B22) = 0 (single stream) f. AP TX Power subfield (B28:B33) set to a value between 0 and 60 g. Trigger Dependent Common Info subfield is not present 3. User Info field contains: a. Trigger Dependent User Info subfield is not present b. RU Allocation subfield (B19- B13) is not equal to 61 c. RU Allocation subfield (B12) = 0 d. SS Allocation /RA-RU Information for STA1 and STA3 set to: ▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 0 e. Target RSSI subfield (B32:B38) set to: 0 to 90, or127 Note: (b) and (d) are checked to ensure the BSR frame comes in UL OFDMA, not UL MU-MIMO. If all the above conditions are true, then CONTINUE else FAIL.
7	STA1 sends QoS Null frames to the APUT. Note: Ack Policy=No Ack	STA2 sends QoS Null frames to the APUT. Note: Ack Policy=No Ack	STA3 sends QoS Null frames to the APUT. Note: Ack Policy=No Ack	STA4 sends QoS Null frames to the APUT. Note: Ack Policy=No Ack			SN: If no Ack frame is sent by the APUT, then CONTINUE else FAIL.
8	Disassociate STA1 from the APUT.	Disassociate STA2 from the APUT.	Disassociate STA3 from the APUT.	Disassociate STA4 from the APUT.			
9	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI.txt, which covers two	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI.txt, which covers two	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI.txt, which covers two	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI.txt, which covers two	Repeat Steps 3-8.		If the verification in Steps 3-8 is successful, then CONTINUE else FAIL.

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
	ACs: AC_BE and AC_VI.	ACs: AC_BE and AC_VI.	ACs: AC_BE and AC_VI.	ACs: AC_BE and AC_VI.			
10	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI-VO-BK.txt, which covers four ACs: AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI-VO-BK.txt, which covers four ACs: AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI-VO-BK.txt, which covers four ACs: AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI-VO-BK.txt, which covers four ACs: AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8.		If the verification in Steps 3-8 is successful, then CONTINUE else FAIL.
If the APUT supports 5 GHz, go to Step 11 else PASS.							
11	Configure STA1 to join the APUT's BSS in the 5 GHz band.	Configure STA2 to join the APUT BSS in the 5 GHz band.	Configure STA3 to join the APUT BSS in the 5 GHz band.	Configure STA4 to join the APUT BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to the STAs.		
12	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to the STAs.		If association between the APUT and all the STAs are successful, then CONTINUE else FAIL.
13	Repeat Steps 4-8.	Repeat Steps 4-8.	Repeat Steps 4-8.	Repeat Steps 4-8.	Repeat Steps 4-8.		The verification in Steps 4-8 is the same except: : • BW subfield (B18:B19) = 2 (80 MHz) in Step 6 • RU Allocation subfield: B19- B13 is not equal to 67 in Step 6 • At least one RU allocation in each 20 MHz channel used to send the Trigger frame in Step 6 If the verification in Steps 4-7 is successful, then CONTINUE else FAIL.
14	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI.txt, which covers two ACs: AC_BE and AC_VI.	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI.txt, which covers two ACs: AC_BE and AC_VI.	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI.txt, which covers two ACs: AC_BE and AC_VI.	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI.txt, which covers two ACs: AC_BE and AC_VI.	Repeat Steps 3-8.		If the verification in Steps 3-8 is successful, then CONTINUE else FAIL.

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
15	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI-VO-BK.txt, which covers four ACs: AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI-VO-BK.txt, which covers four ACs: AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI-VO-BK.txt, which covers four ACs: AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8 with script HE1-ULOFDMA-APUT-BE-VI-VO-BK.txt, which covers four ACs: AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8.		If the verification is Steps 3-8 is successful, then PASS else FAIL.

4.50 APUT receives Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths tests

4.50.1 APUT receives Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths test

Objective

This test case verifies that the APUT correctly receives single TID A-MPDU with up to 256 MSDUs and no fragmentation in HE SU PPDU with different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Optional. This test shall be executed only if the APUT declared support for Compressed BlockAck (C-BA) fames with up to 256 MSDUs/A-MSDUs, with no fragmentation in Table 1.

References

Section 6.4.1.16 and 6.3.1.22 [1]

Section 9.3.1.8.2 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 116 defines the specific parameter values required for this test case.

Table 116. APUT receives Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Qualcomm	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	20 MHz in 2.4 GHz 80 MHz in 5 GHz	20 MHz in 2.4 GHz 80 MHz in 5 GHz
Preamble format	HE_SU	HE_SU
HE Capabilities: Fragmentation Support field	0	N/A
Block Ack Parameter Set field: A-MSDU supported	0	N/A
Configure to use 256 BA	Enabled	Enabled

Parameter	Test bed STA1 value	APUT value
ADDBA Request includes Block Ack Parameter Set Field: Buffer Size value > 64 ADDBA Response includes Block Ack Parameter Set Field: Buffer Size > 64		

Test procedure and expected results

Table 117 provides the specific test procedure and expected results for this test case.

Table 117. APUT receives Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 116.	Configure the APUT per Table 12 and Table 116.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Request frame to the APUT with Buffer Size > 64.	The APUT sends an ADDBA Response frame to STA1.		SN: If the ADDBA Response frame sent by the APUT has the following format: 1. Buffer size > 64 2. Dialog Token and TID fields match the values in ADDBA Request frame then CONTINUE else FAIL.
5	Run script HE1-STA-AP-60.txt to APUT.		Verify that the PPDU carrying QoS Data has an aggregate of > 64 MPDUs in at least 4501S5_PPDU_24G% of PPDUs.	SN: If the APUT responds with BA Type = Compressed BlockAck (BA Type field B1-B4 in BA Control field = 2) as per Table 9-30a of [7] with the following format: The Fragment Number subfield (B3-B0) of the Block Ack Starting Sequence Control field within the BA information field = 4 (Fragmentation Level 3 OFF and Maximum number of MSDUs acknowledged =256) at least in 4501S5_BA_24G % of Block Acks. then CONTINUE else FAIL.
6	Disassociate STA1 from the APUT.			
If the APUT supports 5 GHz, go to Step 7 else PASS.				

Step	Test bed STA1	APUT	Test bed validation	Expected result
7	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
8	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If STA1 association succeeds, then CONTINUE else FAIL.
9	STA1 sends an ADDBA Request frame to the APUT with Buffer Size = 256.	The APUT sends an ADDBA Response frame to STA1.		SN: If the ADDBA Response frame sent by the APUT has the following format: 1. Buffer size > 64 2. Dialog Token and TID fields match the values in ADDBA Request frame then CONTINUE else FAIL.
10	Run script HE1-STA-AP-60.txt to the APUT.		Verify that PPDU carrying QoS Data has an aggregate of > 64 MPDUs in at least 4501S10_PPDU_5G% of PPDUs.	SN: If the APUT responds with BA Type = Compressed BlockAck (BA Type field B1-B4 in BA Control field = 2) as per Table 9-30a of [7] with the following format: The Fragment Number subfield (B3-B0) of the Block Ack Starting Sequence Control field within the BA information field = 4 (Fragmentation Level 3 OFF and Maximum number of MSDUs acknowledged =256) at least in 4501S10_BA_5G % of Block Acks. then PASS else FAIL.

4.51 APUT transmits Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths tests

4.51.1 APUT transmits Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths test

Objective

This test case verifies that the APUT correctly transmits single TID A-MPDU with up to 256 MSDUs and no fragmentation in HE SU PPDU with different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Optional. This test shall be executed only if the APUT declared support for Compressed BlockAck (C-BA) fames with up to 256 MSDUs/A-MSDUs, with no fragmentation in Table 1.

References

Section 6.4.1.16 and 6.3.1.22 [1]

Section 9.3.1.8.2 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 118 defines the specific parameter values required for this test case.

Table 118. APUT transmits Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Qualcomm	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	20 MHz in 2.4 GHz, or 80 MHz in 5 GHz	20 MHz in 2.4 GHz, or 80 MHz in 5 GHz
Preamble format	HE_SU	HE_SU
HE Capabilities: Fragmentation Support field	0	N/A
Block Ack Parameter Set field: A-MSDU supported	0	N/A
Configure to use 256 BA	Enabled	Enabled

Parameter	Test bed STA1 value	APUT value
ADDBA Request includes Block Ack Parameter Set Field: Buffer Size value > 64 ADDBA Response includes Block Ack Parameter Set Field: Buffer Size > 64		

Test procedure and expected results

Table 119 provides the specific test procedure and expected results for this test case.

Table 119. APUT transmits Single TID Compressed BA with up to 256 MSDUs, no fragmentation and channel widths test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 118.	Configure the APUT per Table 12 and Table 118.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
3	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If STA1 association succeeds, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Response frame to the APUT with Buffer size > 64.	The APUT sends an ADDBA Request frame to STA1 with Buffer Size > 64.	Verify that the ADDBA Response frame Block Ack Parameter Set field has Buffer Size > 64.	SN: If the Buffer Size in ADDBA Request frame is > 64, then CONTINUE else FAIL.
5		Run script HE1-APUT-STA1-60.txt .	Verify that the BA Bitmap Length = 32 bytes.	SN: Verify the following conditions are true: 1. Fragment Number subfield within the Sequence Control field and the More Fragments subfield within the Frame Control field in the SU PPDUs sent by the APUT = 0 (no fragmentation). 2. SU PPDUs sent by the APUT contain HE-SIG-A with the following format: a. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) b. Bandwidth field in HE-SIG-A1 (B19,B20) = 0 (20 MHz) c. UL/DL field in HE-SIG-A1 (B2) = 0 (DL) 3. PPDU carrying QoS Data has an aggregate of > 64 MPDUs in at least 4511S5_256_24G% of PPDUs If all the above conditions are true, then CONTINUE else FAIL.
6	Disassociate STA1 from the APUT.			

Step	Test bed STA1	APUT	Test bed validation	Expected result
If the APUT supports 5 GHz, go to Step 7 else PASS.				
7	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
8	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		If STA1 association succeeds, then CONTINUE else FAIL.
9	STA1 sends an ADDBA Response frame to the APU with Buffer size >64T.	The APUT sends an ADDBA Request frame to STA1 with Buffer Size > 64.	Verify that the ADDBA Response frame Block Ack Parameter Set field has Buffer Size > 64.	SN: If the Buffer Size in ADDBA Request frame is > 64, then CONTINUE else FAIL.
10		Run script HE1-APUT-STA1-60.txt.	Verify that the BA Bitmap Length = 32 bytes.	SN: Verify the following conditions are true: 1. Fragment Number subfield within the Sequence Control field and the More Fragments subfield within the Frame Control field in the SU PPDUs sent by the APUT = 0 (no fragmentation). 2. SU PPDUs sent by the APUT contain HE-SIG-A with the following format: a. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) b. Bandwidth field in HE-SIG-A1 (B19,B20) = 2 (80 MHz) c. UL/DL field in HE-SIG-A1 (B2) = 0 (DL) 3. PPDU carrying QoS Data has an aggregate of > 64 MPDUs in at least 4511S5_256_5G% of PPDUs If all the above conditions are true, then PASS else FAIL.

4.52 APUT receives A-Control OM for ROM tests

4.52.1 APUT receives A-Control OM for ROM test

Objective

This test case verifies that the DUT shall successfully receive the OM Control field within the HE Variant of HT Control field sent by its STAs.

Applicability: If the APUT declared primary device category as AP in Table 1, then Mandatory.

If the APUT declared primary device category as Mobile AP in Table 1 and supports only 1SS,then only 5 GHz or If the Mobile AP supports 2SS, then both 2.4 GHz and 5 GHz variations are Conditional Mandatory if iTWT is supported

References

Section 6.3.1.27 [1]

Section 26.9.2 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 120 defines the specific parameter values required for this test case.

Table 120. APUT receives A-Control OM for ROM test configuration

Parameter	APUT value	Test bed STA1 value
Test bed vendor	N/A	Intel200W
Security	WPA2-Personal	WPA2-Personal
Encryption key	12345678	12345678
AP control channel	6 for 2.4 GHz band 36 for 5 GHz band	N/A
Bandwidth	20 MHz in 2.4 GHz 80 MHz in 5 GHz	N/A
Spatial streams implemented	Default	2
Transmit OM Control field in a MPDU that solicits an immediate response (Ack or BlockAck)	N/A	Enable

Test procedure and expected results

Table 121 provides the specific test procedure and expected results for this test case.

Table 121. APUT receives A-Control OM for ROM test procedure and expected results

Step	APUT	Test bed STA1	Test bed validation	Expected result
1	If the APUT supports 5 GHz, go to Step 2 else go to Step 10.			
2	Configure the APUT to operate in 5 GHz per Table 4 and Table 120.	Configure STA1 per Table 6 and Table 120.		
3	The APUT sends Beacon and Probe Response frames to STA1.	Configure STA1 to join the APUT's BSS.		SN: Verify the following conditions are true: 1. +HTC-HE field of the HE Capabilities element = 1 in the Beacon and Probe Response frames. 2. OM Control Support field of the HE Capabilities element = 1 in the Beacon and Probe Response frames. If all the conditions above are true, then CONTINUE else FAIL. SN : Log the value of the BSS Color subfield in BSS Color Information field in HE Operation element in Beacon frames transmitted by the APUT. If in the HE Operation element, BSS Color = 0 or BSS Color Disabled subfield = 1, then FAIL else CONTINUE.
4	The APUT sends an Association Response frame to STA1.	STA1 sends an Association Request frame to the APUT.		SN: Verify the following conditions are true: 1. Association is successful between the APUT and STA1. 2. +HTC-HE field of the HE Capabilities element = 1 in the Association Response frame. 3. OM Control Support field of the HE Capabilities element = 1 in the Association Response frame. 4. Value of the BSS Color subfield in BSS Color Information field in HE Operation element in Association Response frame transmitted by the APUT is the same as the BSS Color value logged in Step 3 If all the conditions above are true, then CONTINUE else FAIL.
5	Run script DT1-APUT-STA1_4.52.X.txt to STA1 using AC_BE for 20 seconds.			SN: Verify the following conditions are true: 1. Each PPDU sent by the APUT to STA1 is 80 MHz or narrower, uses no more than 2 SS, and there are PPDUs that use 2 SS. 2. If BSS Color (B8-B13) subfield in HE-SIG-A of HE PPDUs transmitted by the APUT is the same as the BSS Color value logged in Step 3 If all the conditions above are true, then CONTINUE else FAIL. Measured throughput ≥4521S5_TP_5G , then CONTINUE else FAIL.
6	Run script DT1-APUT-STA1_4.52.X.txt to STA1 using AC_BE for 20 seconds.	At time 2 seconds after the traffic initiated by the APUT, configure STA1 to signal APUT OM Control field with:	STA1 sends MPDU with OM Control field: 1. Rx NSS subfield = 0 (NSS=1)	SN: Verify the following conditions are true: 1. APUT acknowledges MPDU carrying OM Control field sent by STA1 2. The bandwidth and NSS of each PPDU sent by the APUT to STA1 after 4521S6_TXOP_5G, following the acknowledgement of the MPDU with OMI from STA1 is:

Step	APUT	Test bed STA1	Test bed validation	Expected result
	If DUT is a MAP and supports only 1SS then , go to step 8 else go to step 7	1. Rx NSS subfield = 0 (NSS=1) 2. Channel Width subfield = 0 (BW = 20MHz)	2. Channel Width subfield = 0 (BW = 20MHz)	a. 20 MHz b. 1 SS If all the conditions above are true, then CONTINUE else FAIL. Measured throughput ≥ 4521S6_TP_5G / 8, then CONTINUE else FAIL.
7	Run script DT1-APUT-STA1_4.52.X.txt to STA1 using AC_BE for 20 seconds.	At time 2 seconds after the traffic initiated by the APUT, configure STA1 to signal APUT OM Control field with: 3. Rx NSS subfield = 1 (NSS = 2) 4. Channel Width subfield = 0 (BW = 20 MHz)	STA1 sends MPDU with OM Control field: a. Rx NSS subfield = 1 (NSS = 2) b. Channel Width subfield = 0 (BW = 20 MHz)	SN: Verify the following conditions are true: 1. APUT acknowledges MPDU carrying OM Control field sent by STA1 2. The bandwidth and NSS of each PPDU sent by the APUT to STA1 after 4521S7_TXOP_5G, following the acknowledgement of the MPDU with OMI from STA1 is: a. 20 MHz b. Uses no more than 2 SS, but there are PPDUs that are 2 SS If all the conditions above are true, then CONTINUE else FAIL. Measured throughput ≥ 4521S7_TP_5G /4 , then CONTINUE else FAIL.
8	Run script DT1-APUT-STA1_4.52.X.txt to STA1 using AC_BE for 20 seconds.	At time 2 seconds after the traffic is initiated by the APUT, configure STA1 to signal APUT OM Control field with: 1. Rx NSS subfield = 0 (NSS = 1) 2. Channel Width subfield = 2 (BW = 80 MHz)	STA1 sends MPDU with OM Control field: 1. Rx NSS subfield = 0 (NSS = 1) 2. Channel Width subfield = 2 (BW = 80 MHz)	SN: Verify the following conditions are true: 1. APUT acknowledges MPDU carrying OM Control field sent by STA1 2. The bandwidth and NSS of each PPDU sent by the APUT to STA1 after 4521S8_TXOP_5G, following the acknowledgement of the MPDU with OMI from STA1 is: a. 80 MHz b. 1 SS. If all the conditions above are true, then CONTINUE else FAIL. Measured throughput ≥ 4521S8_TP_5G / 2, then CONTINUE else FAIL.
9	If the DUT is a MAP and supports 2.4 GHz and only 1SS, PASS else go to Step 10.. Disassociate STA1 from the APUT.			
10	Configure the APUT to operate in 2.4 GHz per Table 12and Table 120.	Configure STA1 per Table 6 and Table 120.		
11	The APUT sends Beacon and Probe Response frames to STA1.	Configure STA1 to join the APUT's BSS.		SN: Verify the following conditions are true: 1. +HTC-HE field of the HE Capabilities element = 1 in the Beacon and Probe Response frames. 2. OM Control Support field of the HE Capabilities element = 1 in the Beacon and Probe Response frames. If all the conditions above are true, then CONTINUE else FAIL. SN: Log the value of the BSS Color subfield in BSS Color Information field in HE Operation element in Beacon frames transmitted by the APUT. Check the following fields in HE Operation element. If BSS Color = 0 or BSS Color Disabled subfield = 1, then FAIL else CONTINUE.

Step	APUT	Test bed STA1	Test bed validation	Expected result
12	The APUT sends an Association Response frame to STA1.	STA1 sends an Association Request frame to the APUT.		SN: Verify the following conditions are true: 1. Association is successful between the APUT and STA1. 2. +HTC-HE field of the HE Capabilities element = 1 in the Association Response frame. 3. OM Control Support field of the HE Capabilities element = 1 in the Association Response frame. 4. Value of the BSS Color subfield in BSS Color Information field in HE Operation element in Association Response frame transmitted by the APUT is the same as the BSS Color value logged in Step 11 If all the conditions above are true, then CONTINUE else FAIL.
13	Run script DT1-APUT-STA1_4.52.X.txt to STA1 using AC_BE for 20 seconds.			SN: Verify the following conditions are true: 1. Each PPDU sent by the APUT to STA1 is 20 MHz, uses no more than 2 SS, and there are PPDUs that use 2 SS. 2. BSS Color (B8-B13) subfield in HE-SIG-A of HE PPDUs transmitted by the APUT is the same as the BSS Color value logged in Step 11. If all the conditions above are true, then CONTINUE else FAIL. Measured throughput ≥4521S13_TP_24G , then CONTINUE else FAIL.
14	Run script DT1-APUT-STA1_4.52.X.txt to STA1 using AC_BE for 20 seconds.	At time 2 seconds after the traffic is initiated by the APUT, configure STA1 to signal APUT OM Control field with: 1. Rx NSS subfield = 0 (NSS = 1) 2. Channel Width subfield = 0 (BW = 20 MHz)	STA1 sends MPDU with OM Control field: 1. Rx NSS subfield = 0 (NSS = 1) 2. Channel Width subfield 0 (BW = 20 MHz)	SN: Verify the following conditions are true: 1. APUT acknowledges MPDU carrying OM Control field sent by STA1 2. The bandwidth and NSS of each PPDU sent by the APUT to STA1 after 4521S14_TXOP_24G, following the acknowledgement of the MPDU with OMI from STA1 is: a. 20 MHz b. 1 SS If all the conditions above are true, then CONTINUE else FAIL If the measured throughput ≥ 4521S14_TP_24G /2, then CONTINUE else FAIL.
15	Run script DT1-APUT-STA1_4.52.X.txt to STA1 using AC_BE for 20 seconds.	At time 2 seconds after the traffic is initiated by the APUT, configure STA1 to signal APUT OM Control field with: 1. Rx NSS subfield = 1 (NSS = 2) 2. Channel Width subfield = 0 (BW = 20 MHz)	STA1 sends MPDU with OM Control field: 1. Rx NSS subfield = 1 (NSS = 2) 2. Channel Width subfield = 0 (BW = 20 MHz)	SN: Verify the following conditions are true: 1. APUT acknowledges MPDU carrying OM Control field sent by STA1 2. The bandwidth and NSS of each PPDU sent by the APUT to STA1 after 4521S15_TXOP_24G, following the acknowledgement of the MPDU with OMI from STA1 is: a. 20 MHz b. Uses no more than 2 SS, but there are PPDUs that are 2 SS. If all the conditions above are true, then CONTINUE else FAIL. If the measured throughput ≥ 4521S15_TP_24G, then PASS else FAIL.

4.53 APUT MU BFRP tests

4.53.1 APUT MU BFRP test

Objective

This test case verifies that the APUT correctly transmits a MU BFRP Trigger frame to multiple STAs and solicits beamforming reports through UL MU operation from the STAs.

Applicability: Conditional. This test shall be mandatory only if the DUT declared support for DL MU-MIMO Tx in Table 1.

References

Section 6.5.1.3 and 6.5.1.9 [1]

Section 9.3.1.22.3 and 26.7 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 122 defines the specific parameter values required for this test case.

Table 122. APUT MU BFRP test configuration

Parameter	Test bed STA1	Test bed STA2	APUT value
Test bed vendor	Cypress	Intel200W	N/A
AP control channel	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Channel bandwidth	20 MHz in 2.4 GHz, 80 MHz in 5 GHz	20 MHz in 2.4 GHz or 80 MHz in 5 GHz	20 MHz in 2.4 GHz, 80 MHz in 5 GHz
Beamformee STS ≤ 80 MHz	3	3	N/A

Test procedure and expected results

Table 123 provides the specific test procedure and expected results for this test case.

Table 123. APUT MU BFRP test procedure and expected results

Step	Test bed STA1, STA2	APUT	Test bed validation	Expected result
1	Configure STA1 and STA2 as per Table 6 and Table 122.	Configure the APUT per Table 12 and Table 122.		
If the APUT supports 5 GHz, go to Step 2 else go to Step 7.				
2	Configure STA1 and STA2 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1 and STA2.		SN: Verify the following in HE PHY Capabilities Information field in the Beacon and Probe Response frames: 1. MU Beamformer subfield (B33) = 1 2. SU Beamformer subfield (B31) = 1 3. Number of Sounding Dimensions ≤ 80 MHz subfield (B40:B42) is not set to 0 If all of the above conditions are true, then CONTINUE else FAIL.
3	STA1 and STA2 send an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1 and STA2.		If all STA associations succeed, then CONTINUE else FAIL. SN: Verify the following in the HE PHY Capabilities Information field in the Association Response frame: 1. MU Beamformer subfield (B33) = 1 2. SU Beamformer subfield (B31) = 1 3. Number of Sounding Dimensions ≤ 80 MHz subfield (B40:B42) is not set to 0 If all of the above conditions are true, then CONTINUE else FAIL.
4		Configure the APUT to send a BFRP Trigger frame to STA1 and STA2.		
5	STA1 and STA2 send BFR feedback to the APUT in HE TB PPDU.	Run script HE1-DLMUMIMO-APUT.txt to STAUT and STA1. Note that the APUT is expected to initiate MU sounding protocol against STA1 and STA2.		SN: Verify the following conditions are true. 1. BFRP Trigger frame sent to STA1 and STA2. 2. APUT transmits an HE NDP Announcement frame followed by an HE NDP, then followed by one or more BFRP Trigger frames (i.e., no PPDUs captured in the Sniffer between NDPA and first BFRP Trigger frame other than NDP) 3. NDP Announcement frame has the following format: a. RA field is set to broadcast b. Note: For non-HT or non-HT duplicate frames, the TA field has Individual/Group bit = 1 (bandwidth signaling TA) c. HE subfield (B1) of the Sounding Dialog Token = 1 in the HE NDP Announcement frame

Step	Test bed STA1, STA2	APUT	Test bed validation	Expected result
				d. Two STA Info fields are present that match STA1 and STA2's AID11s e. STA Info fields corresponding to STA1and STA2 in the HE NDP Announcement frame from the APUT have the following settings: • Feedback Type And Ng (B25:B26)= 1 (MU, Ng=4) • Disambiguation (B27) = 1 • Codebook Size (B28) = 1 {9,7} • Nc (B29:B31) set such that: ▪ The value of Nc+1 does not exceed the max NSS according to the Rx HE-MCS Map ≤ 80 MHz in the Supported HE-MCS And NSS Set field sent by the corresponding STA for this STA Info field (STA1 or STA2) ▪ The value of Nc does not exceed the value of Max Nc indicated in the HE PHY Capabilities sent by the corresponding STA for this STA Info field (STA1 or STA2) • RU Start (B11:B17) = 0 • RU End (B18:B24) = 36 (80 MHz Full BW) 4. BFRP Trigger frame has the following format:: a. RA field is set to broadcast address and there are at least two User Info fields, or RA field is set to unicast address and there is only one User Info field b. Common Info field has the following settings: ▪ Trigger Type (B0:B3) = 1 (BFRP) ▪ UL BW (B18:B19) = 2 (80 MHz) ▪ Trigger Dependent Common Info subfield is not present c. AID field of at least one User Info field matches the AID of either STA1 or STA2 d. Two User Info fields that match STA1 and STA2’s AID12s are covered across BFRP Trigger frames which means that sounding sequence is either: ▪ NDPA->NDP->BFRP TF(2users: STA1 AID + STA2 AID)->CBF, or

Step	Test bed STA1, STA2	APUT	Test bed validation	Expected result
				▪ NDPA->NDP->BFRP TF(1user: STA1 AID)->CBF->BFRP TF(1user:STA2 AID)->CBF, or ▪ NDPA->NDP->BFRP TF(1user: STA2 AID)->CBF->BFRP TF(1user:STA1 AID)->CBF e. RU allocation to the STAs includes at least one RU in all 20 MHz channels used to send the Trigger frame (996 tones RU or (484,484) tones RU) f. Each User Info field contains the Trigger dependent User Info subfield and the Feedback Segment Retransmission Bitmap subfield = 0xFF (all segments) If all of the above conditions are true, then CONTINUE else FAIL.
6	STA1 and STA2 disassociate from the APUT.			
If the APUT supports 2.4 GHz, go to Step 7 else PASS.				
7	Configure STA1 and STA2 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1 and STA2.		
8	Repeat Steps 3-5.	Repeat Steps 3-5.		The verification in Steps 2-6 is the same except: NDP Announcement: RU End (B18:24) = 8 (20 MHz Full BW) BFRP Trigger frame, Common info field: BW (B18:B19) = 0 (20 MHz) If the verification in Steps 3-5 is successful, then PASS else FAIL.

4.53.2 APUT MU BFRP for eight spatial stream sounding test

Objective

This test case verifies that the APUT which supports transmitting HE NDSs using 8 SS can transmit a MU BFRP Trigger frame to multiple STAs and solicit beamforming reports through UL MU operation from the STAs.

Applicability: Optional. This test shall be executed only if the DUT declared support for 8 SS in Table 1.

References

Section 6.5.1.3 and 6.5.1.9 [1]

Section 9.3.1.22.3 and 26.7 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 124 defines the specific parameter values required for this test case.

Table 124. APUT MU BFRP for eight spatial stream sounding test configuration

Parameter	Test bed STA1	Test bed STA2	APUT value
Test bed vendor	Intel200L	Qualcomm	N/A
AP control channel	N/A	N/A	36 in 5 GHz
Channel bandwidth	80 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz
Beamformee STS ≤ 80 MHz	7	7	N/A

Test procedure and expected results

Table 125 provides the specific test procedure and expected results for this test case.

Table 125. APUT MU BFRP for eight spatial stream sounding test procedure and expected results

Step	Test bed STA1, STA2	APUT	Test bed validation	Expected result
1	Configure STA1, STA2 to per Table 6 and Table 124.	Configure the APUT per Table 12 and Table 124.		
If the APUT supports 5 GHz, go to Step 2 else go to Step 7.				

Step	Test bed STA1, STA2	APUT	Test bed validation	Expected result
2	Configure STA1, STA2 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon Probe Response frames to STA1 and STA2.		SN: Verify the following in HE PHY Capabilities Information field in the Beacon and Probe Response frames: 1. MU Beamformer subfield (B33) = 1 2. SU Beamformer subfield (B31) = 1 3. Number of Sounding Dimensions ≤ 80 MHz subfield (B40:B42) = 7 If all of the above conditions are true, then CONTINUE else FAIL.
3	STA1 and STA2 send an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1 and STA2.		If all STA associations succeed, then CONTINUE else FAIL. SN: Verify the following in the HE PHY Capabilities Information field in the Association Response frame: 1. MU Beamformer subfield (B33) = 1 2. SU Beamformer subfield (B31) = 1 3. Number of Sounding Dimensions ≤ 80 MHz subfield (B40:B42) = 7 If all of the above conditions are true, then CONTINUE else FAIL.
4		Configure the APUT to send a BFRP Trigger frame to STA1 and STA2.		
5	STA1 and STA2 send BFR feedback in HE TB PPDU to the APUT.	Run script HE1-DLMUMIMO-APUT.txt to STAUT and STA1. Note that the APUT is expected to initiate MU sounding protocol against, STA1 and STA2.		SN: Verify the following conditions are true. 1. BFRP Trigger frame sent to STA1, STA2 2. APUT transmits an HE NDP Announcement frame followed by an HE NDP, then followed by one or more BFRP Trigger frames (i.e., no PPDUs captured in the Sniffer between NDPA and first BFRP Trigger frame other than NDP) 3. NDP Announcement frame has the following format: a. RA field is set to broadcast b. Note: For non-HT/non-HT duplicate frames, the TA field has Individual/Group bit = 1 (bandwidth signaling TA) c. HE subfield (B1) of the Sounding Dialog Token = 1 in the HE NDP Announcement frame d. Two STA Info fields are present that match STA1 and STA2's AID11s e. STA Info fields corresponding to STA1 and STA2 in the HE NDP Announcement frame from APUT have the following settings: • Feedback Type And Ng (B25:B26) = 1 (MU, Ng=4)

Step	Test bed STA1, STA2	APUT	Test bed validation	Expected result
				• Disambiguation (B27) = 1 • Codebook Size (B28) = 1 {9,7} • Nc (B29:B31) set such that: ▪ The value of Nc+1 does not exceed the max NSS according to the Rx HE-MCS Map ≤ 80 MHz in the 'Supported HE-MCS And NSS Set' field sent by the corresponding STA for this STA Info field (STA1,STA2) ▪ The value of Nc does not exceed the value of Max Nc indicated in the HE PHY Capabilities sent by the corresponding STA for this STA Info field (STA1 or STA2) • RU Start (B11:B17) = 0 • RU End (B18:B24) = 36 (80 MHz Full BW) 4. BFRP Trigger frame has the following format: a. RA field is set to broadcast address and there are at least two User Info fields, or RA field is set to unicast address and there is only one User Info field b. Common Info field has the following settings ▪ Trigger Type (B0:B3) = 1 (BFRP) ▪ BW (B18:B19) = 2 (80 MHz) c. Trigger Dependent Common Info subfield is not present d. AID field of at least one User Info field matches the AID of either STA1 or STA2 e. Two User Info fields that match STA1, STA2's AID12s are covered across BFRP Trigger frames f. RU allocation to the STAs includes at least one RU in all 20 MHz channels used to send the Trigger frame g. Each User Info field has Trigger dependent User Info subfield and Feedback Segment Retransmission Bitmap subfield = 0xFF (all segments) If all of the above conditions are true, then PASS else FAIL.
6	STA1 and STA2 disassociate from the APUT.			

4.53.3 (Deleted)

4.54 APUT DL-MU-MIMO tests

4.54.1 APUT DL-MU-MIMO test

Objective

This test case verifies that the APUT correctly transmits DL-MU-MIMO PPDUs and receives acknowledgement from the STAs.

Applicability: Conditional. This test shall be mandatory only if the DUT declared support for greater than or equal to four SS DL transmission in Table 1.

References

Section 6.4.1.2 and 6.5.1.1 [1]

Section 27.3.3.1 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 126 defies the specific parameter values required for this test case.

Table 126. APUT DL-MU-MIMO test configuration

Parameter	APUT value	Test bed STA1	Test bed STA2
Test bed vendor	N/A	Intel200L	Broadcom98
AP control channel	36 in 5 GHz 6 in 2.4 GHz	N/A	N/A
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	DL MU-MIMO (HE_MU)	N/A	N/A

Test procedure and expected results

Table 127 provides the specific test procedure and expected results for this test case.

Table 127. APUT DL-MU-MIMO test procedure and expected results

Step	Test bed STA1 and STA2	APUT	Test bed validation	Expected result
1	Configure STA1 and STA2 per Table 6 and Table 126.	Configure the APUT per Table 12 and Table 126. Configure the APUT to transmit using DL MU-MIMO.		
2		The APUT sends Beacon and Probe Response frames to STA1 and STA2 in the 2.4 GHz band.		
3	Configure STA1 and STA2 to join the APUT's BSS in the 2.4 GHz band.			
4	STA1 and STA2 send an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1 and STA2.		If all STA associations succeed, then CONTINUE else FAIL.
5	STA1 and STA2 send an ADDBA Response with Buffer Size ≤ 64.	The APUT sends an ADDBA Request to STA1, STA2.		
6		Run script HE1-DLMUMIMO-APUT.txt to STA1 and STA2.		SN: Verify the following conditions are true: 1. APUT transmits DL MU-MIMO to STA1 and STA2 in the same PPDU. 2. Sequentially capture at least 10,000 packets for each STAAID and verify that 4541S6_STAID_24G of the packets are DL MU PPDUs with: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. BW bits of HE-SIG-A = 0 c. Number of users in the MU-MIMO Users field in HE-SIG-A= 2. 3. APUT set Ack Policy to one of the following: a. Block Ack on a PPDU to a STA Block Ack, and receiving STA sends C-BA with non-zero bitmap after receiving BAR, or in response to DL-MU-MIMO PPDU. b. Normal /Implicit Ack on a PPDU to a STA, and the receiving STA sends C-BA with non-zero bitmap in response to DL-MU-MIMO PPDU. 4. SIG-B Compression field in SIG-A of HE MU PDDU = 1 to indicate that FULL BW MU-MIMO is used 5. Aggregate throughput is more than 4541S6_ATP_24G 6. Throughput of each STA > 4541S6_STA_TP_24G 7. Percent of MU packets is > 4541S6_MU_24G% If all conditions above are true, then CONTINUE else FAIL.
7	STA1 and STA2 disassociate from the APUT.			
If the APUT supports 5 GHz, then CONTINUE else PASS.				
8		Configure the APUT to the 5 GHz band.		

Step	Test bed STA1 and STA2	APUT	Test bed validation	Expected result
		The APUT sends Beacon and Probe Response frames to STA1 and STA2 in the 5 GHz band.		
9	Configure STA1, STA2 to join the APUT's BSS in the 5 GHz band.			
10	STA1 and STA2 send an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1 and STA2.		If all STA associations succeed, then CONTINUE else FAIL.
11	STA1 and STA2 send an ADDBA Response with Buffer Size ≤ 64.	The APUT sends an ADDBA Request to STA1, STA2.		
12		Run script HE1-DLMUMIMO-APUT.txt to STA1 and STA2.		SN: Verify the following conditions are true: 1. APUT transmits DL-MU-MIMO to STA1 and STA2 in the same PPDU. 2. Sequentially capture at least 10000 packets for each STAAID and verify 4541S12_STAID_5G of the packets are DL MU PPDUs with: a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. BW bits of HE-SIG-A = 2 c. Number of users in the MU-MIMO Users field in HE-SIG-A = 2. 3. APUT set Ack Policy to one of the following: a. Block Ack on a PPDU to a STA Block Ack, and receiving STA sends C-BA with non-zero bitmap after receiving BAR, or in response to DL-MU-MIMO PPDU. b. Normal /Implicit Ack on a PPDU to a STA, and the receiving STA sends C-BA with non-zero bitmap in response to DL-MU-MIMO PPDU. 4. SIG-B Compression field in SIG-A of HE MU PDDU = 1 to indicate that FULL BW MU-MIMO is used 5. Aggregate throughput is more than 4541S12_ATP_5G 6. Throughput of each STA > 4541S12_STA_TP_5G 7. Percent of MU packets is > 4541S12_MU_5G% If all conditions above are true, then PASS else FAIL.

4.55 (Deleted)

4.56 APUT individual TWT tests

4.56.1 APUT individual TWT test

Objective

This test case verifies that the APUT correctly advertises support to operate as a TWT responder and correctly responds to requests for individual TWT (iTWT) setup from associated STAs.

An AP creates trigger-enabled TWT SPs that follow a periodic timing cycle. The AP includes Trigger frames within triggered TWT SPs. The AP tracks the power save state of power save STAs according to PS-Poll and APSD trigger receptions for announced TWT SPs and tracks the power save state of power save STAs according to TWT SP start and end times for unannounced TWT SPs.

Applicability: Mandatory. This is not applicable for Mobile APUT.

References

Section 6.3.1.24 [1]

Section 26.8 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 128 defines the specific parameter values required for this test case.

Table 128. APUT individual TWT test configuration

Parameter	APUT value	Test bed STA1	Test bed STA2
Test bed vendor	N/A	Broadcom75	Qualcomm
AP control channel	6 for 2.4 GHz band, 36 for 5 GHz band	N/A	N/A
Channel width	20 MHz for 2.4 GHz, 80 MHz for 5 GHz	20 MHz for 2.4 GHz, 80 MHz for 5 GHz	20 MHz for 2.4 GHz, 80 MHz for 5 GHz
TWT Requester Support	N/A	Enabled	Enabled
PPDU format	Rx HE_TRIG (UL OFDMA)	N/A	N/A
Do not send UL before Trigger frame when using trigger-enabled and Announced TWT	N/A	Enabled	Enabled

Test procedure and expected results

Table 129 provides the specific test procedure and expected results for this test case.

Table 129. APUT individual TWT test procedure and expected results

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
1	If the APUT supports 2.4 GHz, go to Step 2 else go to Step 12.			
2	Configure the APUT per Table 12 and Table 128. Configure the APUT to operate in the 2.4 GHz band.	Configure STA1 and STA2 per Table 6 and Table 128. Configure STA1, STA2 to operate in the 2.4 GHz band. Enable Power Save mode on STA1, STA2. Configure STA1, STA2 for MU EDCA override as per Table 7. Enable TWT Only PS Operation on STA1, STA2. Note : TWT is a scheduling algorithm, not a PS mode. TWT is independent of PS mode as per [7] . The STA should be configured not to be awake outside of TWT SPs.		
3	The APUT sends Beacon and Probe Response frames to the STAs.	Configure STA1, STA2 to join the APUT's BSS in the 2.4 GHz band..		SN: Verify that the APUT transmits Beacons and Probe Response frames with: 1. TWT Responder Support subfield of the Extended Capabilities element = 1 2. TWT Responder Support subfield of the HE Capabilities element = 1 If all of the above conditions are true, then CONTINUE else FAIL.
4	The APUT sends an Association Response frame to STA1, STA2.	STA1and STA2 send an Association Request frame to the APUT.		If STA1 and STA2 associations succeed, then CONTINUE else FAIL.
5		Enable STA1 for TWT Request with the Request Type field set to: 1. TWT Setup Command = 0 (Request TWT) 2. Trigger = 1 3. Flow Type = 0 (announced) 4. TWT Flow ID = any per [7] 5. TWT Wake Interval Exponent = 10 6. Target Wake Time = 0 7. Nominal Minimum TWT Wake Duration = 255 (65.280 ms)		

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
		8. TWT Wake Interval Mantissa = 512 (Note: TWT Wake Interval= TWT Wake Interval Exponent*TWT Wake Interval Mantissa=512* 2^10= 512 TU)		
6	The APUT sends a TWT Setup Response frame to STA1 .			SN: Verify that the APUT transmits a TWT Response frame to STA1 with: 1. Control field: a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type = 0 (B2:B3) 2. Request Type field: a. TWT Request = 0 b. TWT Setup Command = 4 (Accept TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 0 (announced) f. TWT Flow ID = Any per [7] g. TWT Wake Interval Exponent = 10 h. TWT Protection = 0 i. Target Wake Time MOD (16 TU) = 0 (Wi-Fi Aware requirement) j. Nominal Minimum TWT Wake Duration = 255 (65.280 ms) k. TWT Wake Interval Mantissa = 512 (512 TU) l. TWT Channel = 0 If all the parameters of the TWT Response frame to STA1 match the values listed above, then CONTINUE, else FAIL. If the APUT transmits a TWT Response frame to STA1, then CONTINUE else FAIL.
7		Enable STA2 for TWT Request with the following parameters: 1. Request Type field: a. TWT Setup Command = 1 (Suggest TWT) b. Trigger = 1 c. Flow Type = 1 (unannounced) d. TWT Flow ID = any per [7] spec e. TWT Wake Interval Exponent = 0 f. Target Wake Time = any g. Nominal Minimum TWT Wake Duration = 64 (16 TU) h. TWT Wake Interval Mantissa = 32768 (32 TU)		

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
8	The APUT sends a TWT Setup Response to STA2.			SN: Verify that the APUT transmits a TWT Response frame to STA2 with: 1. Control field: a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type = 0 (B2:B3) 2. Request Type field: a. TWT Request = 0 b. TWT Setup Command = 4 (Accept TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 1 (unannounced) f. TWT Flow ID = Any per [8]spec g. TWT Wake Interval Exponent = 0 h. TWT Protection = 0 i. Target Wake Time = any j. Nominal Minimum TWT Wake Duration = 64 (16 TU) k. TWT Wake Interval Mantissa = 32768 (32 TU) l. TWT Channel = 0 If all of the parameters of the TWT Response frame to STA2 match the values listed above, then CONTINUE else FAIL.
9	At the APUT, run script DT1-APUT-STA_4.56.1.txt to STA1and STA2 using AC_BE.			If the downlink throughput at STA1 is less than 4561S9_STA1_DLTP_24G, then FAIL else CONTINUE. If downlink throughput at STA2 is less than 4561S9_STA2_DLTP_24G, then FAIL else CONTINUE. SN: Verify the following conditions are true: 1. Within a randomly selected window of 2.097 seconds, verify that > 92% of the PPDU transmissions from the APUT to STA1 are within TWT SPs with start times separated by 524.288 ms (512 TU). 2. At least one UL PS-Poll, UL QoS Null or UL QoS Data frame is sent from STA1 to APUT before any DL PPDU transmissions (except Trigger frame) from the APUT to STA1 within a sampled TWT SP. 3. Within a randomly selected window of 0.131 seconds, verify that > 92% of the PPDU transmissions from APUT to STA2 are within TWT SPs with start times separated by 32.768 ms, (32 TU). 4. (Trigger Compliance) APUT should send at least one Trigger frame during SP. If multiple STAs are within

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
				SPs (overlapped case), the APUT should trigger the STAs with a single Trigger frame. If all the conditions above are true, then CONTINUE else FAIL.
10	At the APUT, turn off script DT1-APUT-STA_4.56.1.txt to STA1, STA2 using AC_BE.	At STA1 and STA2, run script UT1-STA-APUT_4.56.1.txt to APUT using AC_BE.		If the uplink throughput at STA1 is less than 4561S10_STA1_DLTP_24G:(4561_alpha*63.75TU / 512TU*SU_Throughput), then FAIL else CONTINUE. If uplink throughput at STA2 is < 4561S10_STA2_DLTP_24G:(4561_alpha*16TU / 32TU * SU_Throughput), then FAIL else CONTINUE. SN: Verify the following conditions are true: 1. Within a randomly selected window of 2.097 seconds, verify that > 92% of the PPDU transmissions from STA1 to APUT are within TWT SPs (add 4561_tolerance_SP_start µs margin for SP start time, and 4561_tolerance_SP_end µs margin for SP end time) with start times separated by 524.288 ms (512 TU). 2. Within a randomly selected window of 0.131 seconds, verify that > 92% of the PPDU transmissions from STA2 to APUT are within TWT SPs (add 4561_SP_tolerance µs margin for SP start time, and 4561_SP_toleranceus us margin for SP end time) with start times separated by 32.768 ms, (32 TU). If all the conditions above are true, then CONTINUE else .
11		At STA1, turn off script UT1-STA-APUT_4.56.1.txt to APUT using AC_BE. Configure STA1 to send a TWT Teardown frame to terminate the TWT with the following parameters: • TWT Flow ID = the TWT Flow ID from the APUT in Step 6 • Negotiation Type = 0 At STA1, run script UT1-STA-APUT_4.56.1.txt to APUT using AC_BE At STA1 and STA2, turn off script UT1-STA-APUT_4.56.1.txt to APUT using AC_BE.		If the uplink throughput at STA1 is less than 4561S11_STA1_ULTP_24G:(4561_alpha*SU_Throughput), then FAIL else CONTINUE. If the uplink throughput at STA2 is less than 4561S11_STA2_ULTP_24G:(4561_alpha*SU_Throughput), then FAILelseCONTINUE.
12	If the APUT supports 5 GHz, go to Step 13 else PASS.			
13	Configure the APUT per Table 12 and Table 128.	Configure STA1, and STA2 per Table 124 and Table 128.		

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
	Configure the APUT to operate in the 5 GHz band.	Configure STA1, STA2 to operate in the 5 GHz band. Enable Power Save mode on STA1, STA2. Configure STA1, STA2 for MU EDCA override as per Table 7.Enable TWT Only PS Operation on STA1, STA2.		
14	The APUT sends Beacon and Probe Response frames to the STAs.	Configure STA1, STA2 to join the APUT's BSS in the 5 GHz band.		SN: If the APUT transmits Beacons and Probe Response frames with: 1. TWT Responder Support subfield of the Extended Capabilities element = 1. 2. TWT Responder Support subfield of the HE Capabilities element = 1. then CONTINUE else FAIL.
15	The APUT sends an Association Response frame to STA1, STA2.	STA1 ,STA2 send an Association Request frame to the APUT.		If all STA associations succeed, then CONTINUE else FAIL.
16		Enable STA1 for TWT Request, with the following parameters: 1. Request Type field: a. TWT Setup Command = 0 (Request TWT) b. Trigger = 1 c. Flow Type = 0 (announced) d. TWT Flow ID = any per [7] e. TWT Wake Interval Exponent = 10 f. Target Wake Time = 0 g. Nominal Minimum TWT Wake Duration = 255 (65.280 ms) h. TWT Wake Interval Mantissa = 512 (512 TU)		
17	The APUT sends a TWT Setup Response frame to STA1.			SN: Verify that the APUT transmits a TWT Response frame to STA1 with: 1. Control field: a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type =0 (B2:B3) 2. Request Type field: a. TWT Request = 0 b. TWT Setup Command = 4 (Accept TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 0 (announced) f. TWT Flow ID = Any per [7] g. TWT Wake Interval Exponent = 10

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
				h. TWT Protection = 0 i. Target Wake Time MOD (16 TU) = 0 (Wi-Fi Aware requirement) j. Nominal Minimum TWT Wake Duration = 255 (65.280 ms) k. TWT Wake Interval Mantissa = 512 (512 TU) l. TWT Channel = 0 If al of the parameters of the TWT Response frame to either of STA1 match the values listed above, then CONTINUE else FAIL.
18		Enable STA2 for TWT Request with the following parameters: 1. Request Type field: a. TWT Setup Command = 1 (Suggest TWT) b. Trigger = 1 c. Flow Type = 1 (unannounced) d. TWT Flow ID = any per [7] e. TWT Wake Interval Exponent = 0 f. Target Wake Time = any g. Nominal Minimum TWT Wake Duration = 64 (16 TU) h. TWT Wake Interval Mantissa = 32768 (32 TU)		
19	The APUT sends a TWT Setup Response to STA2.			SN: Verify that the APUT transmits a TWT Response frame to STA2 with: 1. Control field: a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type =0 (B2:B3) 2. Request Type field: a. TWT Request = 0 b. TWT Setup Command = 4 (Accept TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 1 (unannounced) f. TWT Flow ID = Any per [7] g. TWT Wake Interval Exponent = 0 h. TWT Protection = 0 i. Target Wake Time = any j. Nominal Minimum TWT Wake Duration = 64 (16 TU) k. TWT Wake Interval Mantissa = 32768 (32 TU) l. TWT Channel = 0

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
				If all the parameters of the TWT Response frame to STA2 match the values listed above, then CONTINUE else FAIL.
20	At the APUT, run script DT1-APUT-STA_4.56.1.txt to STA1, STA2 using AC_BE.			If the downlink throughput at STA1 is less than 4561S20_STA1_DLTP_5G:(4561_alpha*63.75TU / 512TU*SU_Throughput), then FAIL else CONTINUE. If the downlink throughput at STA2 is less than 4561S20_STA2_DLTP_5G:(4561_alpha*16TU / 32TU * SU_Throughput), then FAIL else CONTINUE. SN: Verify the following conditions are true: 1. Within a randomly selected window of 2.097 seconds, verify that > 92% of the PPDU transmissions from APUT to STA1 are within TWT SPs (add 4561_SP_tolerance µs margin for SP start time, and 4561_SP_tolerance µs margin for SP end time) with start times separated by 524.288 ms (512 TU) 2. There is a Trigger frame sent by APUT to STA1 before there is any transmission from STA1 and at least one UL PS-Poll, UL QoS Null or UL QoS Data frame from STA1 to APUT occurs before any DL PPDU transmissions (except Trigger frame) from APUT to STA1 within a sampled TWT SP 3. At least one Trigger frame is transmitted by the AP within a sampled TWT SP for STA1 4. (Trigger compliance) Within a randomly selected window of 0.131 seconds, verify that > 92% of the PPDU transmissions from APUT to STA2 are within TWT SPs with start times separated by 32.768 ms, (32 TU). If all the conditions above are true, then CONTINUE else FAIL.
21	At APUT, turn off script DT1-APUT-STA_4.56.1.txt to STA1, STA2 using AC_BE.	At STA1 and STA2, run script UT1-STA-APUT_4.56.1.txt to APUT using AC_BE.		If the uplink throughput at STA1 is less than 4561S21_STA1_DLTP_5G:(4561_alpha*63.75TU / 512TU*SU_Throughput), then FAIL else CONTINUE. If the uplink throughput at STA2 is less than 4561S21_STA2_DLTP_5G:(4561_alpha*16TU / 32TU * SU_Throughput) then FAIL else CONTINUE. SN: Verify the following conditions are true: 1. Within a randomly selected window of 2.097 seconds, verify that > 92% of the PPDU transmissions from STA1 to APUT are within TWT SPs (add 4561_SP_tolerance µs margin for SP start time, and 4561_SP_tolerance µs margin for SP end time) with start times separated by 524.288 ms (512 TU).

Step	APUT	Test bed STA1, STA2	Test bed validation	Expected result
				2. Within a randomly selected window of 0.131 seconds, verify that > 92% of the PPDU transmissions from STA2 to APUT are within TWT SPs (add 4561_SP_tolerance µs margin for SP start time, and 4561_SP_tolerance µs margin for SP end time) with start times separated by 32.768 ms, (32 TU). If all the conditions above are true, then CONTINUE else FAIL.
22		At STA1, turn off script UT1-STA-APUT_4.56.1.txt to APUT using AC_BE. Configure STA1 to send a TWT Teardown frame to terminate the TWT with the following parameters: • TWT Flow ID = the TWT Flow ID from the APUT in step 19 • Negotiation Type = 0 At STA1, run script UT1-STA-APUT_4.56.1.txt to APUT using AC_BE		If the uplink throughput at STA1 is less than 4561S22_STA1_ULTP_5G:(4561_alpha*SU_Throughput) , then FAIL else PASS. If the uplink throughput at STA2 is less than 4561S22_STA2_ULTP_5G:(4561_alpha*SU_Throughput) , then FAILelse PASS.

4.56.2 Mobile APUT individual TWT test

Objective

This test case verifies that the APUT correctly advertises support to operate as a TWT responder and correctly responds to requests for individual TWT (iTWT) setup from associated STAs.

An AP creates trigger-enabled TWT SPs that follow a periodic timing cycle. The AP includes Trigger frames within triggered TWT SPs. The AP tracks the power save state of power save STAs according to PS-Poll and APSD trigger receptions for announced TWT SPs and tracks the power save state of power save STAs according to TWT SP start and end times for unannounced TWT SPs.

Applicability: If the APUT declared primary device category as AP in Table 1, then Not applicable.

If the APUT declared primary device category as Mobile AP in Table 1, then it is Optional

References

Section 6.3.1.24 [1]

Section 26.8 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA

- Wireless Sniffer

Test configuration

Table 128 Table 130 defines the specific parameter values required for this test case.

Table 130. APUT individual TWT test configuration

Parameter	DUT value	Test bed STA1
Test bed vendor	N/A	Broadcom75
AP Control channel	6 for 2.4 GHz band, 36 for 5 GHz band	N/A
Channel width	20 MHz for 2.4 GHz, 80 MHz for 5 GHz	20 MHz for 2.4 GHz, 80 MHz for 5 GHz
TWT Requester support	N/A	Enabled
PPDU Format	Rx HE_TRIG (UL OFDMA)	N/A
Do not send UL before Trigger frame when using trigger-enabled and Announced TWT		Enabled

Test procedure and expected results

Table 129 provides the specific test procedure and expected results for this test case.

Table 131. APUT individual TWT test procedure and expected results

Step	APUT	Test bed STA1	Test bed validation	Expected result
1	If the APUT supports 2.4 GHz, go to Step 2, otherwise, go to Step 14.			
2	Configure the APUT per Table 12 and Table 130 Configure the APUT to operate in the 2.4 GHz band.	Configure STA1 per Table 6 and Table 128. Configure STA1 to operate in the 2.4 GHz band. Enable Power Save mode on STA1 Configure STA1 for MU EDCA Override as per Table 7. Enable TWT Only PS Operation on STA1 Note : TWT is a scheduling algorithm, not a PS mode TWT is independent of PS mode as per [7] . The STA should be configured not to be awake outside of TWT SPs.		

Step	APUT	Test bed STA1	Test bed validation	Expected result
3	The APUT sends Beacon and Probe Response frames to the STA1.	Configure STA1 to join the APUT's BSS in the 2.4 GHz band..		SN: Verify that the APUT transmits Beacons and Probe Responses frames with: 1. TWT Responder Support subfield of the Extended Capabilities element =1 2. TWT Responder Support subfield of the HE Capabilities element = 1 If all of the above conditions are true, then CONTINUE else FAIL.
4	The APUT sends an Association Response frame to STA1	STA1 send an Association Request frame to the APUT.		If STA1 association succeedes, then CONTINUE else FAIL.
5		Enable STA1 for TWT Request, with the Request Type field set to: 1. TWT Setup Command = 0 (Request TWT) 2. Trigger = 1 3. Flow Type = 0 (announced) 4. TWT Flow ID = any per [7] 5. TWT Wake Interval Exponent = 10 6. Target Wake Time = 0 7. Nominal Minimum TWT Wake Duration = 255 (65.280 ms) 8. TWT Wake Interval Mantissa = 512 (Note: TWT Wake Interval= TWT Wake Interval Exponent*TWT Wake Interval Mantissa=512* 2^10= 512 TU)		
6	The APUT sends a TWT Setup Response frame to STA1 .			SN: Verify that the APUT transmits a TWT Response frame to STA1 with: 1. Control field: a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type =0 (B2:B3) 2. Request Type field: a. TWT Request = 0 b. TWT Setup Command = 4 (Accept TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 0 (announced) f. TWT Flow ID = Any per [7] g. TWT Wake Interval Exponent = 10 h. TWT Protection = 0 i. Target Wake Time MOD (16 TU) = 0 (Wi-Fi Aware requirement) j. Nominal Minimum TWT Wake Duration = 255 (65.280 ms)

Step	APUT	Test bed STA1	Test bed validation	Expected result
				k. TWT Wake Interval Mantissa = 512 (512 TU) l. TWT Channel = 0 If all the parameters of the TWT Response frame to STA1 match the values listed above, then CONTINUE, else FAIL. If the APUT transmits a TWT Response frame to STA1 , then CONTINUE else FAIL.
7	At the APUT, run script DT1-APUT-STA to STA1 using AC_BE.			If the Downlink throughput at STA1 is less than 4562S7_STA1_DLTP_24G, then FAIL, else CONTINUE. SN: Verify the following condtions are true: 1. Within a randomly selected window of 2.097 seconds, verify that > 92%of the PPDU transmissions from APUT to STA1 are within TWT SPs (add 4562_tolerance_SP_start µs margin for SP start time, and 4562_tolerance_SP_end µs margin for SP end time) with start times separated by 524.288 ms (512 TU). 2. At least one UL PS-Poll, UL QoS Null or UL QoS Data frame from STA1 to APUT before any DL PPDU transmissions (except Trigger Frame) from APUT to STA1 within a sampled TWT SP. 3. (trigger compliance)APUT should send at least one Trigger frame during SP If all the condtions above are true, then CONTINUE else FAIL.
8	At the APUT, turn off script DT1-APUT-STA to STA1 using AC_BE.	At STA1, run script UT1-STA-APUT to APUT using AC_BE.		If the Uplink throughput at STA1 is less than 4561S10_STA1_DLTP_24G:(4562_alpha *63.75TU / 512TU*SU_Throughput), then FAIL else CONTINUE. SN: Verify the following condtion is true: 4. Within a randomly selected window of 2.097 seconds, verify that > 92% of the PPDU transmissions from STA1 to APUT are within TWT SPs (add 4562_tolerance_SP_start µs margin for SP start time, and 4562_tolerance_SP_end µs margin for SP end time) with start times separated by 524.288 ms (512 TU). If all the condtions above are true, then CONTINUE else .
9		At STA1, turn off script UT1-STA-APUT to APUT using AC_BE Configure STA1 for TWT Teardown to send a TWT Teardown frame to terminate the TWT with the following parameters: • TWT Flow ID = the TWT Flow ID from the APUT in Step 6 • Negotiation Type = 0		If the Uplink throughput at STA1 is less than 4561S10_STA1_DLTP_24G:(4562_alpha *SU_Throughput), then FAIL else CONTINUE.

Step	APUT	Test bed STA1	Test bed validation	Expected result
		At STA1, run script UT1-STA-APUT to APUT using AC_BE		
10		Disassociate STA1		
11	The APUT sends an Association Response frame to STA1	STA1 send an Association Request frame to the APUT.		If STA1 association succeedes, then CONTINUE else FAIL.
12		Enable STA1 for TWT Request with the following parameters: Request Type field: a. TWT Setup Command = 1 (Suggest TWT) b. Trigger = 1 c. Flow Type = 1 (unannounced) d. TWT Flow ID = any per [8]spec e. TWT Wake Interval Exponent = 0 f. Target Wake Time = any g. Nominal Minimum TWT Wake Duration = 64 (16 TU) h. TWT Wake Interval Mantissa = 32768 (32 TU)		

Step	APUT	Test bed STA1	Test bed validation	Expected result
13	The APUT sends a TWT Setup Response to STA1.			SN: Verify that the APUT transmits a TWT Response frame to STA1 with: Control field: i. NDP Paging Indicator = 0 j. Responder PM Mode = 0 k. Negotiation Type =0 (B2:B3) l. Request Type field: m. TWT Request = 0 n. TWT Setup Command = 4 (Accept TWT) o. Trigger = 1 p. Implicit = 1 q. Flow Type = 1 (unannounced) r. TWT Flow ID = Any per [8]spec s. TWT Wake Interval Exponent = 0 t. TWT Protection = 0 u. Target Wake Time = any v. Nominal Minimum TWT Wake Duration = 64 (16 TU) w. TWT Wake Interval Mantissa = 32768 (32 TU) x. TWT Channel = 0 y. If the APUT transmits a TWT Response frame to STA1, then CONTINUE else FAIL. If all of the parameters of the TWT Response frame to STA1 match the values listed above, then CONTINUE else FAIL.
14	At the APUT, run script DT1-APUT-STA to STA1 using AC_BE.			If Downlink throughput at STA1 is less than 4.2.xxHE4OPEN, then FAIL, else CONTINUE. SN: Verify the following condtions are true: 1. Within a randomly selected window of 0.131 seconds, verify that > 92% of the PPDU transmissions from APUT to STA1 are within TWT SPs (add 4561_tolerance_SP_start µs margin for SP start time, and 4561_tolerance_SP_end µs margin for SP end time) with start times separated by 32.768 ms, (32 TU). 2. . (trigger compliance)AP should send at least one Trigger frame during SP. If all the condtions above are true, then CONTINUE else FAIL.
15	At the APUT, turn off script DT1-APUT-STA to STA1 using AC_BE.	At STA1, run script UT1-STA-APUT to APUT using AC_BE.		If Uplink throughput at STA1 is less than 4561S15_STA1_DLTP_24G:(4562_alpha *16TU / 32TU * SU_Throughput), then FAIL else CONTINUE. SN: Verify the following condtion is true: 3. Within a randomly selected window of 0.131 seconds, verify that > 92 %of the PPDU transmissions from STA1 to APUT are within TWT SPs (add 4562_tolerance_SP_start µs margin for SP start time, and 4562_tolerance_SP_end µs

Step	APUT	Test bed STA1	Test bed validation	Expected result
				margin for SP end time) with start times separated by 32.768 ms, (32 TU). If the above condtions are true, then CONTINUE else . FAIL
16	If the APUT supports 5 GHz, go to Step 15, otherwise PASS.			
17	Configure the APUT per Table 12 and Table 128. Configure the APUT to operate in the 5 GHz band.	Configure STA1 per Table 124 and Table 128. Configure STA1 to operate in the 5 GHz band. Enable Power Save mode on STA1 Configure STA1 for MU EDCA Override as per Table 7.Enable TWT Only PS Operation on STA1.		
18	The APUT sends Beacon and Probe Response frames to the STAs.	Configure STA1 to join the APUT's BSS in the 5 GHz band.		SN: Ift the APUT transmits Beacons and Probe Response frame with: 1. TWT Responder Support subfield of the Extended Capabilities element set to 1. 2. TWT Responder Support subfield of the HE Capabilities element set to 1. If the above condtions are true then CONTINUE else FAIL.
19	The APUT sends an Association Response frame to STA1	STA1 sends an Association Request frame to the APUT.		If STA1 association succeedes, then CONTINUE else FAIL.
20		Enable STA1 for TWT Request, with the following parameters: Request Type field: a. TWT Setup Command = 0 (Request TWT) b. Trigger = 1 c. Flow Type = 0 (announced) d. TWT Flow ID = any per [7] e. TWT Wake Interval Exponent = 10 f. Target Wake Time = 0 g. Nominal Minimum TWT Wake Duration = 255 (65.280 ms) TWT Wake Interval Mantissa = 512 (512 TU)		
21	The APUT sends a TWT Setup Response to STA1			SN: Verify that the APUT transmits a TWT Response frame to STA1 with: Control field: a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type =0 (B2:B3)

Step	APUT	Test bed STA1	Test bed validation	Expected result
				Request Type field: d. TWT Request = 0 e. TWT Setup Command = 4 (Accept TWT) f. Trigger = 1 g. Implicit = 1 h. Flow Type = 0 (announced) i. TWT Flow ID = Any per [7] j. TWT Wake Interval Exponent = 10 k. TWT Protection = 0 l. Target Wake Time MOD (16 TU) = 0 (because of WFA NAN requirement) m. Nominal Minimum TWT Wake Duration = 255 (65.280 ms) n. TWT Wake Interval Mantissa = 512 (512 TU) o. TWT Channel = 0 If all of the parameters of the TWT Response frame to STA1 match the values listed above, then CONTINUE else FAIL. If the APUT transmits a TWT Response frame to STA1 , then CONTINUE else FAIL.
22	At APUT, run script DT1-APUT-STA to STA1 using AC_BE.			If theDownlink throughput at STA1 is less than 4561S22_STA1_DLTP_5G:(4562_alpha *63.75TU / 512TU*SU_Throughput), then FAIL else CONTINUE. SN: Verify the following condtions are true: 1. Within a randomly selected window of 2.097 seconds, verify that > 92%of the PPDU transmissions from APUT to STA1 are within TWT SPs (add 4562_SP_tolerance µs margin for SP start time, and 4562_SP_tolerance µs margin for SP end time) with start times separated by 524.288 ms (512 TU) 2. There is a Trigger frame sent by APUT to STA1 before there is any transmission from STA1 and at least one UL PS-Poll, UL QoS Null or UL QoS Data frame from STA1 to APUT occurs before any DL PPDU transmissions (except Trigger frame) from APUT to STA1 within a sampled TWT SP 3. At least one Trigger frame is transmitted by the AP within a sampled TWT SP for STA1 If all the condtions above are true, then CONTINUE else FAIL.
23	At APUT, turn off script DT1-APUT-STA to STA1 using AC_BE.	At STA1, run script UT1-STA-APUT to APUT using AC_BE..		If the Uplink throughput at STA1 is less than 4561S23_STA1_DLTP_5G:(4562_alpha *63.75TU / 512TU*SU_Throughput),, then FAIL else CONTINUE. SN: Verify the following condtion is true: 1. Within a randomly selected window of 2.097 seconds, verify that > 92%of the PPDU transmissions from STA1 to APUT are within TWT SPs (add 4562_SP_tolerance µs margin for SP start time, and 4562_SP_tolerance µs margin for SP end time) with start times separated by 524.288 ms (512 TU).

Step	APUT	Test bed STA1	Test bed validation	Expected result
				If the above condition is true, then CONTINUE else FAIL.
24		At STA1, turn off script UT1-STA-APUT to APUT using AC_BE Configure STA1 for TWT Teardown to send a TWT Teardown frame to terminate the TWT with the following parameters: • TWT Flow ID = the TWT Flow ID from the APUT in step 19 • Negotiation Type = 0 At STA1, run script UT1-STA1-APUT to APUT using AC_BE		If the Uplink throughput at STA1 is less than 4561S24_STA1_DLTP_5G:(4562_alpha *SU_Throughput), then FAIL else PASS.
25		Disassociate STA1		
26	The APUT sends an Association Response frame to STA1	STA1 send an Association Request frame to the APUT.		If STA1 association succeedes, then CONTINUE else FAIL.
27		Enable STA1 for TWT Request with the following parameters: Request Type field: • TWT Setup Command = 1 (Suggest TWT) • Trigger = 1 • Flow Type = 1 (unannounced) • TWT Flow ID = any per [8]spec • TWT Wake Interval Exponent = 0 • Target Wake Time = any • Nominal Minimum TWT Wake Duration = 64 (16 TU) TWT Wake Interval Mantissa = 32768 (32 TU)		
28	The APUT sends a TWT Setup Response to STA1.			SN: Verify that the APUT transmits a TWT Response frame to STA1 with: Control field: a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type =0 (B2:B3) Request Type field: d. TWT Request = 0 e. TWT Setup Command = 4 (Accept TWT)

Step	APUT	Test bed STA1	Test bed validation	Expected result
				f. Trigger = 1 g. Implicit = 1 h. Flow Type = 1 (unannounced) i. TWT Flow ID = Any per [8]spec j. TWT Wake Interval Exponent = 0 k. TWT Protection = 0 l. Target Wake Time = any m. Nominal Minimum TWT Wake Duration = 64 (16 TU) n. TWT Wake Interval Mantissa = 32768 (32 TU) o. TWT Channel = 0 p. If the APUT transmits a TWT Response frame to STA1, then CONTINUE else FAIL. If all of the parameters of the TWT Response frame to STA1 match the values listed above, then CONTINUE else FAIL.
29	At APUT, run script DT1-APUT-STA to STA1 using AC_BE.			If Downlink throughput at STA1 is less than 4561S29_STA1_ULTP_5G:(4561_alpha *16TU / 32TU * SU_Throughput)), then FAIL else CONTINUE. SN: Verify the following condtions are true: 1. Within a randomly selected window of 2.097 seconds, verify that >92%) of the PPDU transmissions from APUT to STA1 are within TWT SPs (add 4562_SP_tolerance µs margin for SP start time, and 4562_SP_tolerance µs margin for SP end time) with start times separated by 524.288 ms (512 TU) 2. At least one Trigger frame is transmitted by the AP within a sampled TWT SP for STA1 If all the condtions above are true, then CONTINUE else FAIL.
30	At APUT, turn off script DT1-APUT-STA to STA1 using AC_BE.	At STA1, run script UT1-STA-APUT to APUT using AC_BE.		If Uplink throughput at STA1 is less than 4561S30_STA1_ULTP_5G(:(4561_alpha *16TU / 32TU * SU_Throughput)) then FAIL else CONTINUE. SN: Verify the following condtion is true: - Within a randomly selected window of 0.131 seconds, verify that > 92% of the PPDU transmissions from STA1 to APUT are within TWT SPs (add 4562_SP_tolerance µs margin for SP start time, and 4562_SP_tolerance µs margin for SP end time) with start times separated by 32.768 ms, (32 TU). If the condtion is true, then PASS else FAIL.

4.57 (Deleted)

4.58 APUT transmits and receives its operating mode tests

4.58.1 APUT transmits and receives its operating mode test

Objective

This test case verifies that the DUT properly interprets received OM A-Control information for UL MU operation.

Applicability: If the APUT declared primary device category as AP in Table 1, then Mandatory.

If the APUT declared primary device category as Mobile AP in Table 1 and supports only 1SS,then only 5 GHz or If the Mobile AP supports 2SS, then both 2.4 GHz and 5 GHz variations are Conditional Mandatory if iTWT is supported.

References

Section 6.3.1.28 [1]

Section 26.9.1 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 132 defines the specific parameter values required for this test case.

Table 132. APUT transmits and receives its operating mode configuration

Parameter	APUT value	Test bed STA1 value
Test bed vendor	N/A	Qualcomm for 2.4 GHz Broadcom98 for 5 GHz
Security	WPA2-Personal	WPA2-Personal
Encryption key	12345678	12345678
AP control channel	6 for 2.4 GHz band 36 for 5 GHz band	N/A
Bandwidth	20 MHz in 2.4 GHz 80 MHz in 5 GHz	N/A
Spatial streams implemented	Default	2
Transmit UPH and OM Control field in MPDU(s) sent in a PPDU when signaled by the script. The MPDU(s) in the PPDU solicit an immediate response (Ack or BlockAck))	NA	Enable

Parameter	APUT value	Test bed STA1 value
The PPDU is sent in HE TB PPDU if the Testbed STA is not configured to Disable MU in OMI field, otherwise it is sent in an SU PPDU (there is no UPH when sent in SU PPDU).		
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz on 5 GHz 20 MHz on 2.4 GHz
PPDU format	Rx HE_TRIG (UL OFDMA)	N/A
MU functionality	Enable UL OFDMA	Enable UL OFDMA

Test procedure and expected results

Table 133 provides the specific test procedure and expected results for this test case.

Table 133. APUT transmits and receives its operating mode procedure and expected results

Step	APUT	Test bed STA1	Test bed validation	Expected result
1	If the APUT supports 5 GHz, go to Step 2, else go to Step 15.			
2	Configure the APUT to operate in the 5 GHz band per Table 132 and Table 12	Configure STA1 per Table 132. and Table 6 Configure for MU EDCA override as per Table 7.		
3	The APUT sends Beacon and Probe Response frames to STA1.	Configure STA1 to join the APUT's BSS.		SN: Verify that the following conditions within Beacon and Probe Response frames are true: 1. +HTC-HE field of the HE Capabilities element = 1 2. OM Control Support field of the HE Capabilities element = 1 If all conditions are true, then CONTINUE else FAIL.
4	The APUT sends an Association Response frame to STA1.	STA1 sends an Association Request frame to the APUT.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: Verify the following conditions are true: 1. +HTC-HE field of the HE Capabilities element in the Association Response frame = 1. 2. OM Control Support field of the HE Capabilities element in the Association Response frame = 1. If all conditions are true, then CONTINUE else FAIL.
5	The APUT sends an ADDBA Response to STA1.	STA1 sends an ADDBA Request frame to the APUT.		SN: If the BA setup is successful, then CONTINUE else FAIL.
6	Configure the APUT to send a Basic Trigger frame to Solicit HE TB PPDU (even if there is			

Step	APUT	Test bed STA1	Test bed validation	Expected result
	only one STA that is supporting UL MU operation).			
7		Configure STA1 to run script UT1-STA1-APUT_4.58.X.txt to APUT for 20 seconds.		SN: Verify the Common Info subfield settings in the Basic Trigger frame are true: 1. Trigger Type = 0 (Basic) 2. BW = 2 (80 MHz) 3. User Info field contains: a. AID12 subfield equal to the AID of the STA1 and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 1 If all conditions are true, then CONTINUE else FAIL. Compute the throughput. If the throughput > 4581S7_S_MU_OMI_5G, then CONTINUE else FAIL.
8	Note: only change 80MHz→20MHz .	Configure STA1 to run script UT1-STA1-APUT-OMCtrl.txt to the APUT for 20 seconds. After 2 seconds configure STA1 to include UPH and the OM Control field in transmitted MPDU(s) in a PPDU with: 1. Channel Width subfield = 0 (BW=20MHz) 2. UL MU Disable subfield = 0 3. Tx NSTS subfield = 1 (actual Tx NSTS=2)	Verify that the HE TB PPDU is carrying MPDUs that has HT Control field carrying OMI and UPH. Verify the OMI signaling includes: 1. Channel Width subfield = 0 (BW=20MHz) 2. UL MU Disable subfield = 0 3. Tx NSTS subfield = 1 (actual Tx NSTS=2)	SN: Verify that the APUT properly acknowledges at least one instance of HE TB PPDU that has MPDUs carrying UPH and OMI field according to the following rules: 1. If QoS Null as S-MPDU is used to carry UPH and OM Control, the Ack Policy of the QoS Null from STA1 must be Normal Ack. The APUT must send back a Normal Ack. 2. OR 3. If QoS Data frames and QoS Null data frame are aggregated in one A-MPDU to carry UPH and OM Control a. QoS Data frames from STA1 must have Implicit BAR and the APUT must send a BlockAck b. QoS Null from STA1 must have No Ack. The APUT must not send any Ack in response. 4. If QoS Data frames are aggregated in one A-MPDU to carry UPH and OM Control, QoS Data frames must have Implicit BAR. The APUT must send a BlockAck. All frames in one A-MPDU should have the same HTC value. 5. If QosData from STA1 with UPH and OM Control is in S-MPDU then its Ack Policy should be normal Ack. The APUT should send Ack in response. After the APUT acknowledges HE TB PPDU that has MPDUs carrying UPH and OMI field verify the following conditions are true: The Basic Trigger frame sent by the APUT after 4581S8_TF_5G Basic Trigger frame and within 4581S8_TIME_5G TXOP has the following setting: 1. Common Info subfield: a. Trigger Type = 0 (Basic) b. BW = 0 (20 MHz)

Step	APUT	Test bed STA1	Test bed validation	Expected result
				2. User Info field with AID12 subfield equal to the AID of STA1 and SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 If all conditions are true, then CONTINUE, else FAIL. Compute throughput. If throughput > 4581S8_MU_OMI_5G / 4 then CONTINUE else FAIL.
9	Note: 20MHz→80MHz .	Configure STA1 to run script UT1-STA1-APUT-OMCtrl.txt to APUT for 20 seconds. At time 2 seconds after the traffic initiated by STA1, configure STA1 to include UPH and OM Control field in transmitted MPDU(s) with: 1. Channel Width = 2 (BW=80 MHz) 2. UL MU Disable = 0 3. Tx NSTS = 1 (actual Tx NSTS=2)	Verify that HE TB PPDU is carrying MPDUs that has HT Control field carrying OMI and UPH. Verify the OMI signaling includes: 1. Channel Width = 2 (BW=80 MHz) 2. UL MU Disable = 0 3. Tx NSTS = 1 (actual Tx NSTS=2)	SN: Using sniffer capture PPDUs after OMI change was triggered by the script. Verify that the APUT properly acknowledges at least one instance of HE TB PPDU that has MPDUs carrying UPH and OMI field according to following rules: 1. If QoS Null as S-MPDU is used to carry UPH and OM Control, the Ack Policy of the QoS Null from STA1 must be Normal Ack. The APUT must send back a Normal Ack. 2. If QoS Data frames and QoS Null data frame are aggregated in one A-MPDU to carry UPH and OM Control a. QoS Data frames from STA1 must have Implicit BAR and the APUT must send a BlockAck b. QoS Null from STA1 must have No Ack. The APUT must not send any Ack in response. 3. If QoS Data frames are aggregated in one A-MPDU to carry UPH and OM Control, QoS Data frames must have Implicit BAR. The APUT must send a BlockAck. All frame in one A-MPDU should have same HTC value. 4. If QosData in S-MPDU from STA1 then its Ack Policy should be normal Ack. The APUT should send Ack in response After the APUT acknowledges HE TB PPDU that has MPDUs carrying UPH and OMI field verify: The Basic Trigger frame sent by the APUT after 4581S9_TF_5G Basic Trigger frame and within 4581S9_TIME_5G TXOP has the following settings: 1. Common Info subfield has: a. Trigger Type = 0 (Basic) b. BW = 2 (80 MHz) 2. User Info field with AID12 subfield equal to the AID of the STA1 3. SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 If all conditions are true, then CONTINUE, else FAIL. Compute throughput. If throughput > 4581S9_MU_OMI_5G, then CONTINUE else FAIL

Step	APUT	Test bed STA1	Test bed validation	Expected result
10	Note: Tx NSTS from 2→1	Configure STA1 to run script UT1-STA1-APUT-OMCtrl.txt to APUT for 20 seconds. At time 2 seconds after the traffic initiated by STA1, configure the STA1 to include UPH and OM Control field in transmitted MPDU(s) with: 1. Channel Width = 2 (BW=80 MHz) 2. UL MU Disable = 0 3. Tx NSTS = 0 (actual Tx NSTS=1)	Verify that HE TB PPDU is carrying MPDUs that has HT Control field carrying OMI and UPH. Verify the OMI signaling includes: 1. Channel Width = 2 (BW=80 MHz) 2. UL MU Disable = 0 3. Tx NSTS = 0 (actual Tx NSTS=1)	SN: Using sniffer capture PPDUs after OMI change was triggered by the script. Verify that the APUT properly acknowledges at least one instance of HE TB PPDU that has MPDUs carrying UPH and OMI field according to following rules: 1. If QoS Null as S-MPDU is used to carry UPH and OM Control, the Ack Policy of the QoS Null from STA1 must be Normal Ack. The APUT must send back a Normal Ack. 2. If QoS Data frames and QoS Null data frame are aggregated in one A-MPDU to carry UPH and OM Control a. QoS Data frames from STA1 must have Implicit BAR and APUT must send a BlockAck. b. QoS Null from STA1 must have No Ack. The APUT must not send any Ack in response. 3. If QoS Data frames are aggregated in one A-MPDU to carry UPH and OM Control, QoS Data frames must have Implicit BAR. The APUT must send a BlockAck. All frames in one A-MPDU should have same HTC value. 4. If QosData in S-MPDU from STA1 then its Ack policy should be normal Ack. The APUT should send Ack in response. After the APUT acknowledges HE TB PPDU that has MPDUs carrying UPH and OMI field verify: 1. Basic Trigger frame sent by the APUT after 4581S10_TF_5G Basic Trigger frame and within 4581S10_TIME_5G TXOP has the following settings in the Common Info subfield: a. Trigger Type = 0 (Basic) b. BW = 2 (80 MHz) 2. Basic Trigger frame contains one User Info field with a. AID12 subfield equal to STA1 AID and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 0 If all conditions are true, then CONTINUE else FAIL. Compute throughput. If the throughput > 4581S10_MU_OMI_5G / 2 then CONTINUE else FAIL.
11	Note: Tx NSTS from 1→2	Configure STA1 to run script UT1-STA1-APUT-OMCtrl.txt to APUT for 20 seconds. At time 2 seconds after the traffic initiated by STA1, configure the STA1 to include UPH and OM Control field in transmitted MPDU(s) with:	Verify that HE TB PPDU is carrying MPDUs that has HT Control field carrying OMI and UPH. Signaling in OMI to have: 1. Channel Width = 2 (BW=80 MHz) 2. UL MU Disable = 0 3. Tx NSTS = 1 (actual Tx NSTS=2)	SN: Using sniffer capture PPDUs after OMI change was triggered by the script. Verify that APUT properly acknowledges at least one instance of HE TB PPDU that has MPDUs carrying UPH and OMI field according to following rules: 1. If QoS Null as S-MPDU is used to carry UPH and OM Control, the Ack Policy of the QoS Null from STA1 must be Normal Ack. APUT must send back a Normal Ack 2. If QoS Data frames and QoS Null data frame are aggregated in one A-MPDU to carry UPH and OM Control

Step	APUT	Test bed STA1	Test bed validation	Expected result
		1. Channel Width = 2 (BW=80M Hz) 2. UL MU Disable = 0 3. Tx NSTS = 1 (actual Tx NSTS=2)		a. QoS Data frames from STA1 must have Implicit BAR and the APUT must send a BlockAck. b. QoS Null from STA1 must have No Ack. The APUT must not send any Ack in response. 3. If QoS Data frames are aggregated in one A-MPDU to carry UPH and OM Control, QoS Data frames must have Implicit BAR. APUT must send a BlockAck. All frames in one A-MPDU should have same HTC value. 4. If QosData in S-MPDU from STA1 then its Ack policy should be normal Ack. The APUT should send Ack in response. After the APUT acknowledges HE TB PPDU that has MPDUs carrying UPH and OMI field verify: 1. Basic Trigger frame sent by the APUT after 4581S11_TF_5G Basic Trigger frame and within 4581S11_TIME_5G TXOP the following settings in the Common Info subfield: a. Trigger Type = 0 (Basic) b. BW = 2 (80 MHz) 2. Basic Trigger frame contains one User Info field with a. AID12 subfield equal to the AID of the STA1 and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 1 If all conditions are true, then CONTINUE else FAIL. Compute throughput. If the throughput > 4581S11_MU_OMI_5G then CONTINUE else FAIL
12	Note: UL MU Enable→Disable test	Configure STA1 to run script UT1-STA1-APUT-OMCtrl-MUEDCA.txt to APUT for 20 seconds. At time 2 seconds after the traffic initiated by STA1, configure the STA1 to include UPH and OM Control field in transmitted MPDU(s) with: 1. Channel Width = 2 (BW=80 MHz) 2. UL MU Disable = 1 3. Tx NSTS = 1 (actual Tx NSTS=2) Disable MU EDCA override on STA1 after triggering OMI change.	Verify that HE TB PPDU is carrying MPDUs that has HT Control field carrying OMI and UPH. Signaling in OMI to have: 1. Channel Width = 2 (BW=80 MHz) 2. UL MU Disable = 1 3. Tx NSTS = 1 (actual Tx NSTS=2) Disable MU EDCA override on STA1 after triggering OMI change.	SN: Capture PPDUs after OMI change was triggered by the script. Verify that the APUT properly acknowledges at least one instance of HE TB PPDU that has MPDUs carrying UPH and OMI field according to following rules: 1. If QoS Null as S-MPDU is used to carry UPH and OM Control, the Ack Policy of the QoS Null from STA1 must be Normal Ack. The APUT must send back a Normal Ack. 2. If QoS Data frames and QoS Null data frame are aggregated in one A-MPDU to carry UPH and OM Control a. QoS Data frames from STA1 must have Implicit BAR and the APUT must send a BlockAck b. QoS Null from STA1 must have No Ack. The APUT must not send any Ack in response. 3. If QoS Data frames are aggregated in one A-MPDU to carry UPH and OM Control, QoS Data frames must have Implicit BAR. The APUT must send a BlockAck. All frames in one A-MPDU should have same HTC value. 4. If QosData in S-MPDU from STA1 then its Ack policy should be normal Ack. The APUT should send Ack in response. After the APUT acknowledges HE TB PPDU that has MPDUs carrying UPH and OMI field verify the following:

Step	APUT	Test bed STA1	Test bed validation	Expected result
				1. After successful transmission of MPDUs carrying the OMI signaling, after 5*TXOP period there are no Trigger frames with AID12 equal to STA1. If all conditions are true, then CONTINUE else FAIL.
13	Note: UL MU Disable->Enable test	After 10 seconds, configure STA1 to run script UT1-STA1-APUT-OMCtrl.txt to include the OM Control field in transmitted MPDU(s) to the APUT with: 1. Channel Width = 2 (BW=80 MHz) 2. UL MU Disable = 0 3. Tx NSTS = 1 (actual Tx NSTS=2)	Verify that PPDU sent by STA1 to APUT is carrying MPDUs that has HT Control field carrying OMI field. Signaling in OMI to have: 1. Channel Width = 2 (BW=80 MHz) 2. UL MU Disable = 0 3. Tx NSTS = 1 (actual Tx NSTS=2)	SN: After the APUT acknowledges the MPDUs carrying the OMI field in the PPDU from STA1 verify the following: 1. After successful transmission of MPDUs carrying the OMI signaling, there is Basic Trigger frame sent by the APUT after 4581S13_TXOP_5G *TXOP period with the following settings in the Common Info: a. Trigger Type = 0 (Basic) b. BW =2 (80 MHz) 2. Contains one User Info field with a. AID12 subfield equal to the AID of the STA1 and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 1 If all the conditions above are true, then CONTINUE else FAIL.
14		Disassociate STA1 from the APUT.		
15	If APUT supports 2.4 GHz, go to step 16 else PASS.			
16	Configure the APUT to operate in the 2.4 GHz band per Table 132.	Configure STA1 per Table 132. Configure for MU EDCA override as per Table 7.		
17	The APUT sends Beacon and Probe Response frames to STA1.	Configure STA1 to join the APUT's BSS.		SN: Verify the following conditions are true: 1. +HTC-HE field of the HE Capabilities element = 1 in Beacon and Probe Response frames. 2. OM Control Support field of the HE Capabilities element in Beacon and Probe Response frames = 1 If all conditions are true, then CONTINUE else FAIL.
18	The APUT sends an Association Response frame to STA1.	STA1 sends an Association Request frame to the APUT.		SN: Verify the following conditions are true: 1. STA1 association succeeds. 2. +HTC-HE field of the HE Capabilities element in the Association Response frame = 1. 3. OM Control Support field of the HE Capabilities element in the Association Response frame = 1 If all conditions are true, then CONTINUE else FAIL.
19	The APUT sends an ADDBA Response from AP to STA1. Configure APUT to send Basic Trigger frame to Solicit HE TB PPDU (even if there is only	STA1 sends an ADDBA Request frame to the APUT.		SN: If BA setup is successful, then CONTINUE else FAIL.

Step	APUT	Test bed STA1	Test bed validation	Expected result
	one STA that is supporting UL MU operation).			
20		Configure STA1 to run script UT1-STA1-APUT_4.58.X.txt to APUT for 20 seconds.		SN: Verify the following conditions are true: 1. Common Info subfield In the Basic Trigger frame includes: a. Trigger Type = 0 (Basic) b. BW = 0 (20 MHz) 2. Each Basic Trigger frame contains a User Info field with: a. AID12 subfield equal to the AID of the STA1 and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 1 If all conditions are true, then CONTINUE else FAIL. Compute throughput. If the throughput > 4581S20_MU_OMI_24G (Aggregate throughput in 4.40.2 (Step 6)) then CONTINUE else FAIL
21	Note: Tx NSTS from 2→1	Configure STA1 to run script UT1-STA1-APUT_4.58.X.txt to APUT for 20 seconds. At time 2 seconds after the traffic initiated by STA1, configure STA1 to include UPH and OM Control field in transmitted MPDU(s) with: 1. Channel Width = 0 (BW=20 MHz) 2. UL MU Disable = 0 Tx NSTS = 0 (actual Tx NSTS=1)	Verify that HE TB PPDU is carrying MPDUs that has HT Control field carrying OMI and UPH. Signaling in OMI to have: 1. Channel Width = "0 (BW=20 MHz) 2. UL MU Disable = 0 3. Tx NSTS = 0 (actual Tx NSTS=1)	SN: Using sniffer capture PPDUs after the OMI change was triggered by the script. Verify that the APUT properly acknowledges at least one instance of HE TB PPDU that has MPDUs carrying UPH and OMI field according to the following rules: 1. If QoS Null as S-MPDU is used to carry UPH and OM Control, the Ack Policy of the QoS Null from STA1 must be Normal Ack. The APUT must send back a Normal Ack. 2. If QoS Data frames and QoS Null data frame are aggregated in one A-MPDU to carry UPH and OM Control a. QoS Data frames from STA1 must have Implicit BAR and the APUT must send a BlockAck. b. QoS Null from STA1 must have No Ack. The APUT must not send any Ack in response. 3. If QoS Data frames are aggregated in one A-MPDU to carry UPH and OM Control, QoS Data frames must have Implicit BAR. The APUT must send a BlockAck. All frames in one A-MPDU should have the same HTC value. 4. If the S-MPDU from STA1 contains QosData , then its Ack Policy should be normal Ack. The APUT should send an Ack in response. After the APUT acknowledges HE TB PPDU that has MPDUs carrying UPH and OMI field verify: 1. Basic Trigger frame sent by the APUT after 4581S21_TF_24G Basic Trigger frame and within 4581S21_TIME_24G TXOP has the following settings in the Common Info field: a. Trigger Type = 0 (Basic) b. BW = 0 (20 MHz) 2. Basic Trigger frame contains one User Info field with the following settings:

Step	APUT	Test bed STA1	Test bed validation	Expected result
				a. AID12 subfield equal to the AID of the STA1 and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 0 If all conditions are true, then CONTINUE else FAIL. If throughput > 4581S21_MU_OMI_24G / 2, then CONTINUE else FAIL
22	Note: Tx NSTS from 1→2	Configure STA1 to run script UT1-STA1-APUT-OMCtrl.txt to APUT for 20 seconds. At time 2 seconds after the traffic initiated by STA1, configure STA1 to include UPH and the OM Control field in transmitted MPDU(s) with: 1. Channel Width = 0 (BW=20 MHz) 2. UL MU Disable = 0 3. Tx NSTS = 1 (actual Tx NSTS=2)	Verify that HE TB PPDU is carrying MPDUs that has HT Control field carrying OMI and UPH. Signaling in OMI to have: 1. Channel Width = 0 (BW=20MHz) 2. UL MU Disable = 0 3. Tx NSTS = 1 (actual Tx NSTS=2)	SN: Using sniffer capture PPDUs after the OMI change was triggered by the script. Verify that the APUT properly acknowledges at least one instance of HE TB PPDU that has MPDUs carrying UPH and OMI field according to following rules: 1. If QoS Null as S-MPDU is used to carry UPH and OM Control, the Ack Policy of the QoS Null from STA1 must be Normal Ack. The APUT must send back a Normal Ack. 2. If QoS Data frames and a QoS Null data frame are aggregated in one A-MPDU to carry UPH and OM Control: a. QoS Data frames from STA1 must have Implicit BAR and the APUT must send a BlockAck. b. QoS Null from STA1 must have No Ack. The APUT must not send any Ack in response. 3. If QoS Data frames are aggregated in one A-MPDU to carry UPH and OM Control, QoS Data frames must have Implicit BAR. The APUT must send a BlockAck. All frames in one A-MPDU should have the same HTC value. 4. If the S-MPDU from STA1 contains QosData, then its Ack policy should be normal Ack. The APUT should send Ack in response. After the APUT acknowledges HE TB PPDU that has MPDUs carrying UPH and OMI field verify: 1. Basic Trigger frame sent by the APUT after 4581S22_TF_24G Basic Trigger frame and within 4581S22_TIME_24G TXOP has the following settings in the Common Info field: a. Trigger Type = 0 (Basic) b. BW = 0 (20 MHz) 2. Basic Trigger frame contains one User Info field with: a. AID12 subfield equal to the AID of the STA1 and: b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 1 If all conditions are true, then CONTINUE, else FAIL. If throughput > 4581S22_MU_OMI_24G, then CONTINUE else FAIL.
23	Note: UL Enable→Disable test	Configure STA1 to run script UT1-STA1-APUT-OMCtrl-MUEDCA.txt to APUT for 20 seconds.	Verify that HE TB PPDU is carrying MPDUs that has the HT Control field carrying OMI and	SN: Using sniffer capture PPDUs after the OMI change was triggered by the script.

Step	APUT	Test bed STA1	Test bed validation	Expected result
		At time 2 seconds after the traffic initiated by STA1, configure the STA1 to include UPH and OM Control field in transmitted MPDU(s) with: 1. Channel Width = 0 (BW=20 MHz) 2. UL MU Disable = 1 3. Tx NSTS = 1 (actual Tx NSTS=2) Disable MU EDCA override on STA1 after triggering the OMI change.	UPH. Verify that the OMI signaling has: 1. Channel Width = 0 (BW=20 MHz) 2. UL MU Disable =1 3. Tx NSTS = 1 (actual Tx NSTS=2)	Verify that APUT properly acknowledges at least one instance of HE TB PPDU that has MPDUs carrying UPH and OMI field according to following rules: 1. If QoS Null as S-MPDU is used to carry UPH and OM Control, the Ack Policy of the QoS Null from STA1 must be Normal Ack. The APUT must send back a Normal Ack. 2. If QoS Data frames and QoS Null data frame are aggregated in one A-MPDU to carry UPH and OM Control: a. QoS Data frames from STA1 must have Implicit BAR and the APUT must send a BlockAck. b. QoS Null from STA1 must have No Ack. The APUT must not send any Ack in response. 3. If QoS Data frames are aggregated in one A-MPDU to carry UPH and OM Control, QoS Data frames must have Implicit BAR. The APUT must send a BlockAck. All frames in one A-MPDU should have the same HTC value. 4. If S-MPDU from STA1 contains QosData then its Ack policy should be normal Ack. The APUT should send Ack in response. After the APUT acknowledges HE TB PPDU that has MPDUs carrying UPH and OMI field verify the following: 1. After successful transmission of MPDUs carrying the OMI signaling, there are no more than 4581S23_TF_24G Basic Trigger frames sent by the APUT that contains a User Info field with the AID12 subfield equal to the AID of STA1. If all conditions are true, then CONTINUE else FAIL.
24	Note: UL MU Disable→Enable	After 10 seconds, configure STA1 to run script UT1-STA1-APUT-OMCtrl.txt to include an OM Control field in transmitted MPDU(s) to the APUT with: 1. Channel Width = 0 (BW=20 MHz) 2. UL MU Disable = 0 3. Tx NSTS = 1 (actual Tx NSTS=2)	Verify that PPDU from STA1 to APUT is carrying MPDUs that has HT Control field carrying OMI . Signaling in OMI to have: 1. Channel Width = 0 (BW=20 MHz) 2. UL MU Disable = 0 3. Tx NSTS = 1 (actual Tx NSTS=2)	After the APUT acknowledges MPDUs carrying OMI filed in the PPDU from STA1 verify the following: 1. After successful transmission of MPDUs carrying the OMI signaling, there is Basic Trigger frame sent by the APUT within 4581S24_TXOP_24G * TXOP with the following in the Common Info field: a. Trigger Type = 0 (Basic) b. BW =0 (20 MHz) 2. Basic Trigger frame contains one User Info field with: a. AID12 subfield equal to the AID of the STA1 b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 1 If all the above conditions are met, then PASS else FAIL.

Note : After program is released when upgrading test bed devices, ensure test bed device behavior doesn't change.

4.58.2 Mobile APUT Transmit operating mode (Receive) test

Objective

This test case verifies that the DUT properly interprets received OM A-Control information for UL MU operation.

Applicability: This test is only applicable for Mobile AP in 5 GHz which supports 1SS only. If the APUT declared primary device category as Mobile AP in Table 1 and supports only 1SS, then it is Conditional Mandatory if iTWT is supported. This is not applicable for Mobile AP that supports 2 SS or more.

References

Section 6.3.1.28 [1]

Section 26.9.1 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 134Table 132 defines the specific parameter values required for this test case.

Table 134. APUT transmits and receives its operating mode configuration

Parameter	APUT value	Test bed STA1 value
Test bed vendor	N/A	Broadcom98
Security	WPA2-Personal	WPA2-Personal
Encryption key	12345678	12345678
AP Control Channel	36 for 5 GHz band	N/A
Spatial Streams implemented	Default	1
Transmit UPH and OM Control field in MPDU(s) sent in a PPDU when signaled by the script. The MPDU(s) in the PPDU solicit an immediate response (Ack or BlockAck)) The PPDU is sent in HE TB PPDU if the Testbed STA is not configured to Disable MU in OMI field, otherwise it is sent in an SU PPDU (there is no UPH when sent in SU PPDU).	NA	Enable
BW	80 MHz in 5 GHz	80 MHz on 5 GHz
PPDU Format	Rx HE_TRIG (UL OFDMA)	N/A
MU functionality	Enable UL OFDMA	Enable UL OFDMA

Test procedure and expected results

Table 135Table 133 provides the specific test procedure and expected results for this test case.

Table 135. APUT transmits and receives its operating mode procedure and expected results

Step	APUT	Test bed STA1	Test bed validation	Expected result
1	If the APUT supports 5 GHz, go to Step 2. Otherwise, go to Step 13.			
2	Configure the APUT to operate in the 5 GHz band per Table 134Table 132 and Table 12	Configure STA1 per Table 134. and Table 6 Configure for MU EDCA override as per Table 7.		
3	The APUT sends Beacon and Probe Response frames to STA1.	Configure STA1 to join the APUT's BSS		SN: Verify that the following conditions within Beacon and Probe Response frames are true: 1. +HTC-HE field of the HE Capabilities element = 1 2. OM Control Support field of the HE Capabilities element = 1 If all conditions are true, then CONTINUE else FAIL.
4	The APUT sends an Association Response frame to STA1.	STA1 sends an Association Request frame to the APUT.		If the association between the APUT and STA1 is successful, then CONTINUE else FAIL. SN: Verify the following conditions are true: 1. +HTC-HE field of the HE Capabilities element in the Association Response frame = 1. 2. OM Control Support field of the HE Capabilities element in the Association Response frame = 1. If all conditions are true, then CONTINUE else FAIL.
5	The APUT sends an ADDBA Response to STA1.	STA1 sends an ADDBA Request frame to the APUT.		SN: If the BA setup is successful, then CONTINUE else FAIL.
6	Configure the APUT to send a Basic Trigger Frame to Solicit HE TB PPDU (even if there is only one STA that is supporting UL MU operation)			
7		Configure STA1 to run script UT1-STA1-APUT_4.58.X.txt to APUT for 20 seconds.		SN: Verify the Common Info subfield settings in the Basic Trigger frame are true: 1. Trigger Type = 0 (Basic) 2. BW = 2 (80 MHz) 3. User Info field contains: a. AID12 subfield equal to the AID of the STA1 and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 1

Step	APUT	Test bed STA1	Test bed validation	Expected result
				If all conditions are true, then CONTINUE else FAIL. Compute the throughput. If the throughput > 4582S7_S_MU_OMI_5G, then CONTINUE else FAIL.
8	Note: only change 80M→20MHz.	Configure STA1 to run script UT1-STA1-APUT-OMCtrl.txt to APUT for 20 seconds At time 2 seconds after the traffic initiated by STA1, configure STA1 to include UPH and the OM Control field in transmitted MPDU(s) in a PPDU with: 1. Channel Width = 0 (BW=20MHz) 2. UL MU Disable = 0 3. Tx NSTS = 0 (actual Tx NSTS=1)	Verify that the HE TB PPDU is carrying MPDUs that has HT-Control field carrying OMI and UPH. Verify the OMI signaling includes: 1. Channel Width = 0 (BW=20MHz) 2. UL MU Disable = 0 3. Tx NSTS = 0 (actual Tx NSTS=1)	SN: Using sniffer capture PPDUs after OMI change was triggered by the script. Verify that the APUT properly acknowledges at least one instance of HE-TB PPDU that has MPDUs carrying UPH and OMI field according to following rules: 1. If QoS Null as S-MPDU is used to carry UPH and OM Control, the Ack Policy of the QoS Null from STA1 must be Normal Ack. The APUT must send back a Normal Ack. 2. If QoS Data frames and QoS Null data frame are aggregated in one A-MPDU to carry UPH and OM Control a. QoS Data frames from STA1 must have Implicit BAR and the APUT must send a BlockAck b. QoS Null from STA1 must have No Ack. The APUT must not send any Ack in response. 3. If QoS Data frames are aggregated in one A-MPDU to carry UPH and OM Control, QoS Data frames must have Implicit BAR. The APUT must send a BlockAck. All frame in one A-MPDU should have same HTC value. 4. If QosData in S-MPDU from STA1 then its Ack Policy should be normal Ack. The APUT should send Ack in response After the APUT acknowledges HE-TB PPDU that has MPDUs carrying UPH and OMI field verify: The Basic Trigger frame sent by the APUT after 4581S8_TF_5G Basic Trigger frame and within 4582S8_TIME_5G TXOP has the following settings: 1. The common Info subfield: a. Trigger Type = 0 (Basic) b. BW = 0 (20MHz) 2. User Info field with AID12 subfield equal to the AID of the STA1 3. SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Stream = 0 If all conditions are true, then CONTINUE, else FAIL. Compute throughput. If throughput > 4582S8_MU_OMI_5G / 4 then CONTINUE else FAIL.
9	Note: 20M→80MHz.	Configure STA1 to run script UT1-STA1-APUT-OMCtrl.txt to APUT for 20 seconds. At time 2 seconds after the traffic initiated by STA1, configure STA1 to include UPH	Verify that HE TB PPDU is carrying MPDUs that has HT-Control field carrying OMI and UPH. Verify the OMI signaling includes:	SN: Using sniffer capture PPDUs after OMI change was triggered by the script. Verify that the APUT properly acknowledges at least one instance of HE TB PPDU that has MPDUs carrying UPH and OMI field according to following rules:

Step	APUT	Test bed STA1	Test bed validation	Expected result
		and OM Control field in transmitted MPDU(s) with: 1. Channel Width = 2 (BW=80MHz) 2. UL MU Disable = 0 3. Tx NSTS = 0 (actual Tx NSTS=1)	1. Channel Width = 2 (BW=80MHz) 2. UL MU Disable = 0 3. Tx NSTS = 0 (actual Tx NSTS=1)	1. If QoS Null as S-MPDU is used to carry UPH and OM Control, the Ack Policy of the QoS Null from STA1 must be Normal Ack. The APUT must send back a Normal Ack. 2. If QoS Data frames and QoS Null data frame are aggregated in one A-MPDU to carry UPH and OM Control a. QoS Data frames from STA1 must have Implicit BAR and the APUT must send a BlockAck b. QoS Null from STA1 must have No Ack. The APUT must not send any Ack in response. 3. If QoS Data frames are aggregated in one A-MPDU to carry UPH and OM Control, QoS Data frames must have Implicit BAR. The APUT must send a BlockAck. All frame in one A-MPDU should have same HTC value. 4. If QosData in S-MPDU from STA1 then its Ack Policy should be normal Ack. The APUT should send Ack in response After the APUT acknowledges HE TB PPDU that has MPDUs carrying UPH and OMI field verify: The Basic Trigger frame sent by the APUT after 4582S9_TF_5G Basic Trigger frame and within 4581S12_TIME_5G TXOP has the following settings: 1. the common Info subfield has: a. Trigger Type = 0 (Basic) b. BW = 2 (80MHz) 2. User Info field with AID12 subfield equal to the AID of the STA1 3. SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Stream = 0 If all conditions are true, then CONTINUE, else FAIL. Compute throughput. If throughput > 4582S9_MU_OMI_5G, then CONTINUE else FAIL
10	Note: UL MU Enable→Disable test	Configure STA1 to run script UT1-STA1-APUT-OMCtrl-MUEDCA.txt to APUT for 20 seconds. At time 2 seconds after the traffic initiated by STA1, configure the STA1 to include UPH and OM Control field in transmitted MPDU(s) with: 1. Channel Width = 2 (BW=80MHz) 2. UL MU Disable = 1 3. Tx NSTS = 0 (actual Tx NSTS=1)	Verify that HE TB PPDU is carrying MPDUs that has HT-Control field carrying OMI and UPH. Signaling in OMI to have: 1. Channel Width = 2 (BW=80MHz) 2. UL MU Disable = 1 3. Tx NSTS = 0 (actual Tx NSTS=1) Disable MU EDCA OverRide on Testbed STA1 after triggering OMI Change	SN: Capture PPDUs after OMI change was triggered by the script. Verify that the APUT properly acknowledges at least one instance of HE TB PPDU that has MPDUs carrying UPH and OMI field according to following rules: 1. If QoS Null as S-MPDU is used to carry UPH and OM Control, the Ack Policy of the QoS Null from STA1 must be Normal Ack. The APUT must send back a Normal Ack. 2. If QoS Data frames and QoS Null data frame are aggregated in one A-MPDU to carry UPH and OM Control a. QoS Data frames from STA1 must have Implicit BAR and the APUT must send a BlockAck b. QoS Null from STA1 must have No Ack. The APUT must not send any Ack in response. 3. If QoS Data frames are aggregated in one A-MPDU to carry UPH and OM Control, QoS Data frames must have Implicit BAR. The

Step	APUT	Test bed STA1	Test bed validation	Expected result
		Disable MU EDCA OverRide on STA1 after triggering OMI Change		APUT must send a BlockAck. All frames in one A-MPDU should have same HTC value. 4. If QosData in S-MPDU from STA1 then its Ack policy should be normal Ack. The APUT should send Ack in response. After the APUT acknowledges HE TB PPDU that has MPDUs carrying UPH and OMI field verify the following: 1. After successful transmission of MPDUs carrying the OMI signaling, after 5*TXOP period there are no Trigger frames with AID12 equal to STA1. If all conditions are true, then CONTINUE else FAIL.
11	Note: UL MU Disable->Enable test	After 10 seconds, configure STA1 to run script UT1-STA1-APUT-OMCtrl.txt to include the OM Control field in transmitted MPDU(s) to the APUT with: 1. Channel Width = 2 (BW=80MHz) 2. UL MU Disable = 0 3. Tx NSTS = 0 (actual Tx NSTS=1)	Verify that PPDU sent by STA1 to APUT is carrying MPDUs that has HT-Control field carrying OMI field. Signaling in OMI to have: 1. Channel Width = 2 (BW=80MHz) 2. UL MU Disable = 0 3. Tx NSTS = 0 (actual Tx NSTS=1)	SN: After the APUT acknowledges the MPDUs carrying the OMI field in the PPDU from STA1 verify the following: 4. After successful transmission of MPDUs carrying the OMI signaling, there is Basic Trigger frame sent by the APUT after 4581S11_TXOP_5G *TXOP period with the following settings in the Common Info: a. Trigger Type = 0 (Basic) b. BW =2 (80 MHz) 5. Contains one User Info field with a. AID12 subfield equal to the AID of the STA1 and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 0 If all the conditions above are true, then CONTINUE else FAIL.

4.59 (Deleted)

4.60 APUT HE TB PPDU channel access rules tests

4.60.1 APUT HE TB PPDU channel access rules test

Objective

This test case verifies that the APUT follows rules governing OBSS Narrow Bandwidth RU in UL OFDMA Tolerance Support.

Applicability: Conditional. This test shall be mandatory if the APUT declared support for the 5 GHz band in Table 1.

If the APUT declared primary device category as Mobile AP and support for iTWT in 5 GHz in Table 1, then this test is Conditional Mandatory

References

Section 6.3.2.43 [1]

Test environment

- APUT
- Test bed Wi-Fi CERTIFIED ac AP1 (or Wi-Fi CERTIFIED 6 dual band AP operating in 11ac mode)
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 136 defines the specific parameter values required for this test case.

Table 136. Table X1. APUT HE TB PPDU channel access rules test configuration

Parameter	APUT value	Test bed AP1 value	Test bed STA1-4 value
Test bed vendor	N/A	Qualcomm	Marvell, Cypress, Intel200L, Broadcom75
AP control channel	100 in 5 GHz	100 in 5 GHz	N/A
Bandwidth	20 MHz in 5 GHz	20 MHz in 5 GHz	20 MHz in 5 GHz
MU functionality	Enable UL OFDMA	N/A	Enable UL OFDMA
Testbed STA included in the test (Yes or No)	NA	NA	If DUT is a Mobile AP, only STA1 is used else STA1-4 are used in the test.

Test procedure and expected results

Table 137 provides the specific test procedure and expected results for this test case.

Table 137. APUT HE TB PPDU channel access rules test procedure and expected results

Step	APUT	Test bed AP1	Test bed STA1, STA2, STA3, STA4	Test bed validation	Expected result
1	Configure the APUT per Table 12 and Table 136.	Configure AP1 per Table 4 and Table 136.	Configure STA1, STA2, STA3 and STA4 per Table 6 and Table 136.		
2		Configure AP1 with a different SSID than APUT	Configure STA1, STA2, STA3 and STA to join the APUT's BSS.		
3	The APUT sends an Association Response frame to STA1, STA2, STA3 and STA4.		STA1, STA2, STA3 and STA 4 each send an Association Request frame to the APUT.		If DUT is a MAP then, if the association between the APUT and STA1 is successful, then CONTINUE else FAIL Else If the association between the APUT and STA1, STA2, STA3 and STA4 is successful, then CONTINUE else FAIL.
4	The APUT sends an ADDBA Response frame to STA1, STA2, STA3 and STA4.		STA1, STA2, STA3 and STA4 send an ADDBA Request frame to APUT with Buffer Size ≤ 64.		
5	Wait 10 seconds.				
6	If the DUT is a MAP, configure APUT to send the Trigger frames in SU PPDU to solicit TB PPDU from STA1 Else configure the APUT to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STA4.				
7			At STA1, STA2, STA3 and STA4, run script HE1-ULOFDMA-APUT.txt.		SN: If any Trigger frame transmitted by the APUT allocates 26-tones RU to any STA, then FAIL else PASS.

4.61 (Deleted)

4.62 APUT generates DL MU PPDU with Trigger frame soliciting an HE TB PPDU response which contains Ack/C-BA tests

4.62.1 APUT generates DL MU PPDU with Trigger frame soliciting an HE TB PPDU response which contains Ack/C-BA test

Objective

This test case verifies that the APUT correctly generates a DL MU PPDU containing Trigger and QoS Data frames with the Ack Policy fields set to HTP Ack to solicit each user's C-BA/Ack response in HE TB PPDUs.

Applicability: Optional. This test shall be executed only if the APUT declared support for Basic Trigger in HE MU PPDUs to solicit Ack/C-BA in HE TB PPDU in Table 1.

References

Section 6.4.1.13[1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 138defines the specific parameter values required for this test case.

Table 138. APUT generates DL MU PPDU with Trigger frame soliciting an HE TB PPDU response which contains Ack/C-BA test configuration

Parameter	APUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed STA4 value
Test bed vendor	N/A	Cypress	Broadcom98	Intel200W	Qualcomm
AP control channel	36 in 5 GHz 6 in 2.4 GHz	N/A	N/A	N/A	N/A
PPDU format	HE_MU (DL OFDMA)	N/A	N/A	N/A	N/A
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
MU functionality	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA
Number of users in each OFDMA transmission	4	N/A	N/A	N/A	N/A

Test procedure and expected results

Table 139 provides the specific test procedure and expected results for this test case.

Table 139. APUT generates DL MU PPDU with Trigger frame soliciting an HE TB PPDU response which contains Ack/C-BA test procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 106.	Configure STA2 per Table 6 and Table 138	Configure STA3 per Table 6 and Table 106.	Configure STA4 per Table 6 and Table 138.	Configure the APUT per Table 12 and Table 138.		
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 8.							
2	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to the STAs.		
3	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		SN: If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
4	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1, STA2, STA3, STA4.		
5					Configure the APUT to send QoS Data frames with Ack Policy set to HTP Ack. Note: this means that the Basic Trigger frame will be aggregated with QoS Data frames in DL OFDMA PPDU.		
6					Run script HE1-DLOFDMA-APUT-no-thrpchk.txt to STA1, STA2, STA3	STA1 to STA4 should send BA in HE TB PPDU in SIFS time	SN: Verify the following conditions are true. 1. In each A-MPDU in HE MU PPDU, at least one Basic

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
					and STA4 using AC_BE. .	after receiving AP's HE MU PPDU.	Trigger frame has the following settings: a. RA is unicast MAC address b. Trigger Type = 0 c. More TF = 0 d. UL BW = 0 e. AP Tx Power is one of 0-60 f. Doppler = 0 g. UL STBC=0 h. UL Spatial Reuse = 0 i. UL Target RSSI is one of 0-90 and 127 j. TID Aggregation Limit = 0 2. QoS Control fields for all STAs are HTP Ack. 3. The first frame in A-MPDU is the Basic Trigger frame. If all the above conditions are true, then CONTINUE else FAIL.
7	STA1 disassociates from the APUT.	STA2 disassociates from the APUT.	STA3 disassociates from the APUT.	STA4 disassociates from the APUT.			
If the APUT supports 5 GHz, go to Step 8 else PASS.							
8	Configure STA1 to join the APUT's BSS. Configure STA1 to not transmit ADDBA Request frame to the APUT.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.	The APUT sends Beacon and Probe Response frames to the STAs.		
9	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to the STAs.		
10	STA1 sends an ADDBA Response frame to the APUT	STA2 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to STA1, STA2,		

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
	with Buffer Size ≤ 64.				STA3, STA4 with Buffer Size ≤ 64.		
11					Configure the APUT to send QoS Data frames with Ack Policy set to HTP Ack Note: this means that the Basic Trigger frame will be aggregated with QoS Data frames in DL OFDMA PPDU.		
12					Run script HE1-DLOFDMA-APUT-no-thrpchk.txt to STA1, STA2, STA3 and STA4 using AC_BE.	The BA(from STA1 to 4) in HE TB PPDU SIFS after HE MU PPDU.	SN: Verify the following conditions are true. 1. In each A-MPDU in HE MU PPDU, at least one Basic Trigger frame has the following format: a. RA is unicast MAC address b. Trigger Type = 0 c. More TF = 0 d. UL BW = 2 e. AP Tx Power is one of 0-60 f. Doppler = 0 g. UL STBC=0 h. UL Spatial Reuse = 0 i. UL Target RSSI is one of 0-90 and 127 j. TID Aggregation Limit = 0. 2. QoS Control fields for all STAs are HTP Ack. 3. The first frame in A-MPDU is the Basic Trigger frame.. If all the above conditions are true, then PASS else FAIL.

4.63 APUT receives MCS 8-9 in HE TB PPDU test

4.63.1 APUT receives MCS 8-9 in HE TB PPDU using one spatial stream test

Objective

This test case verifies that the APUT implements reception of MCS 8-9 in HE TB PPDUs.

Applicability: Optional. This test shall be executed only if the APUT declared support for MCS 8-9 in Table 1.

References

Section 6.4.1.5 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 140 defines the specific parameter values required for this test case.

Table 140. APUT receives MCS 8-9 in HE TB PPDU test configuration

Parameter	STA1 value	STA2 value	APUT value
Test bed vendor	Intel200L	Broadcom75	N/A
AP control channel	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz, or 20 MHz in 2.4 GHz	80 MHz in 5 GHz, or 20 MHz in 2.4 GHz	80 MHz in 5 GHz, or 20 MHz in 2.4 GHz
PPDU format	N/A	N/A	Rx HE_TRIG (UL OFDMA)
LDPC Coding in Payload in 2.4 GHz	Disabled	Disabled	N/A
HE-MCS	HE-MCS 9	HE-MCS 9	Default
MU functionality	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA
Testbed STA included in the test (Yes or No)	Yes	If DUT is AP then. Yes. Else No	NA

Test procedure and expected results

Table 141 provides the specific test procedure and expected results for this test case.

Table 141. APUT receives MCS 8-9 in HE TB PPDU test procedure and expected results

Step	Test bed STA1	Test bedSTA2	APUT	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, then go to Step 1, else go to Step 9.					
1	Configure STA1 per Table 6 and Table 140. Configure STA1 to use 1 SS. Configure for MU EDCA override as per Table 7.	Configure STA2 per Table 6 and Table 140. Configure STA2 to use 1 SS. Configure for MU EDCA override as per Table 7.	Configure APUT per Table 12 and Table 140. Configure the APUT to receive using UL OFDMA.		
2			Configure the APUT to the 2.4 GHz band. The APUT sends Beacon and Probe Response frames to STA1 and STA2.		SN: If the Max HE-MCS for 1 SS subfield in the Rx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Beacon and Probe Response frames = 1 or 2, then CONTINUE else FAIL.
3	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	Configure STA2 to join the APUT's BSS in the 2.4 GHz band.			
4	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to STA1 and STA2.		If DUT is a MAP then, if the assoicaiton between the APUT and STA1 is successful, then CONTINUE else FAIL Else If the association between the APUT and STA1 and STA2 is successful, then CONTINUE else FAIL. SN: If the Max HE-MCS for 1 SS subfield in the Rx HE-MCS Map ≤ 80 MHz field within the HE Capabilities element in the Association Response frame = 1 or 2, then CONTINUE else FAIL.
5	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends ADDBA Responses frames to STA1 and STA2.		SN: If the APUT ADDBA Response frame Buffer Size is ≤ 64, then CONTINUE, else FAIL.

Step	Test bed STA1	Test bedSTA2	APUT	Test bed validation	Expected result
6			Configure the APUT to transmit Trigger frames in Non-HT, Non-HT duplicate, HT or HE SU PPDU format to solicit TB PPDU from STA1, STA2.		
7	Run script HE1-ULOFDMA-APUT-STA1-STA2.txt to STA1 and STA2.	Run script HE1-ULOFDMA-APUT-STA1-STA2.txt to STA1 and STA2.		SN: Verify the HE TB PPDUs transmitted by the STAs include UPH with valid values.	SN: Verify the following conditions are true: If DUT is a MAP 1. Trigger frame has User Info field containing: a. AID12 = STA1's AID b. UL MCS subfields (B21:B24) corresponding to the STA's User Info field is set to 9 c. SS Allocation /RA-RU Information for STA1 and STA2 set to: ▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 0(1SS) 2. Throughput of STA1 > 4631S7_ATP_24G Else 1. Aggregated throughput is > 4631S7_ATP_24G. 2. Throughput of each STA > 4631S7_ATP_24G /2 * (1-4631S7_DELTA_24G) 3. At least one Trigger frame has two User Info fields containing: a. AID12 = STA1's AID, STA2's AID b. UL HE-MCS subfields (B21:B24) corresponding to the STA's User Info fields = 9 c. SS Allocation /RA-RU Information for STA1 and STA2 set to:

Step	Test bed STA1	Test bedSTA2	APUT	Test bed validation	Expected result
					▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 0(1SS) If all the above conditions are true, then CONTINUE, else FAIL.
8	Disassociate STA1 from the APUT.	Disassociate STA2 from the APUT.			
If the APUT supports the 5 GHz band, then go to Step 9 else PASS.					
9	Configure STA1 per Table 6 and Table 140. Configure STA1 to use 1 SS. Configure for MU EDCA override as per Table 7.	Configure STA2 per Table 6 and Table 140.. Configure STA2 to use 1 SS. Configure for MU EDCA override as per Table 7.	Configure APUT per Table 12 and Table 140. Configure the APUT to receive using UL OFDMA.		
10			Configure the APUT to the 5 GHz band. The APUT sends Beacon and Probe Response frames to STA1 and STA2.		
11	Configure STA1 to join the APUT's BSS in the 5 GHz band.	Configure STA2 to join the APUT's BSS in the 5 GHz band.			
12	Repeat Steps 4-6.				If the verification in Steps 4-6 is successful, then PASS else FAIL.
13	Run script HE1-ULOFDMA-APUT-STA1-STA2.txt to STA1 and STA2.	Run script HE1-ULOFDMA-APUT-STA1-STA2.txt to STA1 and STA2.		SN: Verify the HE TB PPDUs transmitted by the STAs include UPH with valid values.	SN: Verify the following conditions are true: If DUT is a MAP 1. Trigger frame has User Info field containing: a. AID12 = STA1's AID b. UL MCS subfields (B21:B24) corresponding to the STA's User Info field is set to 9 c. SS Allocation /RA-RU Information for STA1 and STA2 set to: ▪ Starting Spatial Stream = 0

Step	Test bed STA1	Test bedSTA2	APUT	Test bed validation	Expected result
					▪ Number of Spatial Streams = 0(1SS) 2. Throughput of STA1 > 4631S7_ATP_24G Else 1. Aggregated throughput is > 4631S13_ATP_5G. 2. Throughput of each STA > 4631S13_ATP_5G / 2 * (1-4631S13_DELTA_5G) 3. At least one Trigger frame has two User Info fields containing: a. AID12 = STA1's AID, STA2's AID b. UL HE-MCS subfields (B21:B24) corresponding to 2 STA's User Info fields = 9 c. SS Allocation /RA-RU Information for STA1 and STA2 set to: ▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 0(1SS) If all the above conditions are true, then PASS else FAIL.
14	Disassociate STA1 from the APUT.	Disassociate STA2 from the APUT.			

4.64 APUT receives MCS 10-11 in HE TB PPDU test

Objective

This test case verifies that the APUT implements reception of MCS 10-11 in HE TB PPDUs.

Applicability: Optional. This test shall be executed only if the APUT declared support for MCS10-11 in Table 1.

References

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 142 defines the specific parameter values required for this test case.

Table 142. APUT receives MCS 10-11 in HE TB PPDU test configuration

Parameter	STA1 value	STA2 value	APUT value
Test bed vendor	Intel200W	Cypress	N/A
AP control channel	N/A	N/A	36 in 5 GHz
Bandwidth	80 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz
PPDU format	N/A	N/A	Rx HE_TRIG (UL OFDMA)
HE-MCS	HE-MCS 11	HE-MCS 11	Default
MU functionality	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA
Testbed STA included in the test (Yes or No)	Yes	If DUT is AP then. Yes. Else No	NA

4.64.1 APUT receives MCS 10-11 in HE TB PPDU at 5 GHz using one spatial stream test

Test procedure and expected results

Table 143 provides the specific test procedure and expected results for this test case.

Table 143. APUT receives MCS 10-11 in HE TB PPDU at 5 GHz using one spatial stream test procedure and expected results

Step	Testbed Wi-Fi CERTIFIED ax STA1	Testbed Wi-Fi CERTIFIED ax STA2	APUT	Testbed check	Expected result
1	Configure STA1 per Table 6. Configure STA1 per Table 142. Configure STA1 to use 1 SS. Configure for MU EDCA override as per Table 7.	Configure STA2 per Table 6. Configure STA2 per Table 142. Configure STA2 to use 1 SS. Configure for MU EDCA override as per Table 7.	Configure APUT per Table 12. Configure APUT per Table 142. Configure the APUT to receive using UL OFDMA.		
2			Configure the APUT to the 5 GHz band. The APUT sends Beacon and Probe Response frames to STA1 and STA2.		SN: If the Max HE-MCS for 1 SS subfield in the Rx HE-MCS Map ≤ 80 MHz field within the HE Capabilities element in the Beacon and Probe Response frames = 2, then CONTINUE else FAIL.
3	Configure STA1 to join the APUT's BSS in the 5 GHz band.	Configure STA2 to join the APUT's BSS in the 5 GHz band.			
4	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	The APUT sends Association Response frames to STA1 and STA2.		If the DUT is MAP, then if assocaiton between APUT and STA1 is successful else then CONTINUE else FAIL Else If the association between the APUT and STA1 and STA2 is successful, then CONTINUE else FAIL SN: If the Max HE-MCS for 1 SS subfield in the Rx HE-MCS Map ≤ 80 MHz field within the HE Capabilities element in the Association Response frame = 2, then CONTINUE else FAIL.
5	STA1 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Request frame to the APUT with Buffer Size ≤ 64.	The APUT sends ADDBA Response frames to STA1 and STA2.		SN:

Step	Testbed Wi-Fi CERTIFIED ax STA1	Testbed Wi-Fi CERTIFIED ax STA2	APUT	Testbed check	Expected result
					If the APUT ADDBA Response frame has Buffer Size is ≤ 64, then CONTINUE else FAIL.
6			Configure the APUT to transmit Trigger frames in Non-HT, Non-HT duplicate, or HE SU PPDU format to solicit TB PPDU from STA1, STA2.		
7	Run script HE1-ULOFDMA-APUT-STA1-STA2.txt to STA1 and STA2.	Run script HE1-ULOFDMA-APUT-STA1-STA2.txt to STA1 and STA2.		SN: Verify the HE TB PPDUs transmitted by the STAs include the Headroom field with valid values.	SN: Verify the following conditions are true If DUT is a MAP 1. Trigger frame has User Info field containing: a. AID12 = STA1's AID, b. UL MCS subfields (B21:B24) of STA's User Info fields are set to 11 c. SS Allocation /RA-RU Information for STA1 and STA2 set to: ▪ Starting Spatial Stream = 0 ▪ Number of Spatial Streams = 0(1SS) 2. Throughput of STA1 is > 4641S7_ATP_5G Else 1. Aggregated throughput is > 4641S7_ATP_5G 2. Throughput of each STA > 4641S7_ATP_5G / 2 * (1-4641S7_DELTA_5G) 3. At least one Trigger frame has two User Info fields containing: a. AID12 = STA1's AID, STA2's AID b. UL HE-MCS subfields (B21:B24) corresponding to 2 STA's User Info fields = 11 c. SS Allocation /RA-RU Information for STA1 and STA2 set to: ▪ Starting Spatial Stream = 0

Step	Testbed Wi-Fi CERTIFIED ax STA1	Testbed Wi-Fi CERTIFIED ax STA2	APUT	Testbed check	Expected result
					▪ Number of Spatial Streams = 0(1SS) If all the above conditions are true, then PASS else FAIL.
8	Disassociate STA1 from the APUT.	Disassociate STA2 from the APUT.			

4.65 APUT MU EDCA Parameter Set tests

4.65.1 APUT MU EDCA parameter test

Objective

This test case verifies that the APUT correctly constructs MU EDCA parameters and transmits MU EDCA parameters in Management frames.

Applicability: Optional. This test shall be executed only if the APUT declared support for MU EDCA in Table 1.

References

Section 6.4.1.21

Section 26.2.7 [7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 144 defines the specific parameter values required for this test case.

Table 144. APUT MU EDCA Parameter Set tests configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Qualcomm	N/A
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	N/A	Rx HE_TRIG (UL OFDMA)

Test procedure and expected results

Table 145 provides the specific test procedure and expected results for this test case.

Table 145. APUT MU EDCA Parameter Set tests procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, then go to Step 1, else go to Step 5.				

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 144 for the 2.4 GHz band.	Configure the APUT per Table 12and Table 144 for the 2.4 GHz band.		
2		The APUT sends Beacon frames.		SN: Verify the following conditions are true: 1. Each Beacon frame contains an WMM Information element or WMM Parameter Set element. 2. If the WMM Parameter set element is in the Beacon frame, then the MU EDCA Parameter Set elements is also in the Beacon frame with: a. EDCA Parameter Set Update Count in MU EDCA Parameter Set is the same as Parameter Set Count in the WMM Parameter Set element b. Parameter Set Count and/or EDCA Parameter Set Update Count is the same or one more mod 16 than the EDCA Parameter Set Update Count in the last Beacon frame carrying the MU EDCA parameters. If all the conditions above are true, then CONTINUE else FAIL.
3	STA1 sends a Probe Request frame to the APUT.	The APUT sends a Probe Response frame to STA1.		SN: Verify the following conditions are true: 1. APUT's Probe Response frame contains a MU EDCA Parameters Set element and a WMM Parameter element. 2. EDCA Parameter Set Update Count in MU EDCA Parameter Set is the same as Parameter Set Count in WMM Parameter element. 3. EDCA Parameter Set Update Count is the same or one more mod 16 than the EDCA Parameter Set Update Count in the last Beacon carrying MU EDCA Parameters Set element If all the conditions above are true, then CONTINUE else FAIL.
4	STA1 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to STA1.		SN: Verify the following conditions are true: 1. The APUT's Association Response frame contains a MU EDCA Parameters Set element and a WMM Parameter element with: a. EDCA Parameter Set Update Count in MU EDCA Parameter Set is the same as Parameter Set Count in WMM Parameter element. b. EDCA Parameter Set Update Count is the same or one more mod 16 than the EDCA Parameter Set Update Count in the last Beacon carrying the MU EDCA Parameters Set element 2. STA1 is successfully associated If all the conditions above are true, then CONTINUE else FAIL.
If the APUT supports the 5 GHz band, then go to Step 5 else PASS.				
5	Configure STA1 per Table 6 and Table 144 for the 5 GHz band.	Configure the APUT per Table 12 and Table 144 for the 5 GHz band.		
6	Repeat Steps 2-4.			If the verification in Steps 2-4 is successful, then PASS else FAIL.

4.66 APUT announces TXOP Duration RTS Threshold value test

4.66.1 APUT announces TXOP Duration RTS Threshold value test

Objective

This test case verifies that a DUT that requires STAs to use TXOP duration-based RTS/CTS exchanges is able to advertise the value of the TXOP Duration RTS Threshold subfield during TXOP duration-based RTS/CTS.

Applicability: Optional. This test shall be executed only if the APUT declared support for TXOP duration-based RTS in Table 1.

References

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless ax Sniffer

Test configuration

Table 146 defines the specific parameter values required for this test case.

Table 146. APUT announces TXOP Duration RTS Threshold value test configuration

Parameter	APUUT value	Test bed STA1 value
Test bed vendor	N/A	Intel200W
Control channel	6 in 2.4 GHz 36 in 5 GHz	6 in 2.4 GHz 36 in 5 GHz
Bandwidth	20 MHz in 2.4 GHz 80 MHz in 5 GHz	20 MHz in 2.4 GHz 80 MHz in 5 GHz
Configure to advertise TXOP RTS Threshold in HE Operation Element (value other than 0 and 1023)	Enabled	NA

Test procedure and expected results

Table 147 provides the specific test procedure and expected results for this test case.

Table 147. APUT announces TXOP Duration RTS Threshold value test procedure and expected results

Step	APUT	Test bed STA1	Test bed validation	Expected result
1	Configure the APUT per Table 12 and as defined in Table 146.	Configure STA1 per Table 6 and as defined in Table 146.		
If the APUT supports 5 GHz go to Step 2, else go to Step 5.				
2	Configure the APUT to operate in the 5 GHz band.	Configure STA1 to join the APUT's BSS.		
3	The APUT sends Beacon and Probe Response frames to STA1.			SN: If the HE Operation element is present in Beacon and Probe Response frames and the value of the TXOP Duration RTS Threshold field is not set to 0 or 1023, then CONTINUE else FAIL.
4	The APUT sends an Association Response frame to STA1.	STA1 sends an Association Request to the APUT.		If the STA1 association succeeds, then CONTINUE else FAIL. SN: If the value of the TXOP Duration RTS Threshold field in the Association Response frame is not set to 0 or 1023, then CONTINUE else FAIL.
If the APUT supports 2.4 GHz, then go to Step 5 else PASS.				
5	Configure the APUT to operate in the 2.4 GHz band.	Configure STA1 to join the APUT's BSS.		
6	The APUT sends Beacon and Probe Response frames to STA1.			SN: If the HE Operation element is present in Beacon and Probe Response frames and the value of the TXOP Duration RTS Threshold field is not set to 0 or 1023, then CONTINUE else FAIL.
7	The APUT sends Association Response frame to STA1.	STA1 sends an Association Request to the APUT.		If the STA1 association succeeds, then CONTINUE else FAIL. SN: If the value of the TXOP Duration RTS Threshold field in the Association Response frame is not set to 0 or 1023, then PASS else FAIL.

4.67 APUT supports Multi-BSSID tests

4.67.1 APUT supports Multi-BSSID test

Objective

This test case verifies that the APUT supports the Multi-BSSID feature.

The test scripts for this test case compute the BSSIDs of the non-transmitted BSSID based on the following computation.

The BSSID(i) value corresponding to the ith BSSID in the multiple BSSID set is derived from a reference BSSID (REF_BSSID) as follows (value "I" is determined from Multiple BSSID-Index element):

BSSID(i) = BSSID_A | BSSID_B

where

BSSID_A is (REF_BSSID & ZERO[(47-n+1):47])

BSSID_B is (ZERO[0:(47-n)] & bin[((dec(REF_BSSID[(47-n+1):47]) + i) mod 2n), n])

and

ZERO[b:c] denotes bits b to c inclusive of a 48-bit address set to 0

REF_BSSID[b:c] denotes bits b to c inclusive of the REF_BSSID address

REF_BSSID = BSSID used to transmit Beacon, Probe Response frames

Map BSSID and SSID associated with:

- REF_BSSID corresponds to SSID Prefix_1 (this is the Transmitted BSSID)
- BSSID_1 corresponds to SSID Prefix_2
- BSSID_NUM_BSS-1 corresponds to SSID Prefix_NUM_BSS

Note: It is possible that one Beacon frame might not carry all the Non-Transmitted BSSID Profiles, so the Sniffer will capture multiple Beacon frames to determine all the Non-Transmitted BSSID Profiles supported by the APUT.

Applicability: Optional. This test shall be executed only if the APUT declared support for Multi-BSSID in Table 1.

References

Section 6.4.1.23 [1]

Section 9.4.2.46 [2]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA

- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- 11ax Wireless Sniffer

Test configuration

Table 148 defines the specific parameter values required for this test case.

Table 148. APUT supports Multi-BSSID test configuration

Parameter	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	APUT value
Test bed vendor	Broadcom98	Marvell	Intel200L	N/A
AP control channel	N/A	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
M-BSSID support	N/A	N/A	N/A	Enabled
SSID of M-BSSID	N/A	N/A	N/A	Prefix = Prefix_1, Prefix_2, Prefix_3, …Prefix_NUM_BSS

Test procedure and expected results

Table 149 provides the specific test procedure and expected results for this test case.

Table 149. APUT supports Multi-BSSID test procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 148. Disable MAC address randomization.	Configure STA1 per Table 6 and Table 148. Disable MAC address randomization.	Configure STA1 per Table 6 and Table 148. Note: STA3 is used in the test only if NUM_BSS supported by APUT is > 2. Disable MAC address randomization.	Configure the APUT per Table 12and Table 148.		
If the APUT supports 2.4 GHz go to Step 2, else go to Step 11.						
2				Configure the APUT to operate in the 2.4 GHz band.		

Step	Test bed STA1	Test bed STA2	Test bed STA3	APUT	Test bed validation	Expected result
3	STA1 sends a Probe Request frame with the SSID element set to Wild Card.			The APUT sends Beacon and Probe Response frames to the STAs.		SN: Verify that Probe response and Beacon frames received from the APUT have the following: 1. Extended Capabilities element has Multiple BSSID bit = 1 and HE Operation Parameters element has the Co-Located BSS subfield = 0. 2. One or more Multiple BSSID elements are present and the Max BSSID Indicator field ≥ 1 (i.e., parameter "n") 3. If all the profiles are included, then Complete List of NonTxBSSID Profiles field in Extended Capabilities element = 1. SN: In the transmitted Beacon frames validate the following: 1. Number of BSS that are part of M-BSSID are Num_BSS indicated by the number of SSID elements seen. 2. $1 < Num\_BSS \le 2^n$ 3. Validate that each Multi-BSSID element carries for each advertised profile at a minimum (in the following order): a. nonTxBSSID Capability element b. SSID element c. Multiple BSSID-Index element SN: In the Beacon and Probe Response frames verify that there is no more than one instance of the following: 1. Timestamp and Beacon Interval fields 2. TIM element 3. DSSS Parameter Set element 4. IBSS Parameter Set element 5. Country element 6. Channel Switch Announcement element 7. Extended Channel Switch Announcement element 8. Wide Bandwidth Channel Switch element 9. Transmit Power Envelope element 10. Supported Operating Classes element 11. IBSS DFS, ERP Information elements 12. HT Capabilities element 13. HT Operation element 14. VHT Capabilities and VHT Operation element (only in 5 GHz) 15. HE Capabilities and HE Operation element 16. BSS Color Change Announcement element 17. Spatial Reuse Parameter Set elements If all the above conditions are met, then CONTINUE else FAIL.

Step	Test bed STA1	Test bed STA2	Test bed STA3	APUT	Test bed validation	Expected result
4	STA1 sends a Probe Request frame with the RA field set to Broadcast Address and includes a SSID corresponding to Prefix_2.			The APUT sends a Probe response to the STAs.		SN: If the Probe Response frame received from the APUT and destined to STA1 has the TA field set to REF_BSSID and not the BSSID corresponding to SSID Prefix_2, then CONTINUE else FAIL. If NUM_BSS > 2 then CONTINUE to Step 5 else CONTINUE to Step65.
5	STA1 sends a Probe Request frame with the RA field set to Broadcast Address and includes a SSID corresponding to Prefix_3.			The APUT sends a Probe response to the STAs.		SN: If the Probe Response frame received from the APUT and destined to STA1 has the TA field set to REF_ BSSID and not the BSSID corresponding to SSID Prefix_3, then CONTINUE else FAIL.
6	STA1 sends an Association Request frame to the APUT for Association with REF_BSSID.	STA2 sends an Association Request frame to the APUT for Association with BSSID_1.	If NUM_BSS > 2 then STA3 sends an Association Request frame to the APUT for Association with BSSID_2.	The APUT sends an Association Response frame to STA1, STA2, STA3.		SN: If the association between the APUT and STA1, STA2, STA3 is successful, then CONTINUE else FAIL. AID_1 = assigned AID in the Association Response frame to STA1) AID_2 = assigned AID in the Association Response frame to STA2 AID_3 = assigned AID in the Association Response frame to STA3 If AID_1, AID_2, AID_3 are not assigned a value < 2^n, then CONTINUE else FAIL.
7	STA1 sends an ADDBA Response frame to the APUT.	STA2 sends ADDBA Response frame to the APUT.	STA3 sends ADDBA Response frame to the APUT.	The APUT sends ADDBA Request frames to STA1, STA2, STA3.		SN: If BA session setup with all the STAs is successful, then CONTINUE else FAIL.
8	Configure STA1 to PS mode.	Configure STA2 to PS mode.	Configure STA3 to PS mode.			
9				Run script HE1-AP-STA1_24GHz_M-BSSID_APUT.txt to STA1, STA2, STA3.	Verify that the STAs transmit PS-Poll/QoS Null after the Beacon frame carrying the TIM element with the AID	SN: If the Beacon frame has the TIM bit set to signal traffic for STA1, STA2, STA3 by setting the corresponding bit to AID_1, AID_2, AID_3, then CONTINUE else FAIL.(There could be Beacon frames where the AID might be missing but that would not be the case in all the Beacon frames -> validated also with Throughput check)

Step	Test bed STA1	Test bed STA2	Test bed STA3	APUT	Test bed validation	Expected result
					field of STAs set to 1. If the STAs change to active mode for the buffered frame reception, then the STAs are correctly transitioning back to Power Save mode after receiving data from the APUT (STAs send frame with PM bit = 1 and acknowledged by the APUT)	
10						If the throughput for STA1, STA2, STA3 is > 4671S10_TP_24G, then CONTINUE else FAIL.
If the APUT supports 5 GHz go to Step 11, else PASS.						
11				Configure the APUT to operate in the 5 GHz band.		
Repeat Steps 3 to 8.						If the verification in Steps 3-8 is successful, then CONTINUE else FAIL.
13				Run script HE1-AP-STA1_5GHz_M-BSSID_APUT.txt to STA1, STA2, STA3.	Verify that the STAs transmit PS-Poll/QoS Null after the Beacon frame carrying the TIM element with the AID field of the STAs = 1. If the STAs change to active mode for the buffered frame reception, then the STAs are correctly transitioning back to Power Save mode after receiving data from the APUT (STAs send frame with PM bit = 1 and	SN: If the Beacon frame has the TIM bit set to signal traffic for STA1, STA2, STA3 by setting the corresponding bit to AID_1, AID_2, AID_3, then CONTINUE else FAIL.

Step	Test bed STA1	Test bed STA2	Test bed STA3	APUT	Test bed validation	Expected result
					acknowledged by the APUT)	
14						If the throughput for STA1, STA2, STA3 is > 4671S14_TP_5G, then PASS else FAIL.

4.68 APUT HE MU-RTS/CTS tests

4.68.1 APUT transmits HE MU-RTS/CTS Trigger frames test

Objective

This test case verifies that the APUT correctly transmits MU-RTS Trigger frames.

Applicability: Optional. This test shall be executed only if the APUT declared support for MU-RTS in Table 1.

References

Section 6.4.1.9 and 6.4.1.17 [1]

Section 26.2.6[7]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 150 defines the specific parameter values required for this test case.

Table 150. APUT transmits HE MU-RTS/CTS Trigger frames test configuration

Parameter	Test bed STA1 value	APUT value
Test bed vendor	Marvell	N/A
Bandwidth	20 MHz in 2.4 GHz, 80 MHz in 5 GHz	20 MHz in 2.4 GHz, 80 MHz in 5 GHz
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz

Test procedure and expected results

Table 151 provides the specific test procedure and expected results for this test case.

Table 151. APUT transmits HE MU-RTS/CTS Trigger frames test procedure and expected results

Step	Test bed STA1	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6.and Table 150.	Configure the APUT per Table 12and Table 150.		

Step	Test bed STA1	APUT	Test bed validation	Expected result
If the APUT supports 5 GHz, go to Step 2 else go to Step 8.				
2	Configure STA1 to join the APUT's BSS in the 5 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
3	STA1 sends Association Request frame(s) to the APUT.	The APUT sends Association Response frame(s) to STA1.		If the association between the APUT and STA1 is successful, then CONTNUE else FAIL.
4		Configure the APUT to transmit a MU-RTS Trigger frame to STA1.		
5		Generate UDP DL to STA1 by running the script DT1-APUT-STA1.txt.		If a MU-RTS Trigger frame was transmitted to STA1, then CONTINUE else FAIL. SN: Verify the following settings in the MU-RTS Trigger frame from the APUT: 1. RA set to broadcast address 2. Common Info field has the following settings: a. Trigger Type (B0:B3) = 3 (MU-RTS) b. CS Required (B17) = 1 3. User Info field with AID12 of STA1 If all of the above conditions are true, then CONTINUE else FAIL.
6	STA1 respond with CTS.		STA1 responds with CTS solicited by MU-RTS,.	
7	Disassociate STA1 from the APUT.			
If the APUT supports 2.4 GHz, go to Step 8 else PASS.				
8	Configure STA1 to join the APUT's BSS in the 2.4 GHz band.	The APUT sends Beacon and Probe Response frames to STA1.		
9	Repeat Steps 3-7.	Repeat Steps 3-7.		If the verification in Steps 3-7 is successful, then PASS else FAIL.

4.69 APUT transmits wideband OFDMA packets to 20 MHz only STA tests

4.69.1 APUT transmits wideband OFDMA packets to 20 MHz only STA test

Objective

This test case verifies that the APUT correctly transmits DL OFDMA packets with correct PHY parameters to a 20 MHz only STA.

Applicability: If the APUT declared primary device category as AP in Table 1, then it is Mandatory

If the APUT declared primary device category as Mobile AP in Table 1 , then it is Conditional Mandatory if DL OFDMA is supported.

References

Section 6.3.1.13 [1]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed STA4: Wi-Fi CERTIFIED 6 STA
- Wireless ax Sniffer

Test configuration

Table 152 defines the specific parameter value required for this test case.

Table 152. APUT transmits wideband OFDMA packets to 20 MHz only STA test configuration

Parameter	APUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed STA4 value
Test bed vendor (Bit 5=0)	N/A	Qualcomm	Broadcom75	Broadcom98	Intel200L
Test bed vendor (Bit 5=1)	N/A	Cypress	Broadcom75	Intel200L	Qualcomm
AP control channel	36 in 5 GHz	N/A	N/A	N/A	N/A
Bandwidth	80 MHz in 5 GHz	20 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz
PPDU Format	HE_MU (DL OFDMA)	N/A	N/A	N/A	N/A
HE_LTF+GI	12.8µs LTF, 3.2µs GI	N/A	N/A	N/A	N/A
Number of users in each OFDMA transmission	4	N/A	N/A	N/A	N/A
Scheduling DL Transmissions to 20 MHz	Enabled (Instructs the APUT to schedule DL transmission simultaneously to 20 MHz	N/A	N/A	N/A	N/A

only STA and 80 MHz STA simultaneously	and 80 MHz STAs. This is not enabled by default)				

Test procedure and expected results

Table 153 provides the specific test procedure and expected results for this test case.

Table 153. APUT transmits wideband OFDMA packets to 20 MHz only STA test procedure and expected results

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 152. Set bit 5 in the HE PHY Capabilities Information field to 0.	Configure STA2 per Table 6 and Table 152.	Configure STA3 per Table 6 and Table 152.	Configure STA4 per Table 6 and Table 152.	Configure the APUT per Table 12 and Table 152.		
3	Configure STA1 to join the APUT's BSS.	Configure STA2 to join the APUT's BSS.	Configure STA3 to join the APUT's BSS.	Configure STA4 to join the APUT's BSS.			
4	STA1 sends an Association Request frame to the APUT.	STA2 sends an Association Request frame to the APUT.	STA3 sends an Association Request frame to the APUT.	STA4 sends an Association Request frame to the APUT.	The APUT sends an Association Response frame to the STAs.	Verify that the Channel Width Set subfield B1 is set 0 in the HE PHY Capabilities Information field.	If the association between the APUT and STA1, STA2, STA3, and STA4 is successful, then CONTINUE else FAIL.
5	STA1 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	STA4 sends an ADDBA Response frame to the APUT with Buffer Size ≤ 64.	The APUT sends an ADDBA Request frame to the STAs.		
6					Configure the APUT to transmit using DL OFDMA, LTF=12.8µs, GI=3.2µs.		
7	.				Run script HE1-DLOFDMA-APUT_4.69.1.txt to the STAs.		SN: Verify the following conditions are true: 1. HE PPDUs transmitted by the APUT are DL OFDMA: 2. Sequentially capture at least 10000 packets for first STAAID and verify that in all of the packets:

Step	Test bed STA1	Test bed STA2	Test bed STA3	Test bed STA4	APUT	Test bed validation	Expected result
							a. L-SIG Length % 3 = 2 (check HE MU PPDU) b. SIGB Compression field in HE-SIG-A = 0 c. Bandwidth field in HE-SIG-A1 (B19, B20) = 2 (80 MHz) d. LTF+GI field in HE-SIG-A1 (B21, B22) = 3 (LTF = 12.8µs and GI = 3.2µs) 3. At least 80% of all MU PPDUs' HE-SIG-B common content indicates allocation to ≥ 4 RUs a. If the RU Allocation subfield contains indices with y and z values then those values = 0 b. The RU allocation for STA1 is only on primary 20 MHz channel 4. Verify MCS used for SIG-B is between MCS 0-5 5. Percent of MU packets is > 4691S7_MU_5G%) 6. Throughput of 20 MHz only STA > 4691S7_20M_STA_5G 7. Verify that APUT does not assign RU242 to STA1 if STA1's PHY capability B5 = 0 If all the above conditions are true, then CONTINUE, else FAIL.
8	Configure STA1 per Table 6 and Table 152. Set bit 5 in the HE PHY Capabilities Information field to 1.	Configure STA2 per Table 6 and Table 152.	Configure STA3 per Table 6 and Table 152.	Configure STA4 per Table 6 and Table 152.	Configure the APUT per Table 12and Table 152.		
9	Repeat Steps 1-7.						The verification in Steps 1-7 is the same except: • Verification of item 7 in Step 7 is not applicable If the verification in Steps 1-7 is successful, then PASS else FAIL.

5 STAUT tests

5.1 (Deleted)

5.2 STAUT security tests

5.2.1 (Deleted)

5.2.2 STAUT WEP not used with HE associations negative test

Objective

This test case verifies that the STAUT does not use HE rates when using WEP as the encryption cipher.

Applicability: Mandatory

References

Test case 5.2.51 [3]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP capable of association using WEP with HE (Note that this is a special capability for testing purposes only)
- Wireless Sniffer

Test configuration

Table 154 defines the specific parameter values required for this test case.

Table 154. STAUT WEP not used with HE associations negative test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Broadcom
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Bandwidth	N/A	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band
Spatial streams implemented	Default	1
Security	WEP	WEP
Encryption key	0x9876543210	0x9876543210

Test procedure and expected results

Table 155 provides the specific test procedure and expected results for this test case.

Table 155. STAUT WEP not used with HE associations negative test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 154.	Configure AP1 per Table 4 and Table 154. Configure AP1 with WEP security.	Verify that AP1 advertises only WEP as the security configuration with HT, VHT (5 GHz only) and HE .	
2		AP1 transmits Beacon frames.		
3	Force the STAUT to do an active scan, if supported. The STAUT sends a Probe Request frame to AP1.	If the STAUT sends a Probe Request frame, then AP1 sends a Probe Response frame to the STAUT.	Verify that HE Capabilities element is present in the Beacon and Probe Response frames, and that only WEP is advertised.	
4	Attempt to associate the STAUT to the AP1 with AP1 configured for WEP and HE.	If the STAUT sends an Association Request frame, AP1 replies with an Association Response frame.		SN: If an Association Request frame is not sent from the STAUT, then PASS. Stop the test. If none of the HT Capabilities, VHT (5 GHz only) Capabilities or HE Capabilities elements is present in the Association Request frame, then CONTINUE else FAIL. If the association is successful, then CONTINUE else PASS.
5		FROM PC-ENDPOINT, RUN: PING <STAUT_IP_ADDR> COUNT=10 SIZE=1000		SN: If any of the STAUT data packets are sent with PPDUs that include HE-SIG-A, then FAIL else PASS.

5.2.3 STAUT disallows HE TKIP negative test

Objective

This test case verifies that the STAUT does not use HE rates when using TKIP as the encryption cipher.

Applicability: Mandatory

References

Test case 5.2.51 [3]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP capable of association using TKIP with HE (Note that this is a special capability for testing purposes only)
- PC
- Wireless Sniffer

Test configuration

Table 156 defines the specific parameter values required for this test case.

Table 156. STAUT disallows HE TKIP configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Marvell
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Bandwidth	N/A	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band
Spatial streams implemented	1	Default

Test procedure and expected results

Table 157 provides the specific test procedure and expected results for this test case.

Table 157. STAUT disallows HE TKIP procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 156.	Configure API per Table 4 and Table 156. Configure API with WPA-Personal (TKIP only) so that TKIP is the only advertised pairwise cipher	Verify that AP1 advertises only WPA-Personal as security configuration with	

Step	STAUT	Test bed AP1	Test bed validation	Expected result
		suite in Beacon and Probe Response frames with HE Capability.	TKIP as the only pairwise cipher suite in the WPA element and with HT, VHT (5 GHz only) and HE Capabilities elements.	
2		AP1 transmits Beacon frames		
3	Force the STAUT to do an active scan if supported.	If the STAUT sends a Probe Request frame, then AP1 sends an Probe Response frame to the STAUT.		
4	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If an Association Request frame is not sent from the STAUT, then PASS. Stop the test. If the HE Capabilities element is not present in the Association Request frame, then CONTINUE else FAIL. If the STAUT does not request for TKIP as pairwise cipher along with HT Capabilities or VHT Capabilities, HE Capabilities elements when associating to the APUT, then CONTINUE else FAIL.
5	Run script DUT-AP1-10 from the STAUT to a PC on the wired Ethernet side of AP1 for at least 10 seconds.			SN: If none of the STAUT data packets are sent at HE rates, then PASS else FAIL.

5.3 STAUT basic association in the Wi-Fi CERTIFIED 6 environment tests

5.3.1 STAUT basic association in the Wi-Fi CERTIFIED 6 environment test

Objective

This test case verifies the STAUT's adherence to the advertised operating mode and protection mechanism, and that it transmits Association Request frames with the correct format and appropriate elements.

Applicability: Mandatory

References

Test case 5.2.35 [3]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA operating in 11ac mode
- Test bed STA2: Wi-Fi CERTIFIED 6 STA operating in 11n mode
- Test bed STA3: Wi-Fi CERTIFIED 6 STA operating in 11a mode
- Wireless Sniffer

Test configuration

Table 158 defines the parameter values for the devices in the test bed.

Table 158. STAUT basic association in the Wi-Fi CERTIFIED 6 environment test configuration

Parameter	STAUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed AP1 value
Test bed vendor	N/A	Broadcom98	Cypress	Intel200W	Intel
Security	WPA2-Personal	WPA2-Personal	WPA2-Personal	WPA2-Personal	WPA2-Personal
Encryption key	1234567890	1234567890	1234567890	1234567890	1234567890
Channel width	N/A	80 MHz for 5 GHz 20 MHz for 2.4 GHz	40 MHz	20 MHz	80 MHz for 5 GHz 20 MHz for 2.4 GHz
AP control channel	N/A	N/A	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz

Test procedure and expected results

Table 159 defines the test procedures and expected results.

Table 159. STAUT basic association in the Wi-Fi CERTIFIED 6 environment test procedure and expected results

Step	STAUT	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 158.	Configure STA1 to the default mode defined in [3]. Enable 80 MHz capability in 5 GHz.	Configure STA2 to the default mode defined in [4]. Enable 40 MHz mode.	Configure STA3 per Table 158. Enable 20 MHz capability - 11a.	Configure AP1 per Table 4 and Table 158.		
2	The STAUT sends an Association Request frame to AP1.				AP1 sends an Association Response frame to the STAUT.		SN: If the Association Request frame includes the HE Capability element, then CONTINUE else FAIL.
3	RUN: PING <AP1_IP_ADDR> SIZE=10000 CONTINUOUS=YES						
4		Wait 30 seconds. STA1 sends an Association Request frame to AP1.			AP1 sends an Association Response frame to STA1.		If the ping from the STAUT to AP1 is received, then CONTINUE else FAIL.
5			Wait 30 seconds. STA2 sends an Association Request frame to AP1.		AP1 sends an Association Response frame to STA2.		If the ping from the STAUT to AP1 is received, then CONTINUE else FAIL.
6				Wait 30 seconds. STA3 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to STA3.		If the ping from the STAUT to AP1 is received, then CONTINUE else FAIL.
7	Wait 30 seconds. Disassociate the STAUT from AP1.	Wait 30 seconds. Disassociate STA1 from AP1.	Wait 30 seconds. Disassociate STA2 from AP1.	Wait 30 seconds. Disassociate STA3 from AP1.			
If the STAUT supports 2.4 GHz, then go to Step 8 else PASS.							
8		Configure STA1 to operate in 2.4 GHz.	Configure STA2 to operate in 2.4 GHz.	Configure STA3 to operate in 2.4 GHz.	Configure STA4 to operate in 2.4 G Hz.		

Step	STAUT	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1	Test bed validation	Expected result
9		Configure STA1 to the default mode defined in [3]. Enable 20 MHz capability.	Configure STA2 to the default mode defined in [3]. Enable 40 MHz capability.	Configure STA3 per Table 6 and Table 158. Enable legacy mode 20 MHz.	Configure AP1 per Table 4 and Table 158.		
10	Repeat Steps 2-7.						If the verification in Steps 2-7 is successful, then PASS else FAIL.

5.4 STAUT WPA2 initial ping tests

5.4.1 STAUT WPA2 initial ping using security test

Objective

This test case verifies that the STAUT correctly authenticates, associates and supports pings to a wired authentication server on a subnet connected to the test configuration.

Applicability: Optional

References

Test case 5.2.2 [3]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP configured to support 1 SS only
- Wireless Sniffer

Test configuration

Table 160 defines the specific parameter values required for this test case.

Table 160. STAUT WPA2 initial ping using security test configuration

Parameters	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Qualcomm
SSID	N/A	wpa2
Security	WPA2-Enterprise running TLS	WPA2-Enterprise running TLS
Beacon interval (ms)	N/A	100
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Channel width	N/A	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band
Spatial streams implemented	Default	1
Supplicant/Server	Default	Hostapd

Note: For the STAUT that does not support TLS, use Table 161 to choose the EAP method in priority order.

Table 161. Priority, EAP Types, Supplicant and Servers

Priority	EAP method
First	TTLS
Second	PEAP0
Third	PEAP1
Fourth	SIM
Fifth	FAST
Sixth	AKA

Test procedure and expected results

Table 162 provides the specific test procedure and expected results for this test case.

Table 162. STAUT WPA2 initial ping using security test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected results
If the STAUT supports the 2.4 GHz band, then go to Step 1 else go to Step 5.				
1	Configure the STAUT per Table 14 and Table 160 in the 2.4 GHz band.	Configure AP1 per Table 4 and Table 160 in the 2.4 GHz band. Configure AP1 to support WPA2-Enterprise.		
2		AP1 transmits Beacon frames.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the STAUT successfully associates and authenticates to AP1, then CONTINUE else FAIL.
4	RUN: PING <PC-ENDPOINT_IP_ADDR>			If the STAUT receives ping responses from AP1 within 90 seconds, then PASS else FAIL.
If the STAUT supports 5 GHz, then go to Step 5, else PASS.				
5	Configure the STAUT per Table 14 and Table 160 in the 5 GHz band.	Configure AP1 per Table 4 and Table 160 in the 5 GHz band. Configure AP1 to support WPA2-Enterprise.		
	Repeat Steps 2-4.			If the verification in Steps 2-4 is successful, then PASS else FAIL.

5.4.2 STAUT initial ping interoperability with WPA3-SAE security test

Objective

This test case verifies that the STAUT is able to successfully authenticate, and associate with test bed AP devices using WPA3-SAE Mode and WPA3-SAE Transition Mode security configurations.

Applicability: Mandatory

References

Test case 5.2.4[9]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed AP2: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 163 defines the specific parameter values required for this test case.

Table 163. STAUT initial ping interoperability with WPA3-SAE security test configuration

Parameters	STAUT value	Test bed AP1 value	Test bed AP2 value
Test bed vendor	N/A	Ruckus	Marvell
SSID	N/A	A unique SSID value is randomly generated	A unique SSID value is randomly generated
Security	WPA3-SAE	WPA3-SAE Mode	WPA3-SAE Transition Mode
AKM suite type	8 (SAE)	8 (SAE)	2 (PSK) and 8 (SAE)
Cipher suite type	4 (CCMP-128)	4 (CCMP-128)	4 (CCMP-128)
PMF configuration	Required	Required	Capable
Beacon interval (ms)	N/A	100	100
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band	6 for 2.4 GHz band 36 for 5 GHz band
Channel width	N/A	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band

Test procedure and expected results

Table 164 provides the specific test procedure and expected results for this test case.

Table 164. STAUT initial ping interoperability with WPA3-SAE security test procedure and expected results

Step	STAUT	Test bed AP1	Test bed AP2	Test bed validation	Expected results
If the STAUT supports the 2.4 GHz band, go to Step 1, else go to Step 10.					
1	Configure the STAUT per Table 14 and Table 163 in the 2.4 GHz band.	Configure AP1 per Table 4 and Table 163 in the 2.4 GHz band.	Power off AP2.		
2		AP1 transmits Beacon frames.		SN: Verify that the captured Beacon frame from AP1 contains RSNE with the following: 1. Version field = 01 00 2. Group Data Cipher Suite = 00-0F-AC:4 3. Pairwise Cipher Suite Count = 01 00 4. Pairwise Cipher Suite List = CCMP 00-0F-AC:4 5. AKM Suite Count = 01 00 6. AKM Suite List = 00-0F-AC:8 7. MFPR bit (bit 6) = 1 in RSN Capabilities field	
3	Trigger the STAUT to associate with AP1.				
4	The STAUT and AP1 complete: • SAE authentication exchange • Association exchange • 4-way handshake				SN: Verify the following conditions are true: 1. STAUT initiates SAE authentication with AP1 by transmitting an SAE Commit message. a. Authentication Algorithm Number = 3 b. Authentication Transaction Sequence number = 1 2. STAUT transmits SAE Confirm to AP1. a. Authentication Algorithm Number = 3 b. Authentication Transaction Sequence number = 2 3. STAUT transmits Association Request frame to AP1 containing RSNE. a. Version field = 01 00 b. Group Data Cipher Suite = 00-0F-AC:4 c. Pairwise Cipher Suite Count = 01 00 d. Pairwise Cipher Suite List = CCMP 00-0F-AC:4 e. AKM Suite Count = 01 00 f. AKM Suite List = 00-0F-AC:8 g. MFPR bit (bit 6) = 1 in RSN Capabilities field

Step	STAUT	Test bed AP1	Test bed AP2	Test bed validation	Expected results
					4. STAUT successfully completes 4-way handshake with AP1. If all the conditions are true, then CONTINUE else FAIL.
5	RUN: PING <PC-ENDPOINT_IP_ADDR>				If the STAUT receives ping responses from AP1 within 30 seconds, then CONTINUE else FAIL.
6	Disconnect STAUT from AP1.		Configure AP2 per Table 4 and Table 163.		
7	Trigger the STAUT to associate with AP2.		AP2 transmits Beacon frames.	SN: Verify that the captured Beacon frame from AP2 contains RSNE with the following: 1. Version field = 01 00 2. Group Data Cipher Suite = 00-0F-AC:4 3. Pairwise Cipher Suite Count = 01 00 4. Pairwise Cipher Suite List = CCMP 00-0F-AC:4 5. AKM Suite Count = 02 00 6. AKM Suite List includes 00-0F-AC:2 and 00-0F-AC:8 7. MFPR bit (bit 6) = 0 and MFPC bit (bit 7) set to 1 in RSN Capabilities field	
8	The STAUT and AP2 completes: • SAE authentication exchange • Association exchange • 4-way handshake				SN: Verify the following conditions are true: 1. STAUT initiates SAE authentication with AP2 by transmitting an SAE Commit message. a. Authentication Algorithm Number = 3 b. Authentication Transaction Sequence number = 1 2. STAUT transmits SAE Confirm to AP2. a. Authentication Algorithm Number = 3 b. Authentication Transaction Sequence number = 2 3. STAUT transmits Association Request frame to AP2 containing RSNE. a. Version field = 01 00 b. Group Data Cipher Suite = 00-0F-AC:4 c. Pairwise Cipher Suite Count = 01 00 d. Pairwise Cipher Suite List = CCMP 00-0F-AC:4 e. AKM Suite Count = 01 00 f. AKM Suite List = 00-0F-AC:8 g. MFPC bit (bit 7) = 1 in RSN Capabilities field

Step	STAUT	Test bed AP1	Test bed AP2	Test bed validation	Expected results
					4. STAUT successfully completes 4-way handshake with AP2. If all the conditions are true, then CONTINUE else FAIL.
9	RUN: PING <PC-ENDPOINT_IP_ADDR>				If the STAUT receives ping responses from AP2 within 30 seconds, then PASS else FAIL.
If the STAUT supports 5 GHz, then go to Step 10 else PASS.					
10	Configure the STAUT per Table 14 and Table 163 in the 5 GHz band.	Configure AP1 per Table 4 and Table 163 in the 5 GHz band.	Power off AP2.		
11	Repeat Steps 2-9.				If the verification in Steps 2-9 is successful, then PASS else FAIL.

5.5 STAUT association and throughput using WPA2-PSK tests

5.5.1 STAUT association and throughput using WPA2-Personal test

Objective

This test case verifies that the STAUT correctly passes traffic using WPA2-Personal security.

Applicability: Mandatory

References

Test case 5.2.9[3]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP capable of 2 SS, and capable of being configured to 1 SS
- Wireless Sniffer

Test configuration

Table 165 defines the specific parameter values required for this test case.

Table 165. STAUT association and throughput using WPA2-Personal test configuration

Parameters	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Marvell
SSID	N/A	wpa2
Security	WPA2-Personal	WPA2-Personal
Encryption key	12345678	12345678
Spatial streams implemented	Default	See test procedure
Beacon interval (ms)	N/A	100
AP control channel	N/A	36 for 5 GHz 6 for 2.4 GHz
Channel width	N/A	80 MHz or for 5 GHz 20 MHz for 2.4 GHz

Test procedure and expected results

Table 166 provides the specific test procedure and expected results for this test case.

Table 166. STAUT association and throughput using WPA2-Personal test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected results
If the STAUT supports the 2.4 GHz band, go to Step 1, else go to Step 10.				
1	Configure the STAUT per Table 14 and Table 165 in the 2.4 GHz band.	Configure AP1 per Table 4 and Table 165 in the 2.4 GHz band. Configure AP1 to use 1 SS.	Verify RxMCS/TxMCS are set to MCS 0-7 in the HE Capabilities element on AP1.	
2	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the Association Response frame contains a SUCCESS status, then CONTINUE else FAIL.
3		Run script DT1-AP-DUT.txt to the STAUT.		If the measured throughput > 551S3_TP_24G, then CONTINUE else FAIL.
4	Run script DT2- DUT-AP.txt to AP1.			If the measure throughput > 551S4_TP_24G, then CONTINUE else FAIL. SN: If the PPDUs transmitted by the STAUT contain HE-SIG-A and the BW bits of HE-SIG-A = 0 then CONTINUE else FAIL.
5	Disassociate the STAUT from AP1.			
6		Reconfigure AP1 to with 2 SS. AP1 transmits Beacon frames.		
7	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the Association Response frame contains a SUCCESS status, then CONTINUE else FAIL.
8		Run script DT1-AP-DUT.txt to the STAUT.		If the measure throughput > 551S8_ TP_24G, then CONTINUE else FAIL.
9	Run script DT2-DUT-AP.txt to AP1.			If the measure throughput > 551S9_TP_24G, then CONTINUE else FAIL.
If the STAUT supports 5 GHz, then go to Step 10, else PASS.				
10	Configure the STAUT per Table 14 and Table 165 in the 5 GHz band.	Configure AP1 per Table 4 and Table 165 in the 5 GHz band. Configure AP1 to use 1 SS.	Verify RxMCS/TxMCS are set to MCS 0-7 in the HE Capabilities element on AP1.	
11	Repeat Steps 2-3.			If the measure throughput > 551S11_TP_5G, then CONTINUE else FAIL. SN: If the DUT is 20 MHz-only STAUT then, if the PPDUs transmitted by the STAUT contain HE-SIG-A and the BW bits of HE-SIG-A = 0 then CONTINUE else FAIL Else If the PPDUs transmitted by the STAUT contain HE-SIG-A and the BW bits of HE-SIG-A = 2 then CONTINUE else FAIL

Step	STAUT	Test bed AP1	Test bed validation	Expected results
12	Run script DT2-DUT-AP.txt to AP1.			If the measured throughput > 551S12_TP_5G, then CONTINUE else FAIL. SN: If the DUT is 20 MHz-only STAUT then, if the PPDUs transmitted by the STAUT contain HE-SIG-A and the BW bits of HE-SIG-A = 0 then CONTINUE else FAIL Else If PPDUs transmitted by the STAUT contain HE-SIG-A and the BW bits of HE-SIG-A = 2 , then CONTINUE else FAIL.
13	Repeat Steps 5-9.			The verification in Steps 5-9 is the same except: • Measure throughput > 551S13_8_TP_5G in Step 8 • Measure throughput > 551S13_9_TP_5G in Step 9 If the verification in Steps 5-9 is successful, then PASS else FAIL.

5.5.2 STAUT association and throughput without security test

Objective

This test case verifies that the APUT correctly passes traffic without security.

Applicability: Optional. This test shall be executed only if the STAUT declared support for Open Security in Table 2.

References

Test case 5.2.9.2[3]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP configured to support 1 SS only
- Wireless Sniffer

Test configuration

Table 167 defines the specific parameter values required for this test case.

Table 167. STAUT association and throughput without security test configuration

Parameters	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Intel
SSID	N/A	wpa2
Security	None	None
Beacon interval (ms)	N/A	100
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Bandwidth	N/A	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band
Spatial streams implemented	Default	1

Test procedure and expected results

Table 168 provides the specific test procedure and expected results for this test case.

Table 168. STAUT association and throughput without security test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected results
If the STAUT supports the 2.4 GHz band, go to Step 1, else go to Step 6.				
1	Configure the STAUT per Table 14 and Table 167 in the 2.4 GHz band.	Configure AP1 per Table 4 and Table 167 in the 2.4 GHz band.		
2		AP1 transmits Beacon frames.		SN: If the Beacon frame content does not match Table 167, reconfigure and restart test.
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the Association Response frame contains a SUCCESS status, then CONTINUE else FAIL. If the HE Capabilities element is present in the Association Request frame, then CONTINUE else FAIL.
4		Run script HE-prereq-DT1-AP-DUT.txt to the STAUT.		If the throughput < 552S4_TP_24G, then FAIL else CONTINUE.
5	Run script HE-prereq-DT2-DUT-AP.txt to AP1.			SN: Verify the following conditions are true. 1. PPDUs transmitted by the STAUT contain HE-SIG-A and the BW bits of HE-SIG-A = 0. 1. Test script runs to completion without error. If all the conditions above are true, then CONTINUE else FAIL.
If the STAUT supports 5 GHz, then go to Step 6, else PASS.				
6	Configure the STAUT per Table 14 and Table 167 in the 5 GHz band.	Configure AP1 per Table 4 and Table 167 in the 5 GHz band.		
7	Repeat Steps 2-5.			The verification in Steps 2-5 is the same except: • Recorded throughput is less than 552S7_TP_5G in Step 4 • If the DUT is 20 MHz-only STAUT, then BW bits of HE-SIG-A = 0 else BW bits of HE-SIG-A = 2 in Step 5. If the verification in Steps 2-5 is successful, then PASS else FAIL.

5.6 STAUT association and throughput using WPA2-Enterprise tests

5.6.1 STAUT association and throughput using WPA2-Enterprise test

Objective

This test case verifies that the APUT correctly passes traffic using WPA2-Enterprise security.

Applicability: Optional

References

Test case 5.2.10 [3]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP configured to support 1 SS only
- Wireless Sniffer

Test configuration

Table 169 defines the specific parameter values required for this test case.

Table 169. STAUT association and throughput using WPA2-Enterprise test configuration

Parameters	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Ruckus
SSID	N/A	wpa2
Security	WPA2-Enterprise running TLS	WPA2-Enterprise running TLS
Beacon interval (ms)	N/A	100
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Channel width	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band
Spatial streams implemented	Default	1
Supplicant/Server	Default	Hostapd

Note: For a STAUT that does not support TLS, use Table 170 to select the EAP method in priority order.

Table 170. EAP method in priority order

Priority	EAP method
First	TTLS
Second	PEAP0
Third	PEAP1
Fourth	SIM
Fifth	FAST
Sixth	AKA

Test procedure and expected results

Table 171 provides the specific test procedure and expected results for this test case.

Table 171. STAUT association and throughput using WPA2-Enterprise test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected results
If the STAUT supports the 2.4 GHz band, go to Step 1, else go to Step 7.				
1	Configure the STAUT per Table 14 and Table 169 in the 2.4 GHz band.	Configure AP1 per Table 4 and Table 169 in the 2.4 GHz band.		
2		AP1 transmits Beacon frames.	SN: If the Beacon frame content does not match Table 169, then reconfigure and restart the test	.
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: Verify the following conditions are true. 1. Association Response frame contains a SUCCESS status. 2. HE Capabilities element in the Association Request frame is present. If all the conditions above are true, then CONTINUE else FAIL.
4		Run script HE-gensec-DT1-AP-DUT.txt to the STAUT.		If the recorded throughput is less than 561S4_TP1_24G, then FAIL else CONTINUE.
5	Run script HE-gensec-DT2-DUT-AP.txt to AP1.			If the recorded throughput is less than 561S5_TP2_24G, then FAIL else CONTINUE.
6		Run script HE-gensec-DT3-AP-DUT.txt to the STAUT.		If the recorded throughput is less than 561S6_TP3_24G, then FAIL else PASS..
If the STAUT supports 5 GHz, then go to Step 7, else PASS.				

Step	STAUT	Test bed AP1	Test bed validation	Expected results
7	Configure the STAUT per Table 14 and Table 169 in the 5 GHz band.	Configure AP1 per Table 4 and Table 169 in the 5 GHz band.		
8	Repeat Steps 2-6.			The verification in Steps 2-6 is the same except: • Recorded throughput is less than 561S8_TP1_5G in Step 4 • Recorded throughput is less than 561S8_TP2_5G in Step 5 • Recorded throughput is less than 561S8_TP3_5G in Step 6 If the verification in Steps 2-6 is successful, then PASS else FAIL.

5.7 (Deleted)

5.8 (Deleted)

5.9 Roaming STAUTs with WPA2-PSK tests

5.9.1 Roaming single and dual band STAUTs with WPA2-Personal test

Objective

This test verifies the ability of the STAUT to roam between Wi-Fi CERTIFIED 6, Wi-Fi CERTIFIED ac and Wi-Fi CERTIFIED n APs.

If the STAUT does not support both bands, configure the four test bed APs to the band that the STAUT does support. The STAUT is forced to roam from AP1 to AP2 to AP3 to AP4 and back to AP1. Pings shall not be lost for more than 90 seconds during a roam from one AP to the next.

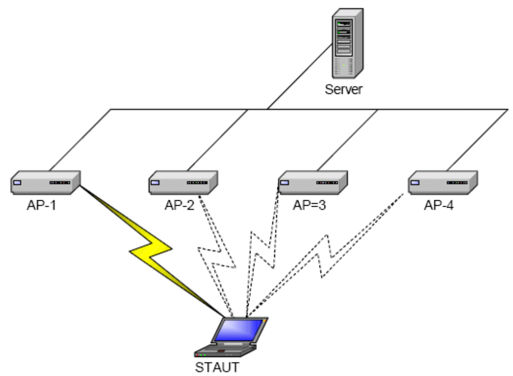

Figure 2. Roaming test for STAs with WPA2-Personal network diagram

Applicability: Mandatory

References

Test case 5.2.26 [3]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed AP2: Wi-Fi CERTIFIED 6 AP
- Test bed AP3: Wi-Fi CERTIFIED n AP, or Wi-Fi CERTIFIED 6 AP operating in 11n mode
- Test bed AP4: Wi-Fi CERTIFIED 6 AP, operating as 11ac in 5 GHz or operating as 11n in 2.4 GHz
- Wireless Sniffer

Test configuration

Table 172 defines the parameter values for the devices in the test bed.

Table 172. Roaming single and dual band STAUTs with WPA2-Personal test configuration

Parameter	STAUT value	Test bed AP1 value	Test bed AP2 value	Test bed AP3 value	Test bed AP4 value
Test bed vendor	N/A	Intel	Qualcomm	Broadcom	Marvell
Beacon interval TUs	N/A	100	100	100	100
AP control channel/Bandwidth	If STAUT is 2.4 GHz only, use 20 MHz BW	Channel 6 / 20 MHz BW	Channel 6/ 20 MHz BW	Channel 6/ 40 MHz BW	Channel 6/ 20 MHz BW
AP control channel/Bandwidth	If STAUT is 5 GHz only, use 80 MHz BW	Channel 36 / 80 MHz BW	Channel 36 / 80 MHz BW	Channel 36 / 40 MHz BW	Channel 36 / 80 MHz BW
Spatial streams implemented	Default	2	2	2	2
ESSID	N/A	"0123456789012345678901 2345678901"	"0123456789012345678901 2345678901"	"0123456789012345678901 2345678901"	"0123456789012345678901 2345678901"
Security	N/A	WPA2-AES Pass Phrase 12345678	WPA2-AES Pass Phrase 12345678	WPA2-AES Pass Phrase 12345678	WPA2-AES Pass Phrase 12345678

Test procedure and expected results

Table 173 defines the test procedures and expected results.

Continuous pings at one second intervals are used to validate connectivity with the PC. Pings shall not be lost for more than 90 seconds during a roam from one AP to the next.

Table 173. Roaming single and dual band STAUTs with WPA2-Personal test procedure and results

Step	STAUT	Test bed AP1	Test bed AP2	Test bed AP3	Test bed AP4	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 172.	Configure AP1 per Table 4 and Table 172.	Configure AP2 per Table 4 and Table 172.	Configure AP3 per Table 4 and Table 172.	Configure AP4 to the default mode defined in [3] or [4], and per Table 172.		
2		AP1 transmits Beacon frames. AP1 sends a Probe Response frame to the STAUT if the STAUT sent a Probe Request frame.	Disable AP2.	Disable AP3.	Disable AP4.		
3	The STAUT sends an						SN: If the STAUT successfully associates

Step	STAUT	Test bed AP1	Test bed AP2	Test bed AP3	Test bed AP4	Test bed validation	Expected result
	Association Response frame to AP1.						to AP1, then CONTINUE else FAIL.
4	RUN: PING <PC-ENDPOINT_IP_ADDR> CONTINUOUS=YES						SN: Verify the following conditions are true. 1. At least one ping is successful 2. Ping from the STAUT contains HE-SIG-A field. If all the above conditions are true, then CONTINUE else FAIL.
5		Disable AP1.	AP2 sends Beacon and Probe Response frames to the STAUT.	Disable AP3.	Disable AP4.		
6	The APUT continues to send pings to the PC-ENDPOINT.						SN: Verify the following conditions are true. 1. At least one ping is successful within 90 seconds. 2. Ping from the STAUT includes the HE-SIG-A field. If all the above conditions are true, then CONTINUE else FAIL.
7		Disable AP1.	Disable AP2.	AP3 sends Beacon and Probe Response frames to the STAUT.	Disable AP4.		
8	The STAUT continues to send pings to the PC-ENDPOINT.						If the pings are successful within 90 seconds, then CONTINUE else FAIL.
9		Disable AP1.	Disable AP2.	Disable AP3.	AP4 sends Beacon and Probe Response frames to the STAUT.		
10	The STAUT continues to send pings to						If the pings are successful within 90 seconds, then CONTINUE else FAIL.

Step	STAUT	Test bed AP1	Test bed AP2	Test bed AP3	Test bed AP4	Test bed validation	Expected result
	the PC-ENDPOINT.						
11		AP1 sends Beacon and Probe Response frames to the STAUT.	Disable AP2.	Disable AP3.	Disable AP4.		
12	The STAUT continues to send pings to the PC-ENDPOINT.						SN: Verify the following conditions are true. 1. At least one ping is successful within 90 seconds. 2. The ping from the STAUT includes the HE-SIG-A field. If all the above conditions are true, then PASS else FAIL.

5.10 (Deleted)

5.11 (Deleted)

5.12 (Deleted)

5.13 (Deleted)

5.14 (Deleted)

5.15 STAUT receives A-MPDU aggregation with and without WPA2-PSK tests

5.15.1 STAUT receives A-MPDU aggregation with and without WPA2-Personal test

Objective

This test case verifies that the STAUT correctly receives A-MPDUs in HE SU PPDUs with HE SU preamble format and different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Mandatory

References

Test case 5.2.37.1 [3]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 174 defines the specific parameter values required for this test case.

Table 174. STAUT receives A-MPDU aggregation with and without WPA2-Personal test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Intel
Bandwidth	See test procedure	20 MHz in 2.4 GHz, Channel 6 80 MHz in 5 GHz, Channel 36
Security	None and WPA2-Personal	None and WPA2-Personal
Encryption key	None and 12345678	None and 12345678
Number of spatial streams	Default	1

Test procedure and expected results

Table 175 provides the specific test procedure and expected results for this test case.

Table 175. STAUT receives A-MPDU aggregation with and without WPA2-Personal test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 174.	Configure AP1 per Table 4 and Table 174.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 12.				
2	Configure the STAUT to join AP1's BSS.	Configure AP1 for 2.4 GHz, and configure security mode to None. AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the STAUT and AP1 association is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1.	Association Response ADDBA Request frame to the STAUT with Buffer size ≤ 64..		
5		Run script HE1-AP-DUT-60.txt to the STAUT.		If the downlink throughput is ≥ 5151S5_DLTP_24G, then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.			
7	.	Configure AP1 to security mode WPA2-Personal. AP1 sends Beacon frames to the STAUT.		
8	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
9	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer size ≤ 64..		
10		Run script HE1-AP-DUT-60.txt to the STAUT.		If the downlink throughput is ≥ 5151S10_DLTP_24G then CONTINUE else FAIL.
11	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 12 else PASS.				
12	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure AP1 for 5 GHz to have security mode as None. AP1 sends Beacon and Probe Response frames to the STAUT.		
13	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
14	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer size ≤ 64..		
15		Run script HE1-AP-DUT-60.txt to the STAUT.		If the downlink throughput is ≥ 5151S15_DLTP_5G then CONTINUE else FAIL.
16	Disassociate the STAUT from AP1.			
17	.	Configure AP1 to have security mode as WPA2-Personal. AP1 sends Beacon and Probe Response frames to the STAUT.		
18	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
19	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an Send ADDBA Request frame to the STAUT with Buffer size ≤ 64.		
20		Run script HE1-AP-DUT-60.txt to the STAUT.		If the downlink throughput is ≥ 5151S20_DLTP_5G then PASS else FAIL.

5.16 STAUT receives A-MSDU tests

5.16.1 STAUT receives A-MSDU test

Objective

This test case verifies that the STAUT correctly receives A-MSDU in HE SU PPDUs with a channel width of 20 MHz in the 2.4 GHz band and a channel width of 80 MHz in the 5 GHz band.

Applicability: Mandatory

References

Test case 5.2.38 [3]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 176 defines the specific parameter values required for this test case.

Table 176. STAUT receives A-MSDU test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Ruckus
Bandwidth	See test procedure	20 MHz in 2.4 GHz, Channel 6 80 MHz in 5 GHz, Channel 36
Number of spatial streams	N/A	1
Security	WPA2-Personal	WPA2-Personal
Encryption key	12345678	12345678
A-MSDU aggregation when transmitting	N/A	Yes
A-MPDU aggregation when transmitting	N/A	NO

Test procedure and expected results

Table 177 provides the specific test procedure and expected results for this test case.

Table 177. STAUT receives A-MSDU test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 176.	Configure AP1 per Table 4 and Table 176.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 6.				
2	Configure the STAUT to join AP1's BSS.	Configure AP1 to operate in the 2.4 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4		Run script HE1-AP-DUT-60.txt to the STAUT.	SN: Verify that for AP1: • MPDUs are > 2346 • PPDUs are 20 MHz HE PPDUs.	If the throughput is ≥ 5161S4_TP_24G, then CONTINUE else FAIL.
5	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 6 else PASS.				
6	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure AP1 for 5 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT.		
7	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
8		Run script HE1-AP-DUT-60.txt to the STAUT.	SN: Verify that for AP1: • MPDUs are > 2346 • PPDUs are 80 MHz HE PPDUs.	If the throughput is ≥ 5161S8_TP_5G, then PASS else FAIL.

5.17 STAUT overlapping BSS at 2.4 GHz tests

5.17.1 STAUT overlapping BSS at 2.4 GHz test

Objective

This test case verifies that the STAUT functions correctly in an overlapping BSS environment in the 2.4 GHz frequency band.

Applicability: Conditional. This test shall be executed only if the STAUT declared support for 2.4 GHz band in Table 1. A 5 GHz only STAUT skips this test case.

References

Test case 5.2.39 [4]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP operating as 802.11ax
- Test bed AP2: Wi-Fi CERTIFIED 6 AP operating as 802.11n
- Test bed STA1: Wi-Fi CERTIFIED 6 STA operating as 802.11n
- Wireless Sniffer

Test configuration

Table 178 defines the parameter values for the devices in the test bed.

Table 178. STAUT overlapping BSS at 2.4 GHz test configuration

Parameter	STAUT value	Test bed AP1 value	Test bed STA1 value	Test bed AP2 value
Vendor	N/A	Qualcomm	Broadcom98	Marvell
AP control channel	N/A	6	N/A	6
Supported channel width set	N/A	0 (20 MHz)	N/A	0 (20 MHz)

Test procedure and expected results

Table 179 defines the test procedures and expected results.

Table 179. STAUT overlapping BSS at 2.4 GHz test procedure and expected results

Step	STAUT	Test bed AP1	Test bed STA1	Test bed AP2	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 178.	Configure AP1 per Table 4 and Table 178.	Configure STA1 to the default mode defined in [4].	Configure AP2 to the default mode defined in [4]. Configure AP2 to Table 178.		

Step	STAUT	Test bed AP1	Test bed STA1	Test bed AP2	Test bed validation	Expected result
		Set AP1 to channel 6.	Configure STA1 to Table 178.	Set AP2 to channel 6.		
2		AP1 sends Beacon and Probe Response frames.		AP2 sends Beacon and Probe Response frames.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.	STA1 sends an Association Request frame to AP2.	AP2 sends an Association Response frame to STA2.		
4	Run script HE1-DUT_STA-AP-60.txt to AP1.		Run script HE1-DUT_STA-AP-60.txt to AP2 for 1 minute.			If the STAUT to AP1 throughput < 5171S4_DUT_AP1_TP_24G, then FAIL else CONTINUE. If the STA1 to AP2 throughput < 5171S4_STA1_AP2_TP_24G, then FAIL else PASS.

5.18 STAUT overlapping BSS at 5 GHz tests

5.18.1 STAUT overlapping BSS at 5 GHz test

Objective

This test case verifies that the STAUT functions correctly in an overlapping BSS environment in the 5 GHz band.

Applicability: Conditional. This test shall be executed only if the STAUT declared support for 5 GHz band in Table 1.

References

Test case 5.2.40 [4]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP operating as 802.11ax
- Test bed AP2: Wi-Fi CERTIFIED 6 AP operating as 802.11ac
- Test bed STA2: Wi-Fi CERTIFIED 6 STA operating as 802.11ac
- Wireless Sniffer

Test configuration

Table 180 defines the parameter values for the devices in the test bed.

Table 180. STAUT overlapping BSS at 5 GHz test configuration

Parameter	STAUT value	Test bed AP1 value	Test bed STA2 value	Test bed AP2 value
Vendor	N/A	Intel	Intel200W	Marvell
AP control channel	N/A	36	N/A	36
Bandwidth	N/A	2 (80 MHz)	20 MHz if DUT is 20 MHz-only STAUT else 80 MHz	2 (80 MHz)

Test procedure and expected results

Table 181 defines the test procedures and expected results.

Table 181. STAUT overlapping BSS at 5 GHz test procedure and expected results

Step	STAUT	Test bed AP1	Test bed STA2	Test bed AP2	Test bed validation	Expected result
1	Configure per Table 14 and Table 180.	Configure AP1 per Table 4 and Table 180.	Configure STA2 to the default mode defined in [3].	Configure AP2 the default mode defined in [3].		

Step	STAUT	Test bed AP1	Test bed STA2	Test bed AP2	Test bed validation	Expected result
			Configure STA2 to Table 180.	Configure AP2 to Table 180.		
2		AP1 sends Beacon and Probe Response frames.		AP1 sends Beacon and Probe Response frames.		
3	The STAUT sends an Association Request to AP1.	AP1 sends an Association Response frame to the STAUT.	STA2 sends an Association Request frame to AP2.	AP2 sends an Association Response frame to STA2.		
4	Run script HE1-DUT_STA-AP-60.txt to AP1.		Run script HE1-DUT_STA-AP-60.txt to AP2 for 1 minute.			If the STAUT to AP1 throughput < 5181S4_DUT_AP1_TP_5G, then FAIL else CONTINUE. If the STA1 to AP2 throughput < 5181S4_STA1_AP2_TP_5G, then FAIL else PASS.

5.19 STAUT transmits A-MPDU aggregation tests

5.19.1 STAUT transmits A-MPDU aggregation test

Objective

This test case verifies A-MPDU aggregation when the STAUT is the transmitter.

Applicability: Mandatory

References

Test case 5.2.47 [3]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 182 defines the specific parameter values required for this test case.

Table 182. STAUT transmits A-MPDU aggregation test configuration

Parameter	STAUT value	Test bed AP1
Test bed vendor	N/A	Marvell
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Channel width	Default	80 MHz in 5 GHz, 20 MHz in 2.4 GHz

Test procedure and expected results

Table 183 provides the specific test procedure and expected results for this test case.

Table 183. STAUT transmits A-MPDU aggregation test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, go to Step 1, else go to Step 6.				
1	Configure the STAUT per Table 14 and Table 182 in the 2.4 GHz band.	Configure AP1 per Table 4 and Table 182 in the 2.4 GHz band.		

Step	STAUT	Test bed AP1	Test bed validation	Expected result
	Configure the STAUT to join AP1's BSS in the 2.4 GHz band			
2		AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		
4	The STAUT sends an ADDBA Request frame to AP1. Note: the STAUT may do this automatically after association or it may be triggered by the data traffic in step 5.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		
5	Run script HE1-DUT-AP-60.txt to AP1.			If the measured throughput is > 5191S5_TP_24G then CONTINUE else FAIL. SN: If the STAUT is using HE PPDUs that contain the HE-SIG-A field, and AP1 responds with C-BA, then CONTINUE else FAIL.
If the APUT supports 5 GHz, then go to Step 6 else PASS.				
6	Configure the STAUT per Table 14 and Table 182 in the 5 GHz band. Configure the STAUT to join AP1's BSS in the 5 GHz band	Configure AP1 per Table 4 and Table 182 in the 5 GHz band.		
7	Repeat Steps 2-5.			The verification in Steps 2-5 is the same except: • Throughput is > 5191S7_TP_5G in Step 5 If the verification in Steps 2-5 is successful, then PASS else FAIL.

5.20 (Deleted)

5.21 STAUT receives A-MPDU with A-MSDU tests

5.21.1 STAUT receives A-MPDU with A-MSDU test

Objective

The test verifies that the STAUT correctly receives A-MPDU with A-MSDU.

Applicability: Optional. This test shall be executed only if the STAUT declared support for A-MPDU with A-MSDU in Table 2.

References

Test case 5.2.56 [3]

Test environment

- APUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 184 defines the parameter values for the devices in the test bed.

Table 184. STAUT receives A-MPDU with A-MSDU test configuration

Parameter	STAUT value	Test bed AP1 value
Vendor	N/A	Broadcom
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Channel width	Default	20 MHz for 2.4 GHz band 80 MHz for 5 GHz band
Spatial streams implemented	Default	1

Test procedure and expected results

Table 185 defines the test procedures and expected results.

Table 185. STAUT receives A-MPDU with A-MSDU test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected results
1	Configure the STAUT per Table 14 and Table 184.	Configure AP1 per Table 4 and Table 184. Enable Tx A-MSDU support.		

Step	STAUT	Test bed AP1	Test bed validation	Expected results
	Configure the STAUT to support A-MPDU with A-MSDU.			
If the APUT supports 2.4 GHz, go to Step 2 else go to Step 8.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon frames.		
3	The STAUT sends an Association Request frame to AP1.			
4		AP1 sends an Association Response frame to the STAUT.		
5	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer size ≤ 64.		SN: If an ADDBA Response frame is sent from the STAUT that includes the Block Ack Parameter Set field with A-MSDU Supported bit = 1, then CONTINUE else FAIL.
6		RUN: PING <STAUT_IP_ADDR> SIZE=16384 COUNT=30		If the STAUT receives the ping for the entire 30 seconds, then CONTINUE else FAIL. SN: If the HE PPDUs sent by the AP1 contain the HE-SIG-A field with Bit 0 = 1 (HE SU PPDU), then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.			
If the APUT supports 5 GHz, go to Step 8 else PASS.				
8	Configure STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon frames.		
9	The STAUT sends an Association Request frame to AP1.			
10		AP1 sends an Association Response frame to the STAUT.		
11	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer size ≤ 64..		SN: If an ADDBA Response frame is sent from the STAUT that includes the Block Ack Parameter Set field with A-MSDU Supported bit = 1, then CONTINUE else FAIL.
12		RUN: PING <STAUT_IP_ADDR> SIZE=16384 COUNT=30		If the STAUT receives the ping for the entire 30 seconds, CONTINUE else then FAIL. SN: If the HE PPDUs sent by the STA1 contain the HE-SIG-A field with Bit 0 = 1 (HE SU PPDU), then PASS else FAIL.

5.22 STAUT receives HE SU preamble format and channel width tests

5.22.1 STAUT receives HE SU preamble format and channel width test

Objective

This test case verifies that the STAUT correctly receives S-MPDUs in HE SU PPDUs with the HE SU preamble format at different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Mandatory

References

Section 6.3.2.8 [1]

Section 27.3.4 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 186 defines the specific parameter values required for this test case.

Table 186. STAUT receives HE SU preamble format and channel width test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Intel
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Bandwidth	See test procedure	20 MHz in 2.4 GHz, 20 MHz, 40 MHz, 80 MHz in 5 GHz
Number of spatial streams	Default	1
Preamble format	HE_SU	HE_SU

Test procedure and expected results

Table 187 provides the specific test procedure and expected results for this test case.

Table 187. STAUT receives HE SU preamble format and channel width test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected results
1	Configure STAUT per Table 14 and Table 186.	Configure AP1 per Table 4 and Table 186. Enable S-MPDU transmission. AP1 should not send ADDBA Request frames.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2		Configure AP1 to be in 20 MHz BSS bandwidth mode in the 2.4 GHz band.		
3		AP1 sends Beacon and Probe Response frames to the STAUT.		
4	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
5		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If there are > 10% ping failures, then FAIL else CONTINUE.
6	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 7 else PASS.				
7		Configure AP1 to be in 20 MHz BSS bandwidth mode in the 5 GHz band.		
8		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If > 10% ping failures, then FAIL else CONTINUE.
9	Disassociate the STAUT from AP1.			
10		Configure AP1 to be in 40 MHz BSS bandwidth mode in 5 GHz band.		
11		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If > 10% ping failures, then FAIL else CONTINUE.
12	Disassociate the STAUT from AP1.			
13		Configure AP1 to be in 80 MHz BSS bandwidth mode in the 5 GHz band.		

14		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If > 10% ping failures, then FAIL else PASS.

5.23 STAUT transmits HE SUpreamble format and channel width tests

5.23.1 STAUT transmits HE SU preamble format and channel width test

Objective

This test case verifies that the STAUT correctly transmits S-MPDUs in HE SU PPDUs with the HE SU preamble format for different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Mandatory

References

Section 6.5.2.1 [1]

Section 27.3.4 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6
- Wireless Sniffer

Test configuration

Table 188 defines the specific parameter values required for this test case.

Table 188. STAUT transmits HE SU preamble format and channel width test configuration

Parameter	STAUT value	Test bed AP 1 value
Test bed vendor	N/A	Qualcomm
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Bandwidth	See test procedure	20 MHz in 2.4 GHz 20 MHz, 40 MHz, 80 MHz in 5 GHz
Number of spatial streams	Default	1
Preamble format	HE_SU	HE_SU

Test procedure and expected results

Table 189 provides the specific test procedure and expected results for this test case.

Table 189. STAUT transmits HE SU preamble format and channel width test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure STAUT per Table 14 and Table 188.	Configure per Table 4 and Table 188. Enable S-MPDU transmission. Decline any ADDBA Request frames from the STAUT.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2		Configure AP1 to be in 20 MHz BSS bandwidth mode in the 2.4 GHz band.		
3	(Optional) The STAUT sends a Probe Request frame to AP1.	AP1 sends Beacon and Probe Response frames to the STAUT.		
4	The STAUT sends a Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
5	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If > 10% ping failures, then FAIL else CONTINUE. SN: Verify the SU PPDU transmitted by the STAUT has the following format: 1. SU PPDU contains a single MPDU and the EOF field = 1. 2. SU PPDU contains HE-SIG-A field with the Format field (B0) = 1, Bandwidth field (B19, B20) = 0, UL/DL field (B2) =1. 3. Ack Policy bits in QoS Control field are set to Normal Ack. 4. BSS_COLOR in HE-SIG-A of PPDUs transmitted by the STAUT contains the BSS color indicated by AP1 in Beacon frames. If all the conditions above are true, then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 7 else PASS.				
7	Configure the STAUT to join AP1's BSS in 5 GHz band.	Configure AP1 to be in 20 MHz BSS bandwidth mode in the 5 GHz band.		
8	The STAUT sends a Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
9	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If > 10% ping failures, then FAIL else CONTINUE.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				SN: Verify the SU PPDU transmitted by the STAUT has the following format: 1. SU PPDU contains a single MPDU and the EOF field= 1. 2. SU PPDU contains HE-SIG-A field with the Format field (B0) = 1, Bandwidth field (B19, B20) = 0, UL/DL field (B2) =1. 3. Ack Policy bits in QoS Control field are set to Normal Ack. If all the conditions above are true, then CONTINUE else FAIL.
10	Disassociate the STAUT from AP1.			If DUT is 20 MHz-only STAUT, then PASS, else CONTINUE
11		Configure AP1 to be in 40 MHz BSS bandwidth mode in the 5 GHz band.		
12	The STAUT sends a Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
13	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If > 10% ping failures, then FAIL else CONTINUE. SN: Verify the SU PPDU transmitted by the STAUT has the following format: 1. SU PPDU contains a single MPDU and the EOF field = 1. 2. SU PPDU contains HE-SIG-A field with the Format field (B0) = 1, Bandwidth field (B19, B20) = 1, UL/DL field (B2) =1. 3. Ack Policy bits in QoS Control field are set to Normal Ack. 4. BSS_COLOR in HE-SIG-A of PPDUs transmitted by the STAUT contains the BSS color indicated by AP1 in Beacon frames If all the conditions above are true, then CONTINUE else FAIL.
14	Disassociate the STAUT from AP1.			
15		Configure AP1 to be in 80 MHz BSS bandwidth mode in the 5 GHz band.		
16	The STAUT sends a Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
17	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If > 10% ping failures, then FAIL else CONTINUE.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				SN: Verify the SU PPDU transmitted by the STAUT has the following format: 1. SU PPDU contains a single MPDU and the EOF field is set to 1. 2. SU PPDU contains HE-SIG-A field with the Format field (B0) = 1, Bandwidth field (B19, B20) = 2, UL/DL field (B2) =1. 3. Ack Policy bits in QoS Control field are set to Normal Ack. 4. BSS_COLOR in HE-SIG-A of PPDUs transmitted by the STAUT contains the BSS color indicated by AP1 in Beacon frames. If all the conditions above are true, then PASS else FAIL.

5.24 STAUT receives LDPC HE A-MPDU with MCS 0-7 tests

5.24.1 STAUT receives LDPC HE A-MPDU with MCS 0-7 test

Objective

This test case verifies that the STAUT correctly receives HE A-MPDU with LDPC with MCS 7.

Applicability: If the STAUT declared primary device category as STA in Table 2, then it is Mandatory for 5 GHz. Optional for a 2.4 GHz STAUT and shall be executed only if the STAUT declared support for LDPC in 2.4 GHz in Table 2

If the STAUT declared primary device category as 20 MHz-only STA in Table 2 , then it is Optional and shall be executed only if the STAUT declared support for LDPC in Table 2.

References

Section 6.5.2.1 [1]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 190 defines the specific parameter values required for this test case.

Table 190. STAUT receives LDPC HE A-MPDU with MCS 0-7 test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Ruckus
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
Coding in payload for transmit	N/A	LDPC
HE-MCS for transmit	Default	HE-MCS 7

Test procedure and expected results

Table 191 provides the specific test procedure and expected results for this test case.

Table 191. STAUT receives LDPC HE A-MPDU with MCS 0-7 test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 190.	Configure AP1 per Table 4 and Table 190.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL If the Association Request frame sent by the STAUT includes the HE PHY Capabilities Information field in the HE Capabilities element with the LDPC Coding in Payload field = 1, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer size ≤64.		
5		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If > 10% ping failures, then FAIL else CONTINUE.
6	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 7 else PASS.				
7	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
8	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL SN: If the Association Request frame sent by the STAUT includes the HE PHY Capabilities Information field in the HE Capabilities element with the LDPC Coding in Payload field = 1, then CONTINUE else FAIL.
9	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer size ≤64.		
10		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If > 10% ping failures, then FAIL else PASS.

5.25 STAUT transmits LDPC HE A-MPDU with MCS 0-7 tests

5.25.1 STAUT transmits LDPC HE A-MPDU with MCS 0-7 test

Objective

This test case verifies that the STAUT correctly transmits HE A-MPDU with LDPC with MCS 0-7.

Applicability: If the STAUT declared primary device category as STA in Table 2, then it is Mandatory for 5 GHz. Optional for a 2.4 GHz STAUT and shall be executed only if the STAUT declared support for LDPC in 2.4 GHz in Table 2

If the STAUT declared primary device category as 20 MHz-only STA in Table 2 , then it is Optional and shall be executed only if the STAUT declared support for LDPC in Table 2.

References

Section 6.3.2.12 [1]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 192 defines the specific parameter values required for this test case.

Table 192. STAUT transmits LDPC HE A-MPDU with MCS 0-7 test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Marvell
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
Coding in payload for transmit	LDPC	LDPC
HE-MCS	HE-MCS 7	Default

Test procedure and expected results

Table 193 provides the specific test procedure and expected results for this test case.

Table 193. STAUT transmits LDPC HE A-MPDU with MCS 0-7 test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 192.	Configure AP1 per Table 4 and Table 192.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL. SN: If the Association Request frame sent by the STAUT includes the HE PHY Capabilities Information field in the HE Capabilities element with the LDPC Coding in Payload field = 1, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT with Buffer size ≤64.		
5	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If > 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs sent by the STAUT contain HE-SIG-A field with the following format: 1. Format field in HE-SIG-A1 (B0)=1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19,B20)=0 (20 MHz) 3. UL/DL field in HE-SIG-A1 (B2)=1 (UL) 4. MCS field in HE-SIG-A1 (B3-B6)=7 (MCS 7) 5. Coding field in HE-SIG-A2 (B7)=1 (LDPC) If all the above conditions are true, then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 7 else PASS.				
7	Configure STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
8	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL. SN: If the Association Request frame sent by the STAUT the HE PHY Capabilities Information field in the HE Capabilities element with the LDPC Coding in Payload field = 1, then CONTINUE else FAIL.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
9	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT.		
10	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If > 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If > 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs sent by the STAUT contain HE-SIG-A field with the following format: 1. Format field in HE-SIG-A1 (B0)=1 (HE SU PPDU) 2. If DUT is 20 MHz-only STA, Bandwidth field in HE-SIG-A1 (B19,B20)=0 (20 MHz) else Bandwidth field in HE-SIG-A1 (B19,B20)=2 (80 MHz) 3. UL/DL field in HE-SIG-A1 (B2)=1 (UL) 4. MCS field in HE-SIG-A1 (B3-B6)=7 (MCS 7) 5. Coding field in HE-SIG-A2 (B7)=1 (LDPC) If all the above conditions are true, then PASS else FAIL.

5.26 STAUT receives BCC HE A-MPDU with MCS 0-7 tests

5.26.1 STAUT receives BCC HE A-MPDU with MCS 0-7 test

Objective

This test case verifies that the STAUT correctly receives HE A-MPDU with BCC with MCS 0-7 in a 20 MHz channel.

Applicability: Mandatory

References

Section 6.3.2.12 [1]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 194 defines the specific parameter values required for this test case.

Table 194. STAUT receives BCC HE A-MPDU with MCS 0-7 test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Intel
Bandwidth	Default	20 MHz in 2.4 GHz 20 MHz in 5 GHz
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Preamble format	HE_SU	HE_SU
Coding in payload for transmit	N/A	BCC
HE-MCS	Default	HE-MCS 7

Test procedure and expected results

Table 195 provides the specific test procedure and expected results for this test case.

Table 195. STAUT receives BCC HE A-MPDU with MCS 0-7 test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 194.	Configure AP1 per Table 4 and Table 194.		
If the STAUT supports 2.4 GHz, go to Step 2 else, go to Step 7.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size ≤ 64..		
5		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE.
6	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, then go to Step 7 else PASS;				
7	Configure STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
8	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
9	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size ≤ 64..		
10		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else PASS.

5.27 STAUT transmits BCC HE A-MPDU with MCS 0-7 tests

5.27.1 STAUT transmits BCC HE A-MPDU with MCS 0-7 test

Objective

This test case verifies that the STAUT correctly transmits HE A-MPDU with BCC and MCS 0-7 in a 20 MHz channel.

Applicability: Mandatory

References

Section 6.3.2.12 [1]

Test environment

- STAUT
- Testbed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 196 defines the specific parameter values required for this test case.

Table 196. STAUT transmits BCC HE A-MPDU with MCS 0-7 test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Qualcomm
Bandwidth	Default	20 MHz in 2.4 GHz 20 MHz in 5 GHz
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Preamble format	HE_SU	HE_SU
Coding in payload for transmit	BCC	BCC
HE-MCS	HE-MCS 7	Default

Test procedure and expected results

Table 197 provides the specific test procedure and expected results for this test case

Table 197. STAUT transmits BCC HE A-MPDU with MCS 0-7 test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 196.	Configure AP1 per Table 4 and Table 196.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64..		
5	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs sent by the STAUT contain HE-SIG-A field with the following format: 1. Format field in HE-SIG-A1 (B0)=1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19,B20)=0 (20 MHz) 3. UL/DL field in HE-SIG-A1 (B2)=1 (UL) 4. MCS field in HE-SIG-A1 (B3-B6)=7 (MCS 7) 5. Coding field in HE-SIG-A2 (B7)=0 (BCC) If all the above conditions are true, then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, then go to the Step 7 else PASS;				
7	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
8	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
9	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64..		
10	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs sent by the STAUT contain HE-SIG-A field with the following format: 1. Format field in HE-SIG-A1 (B0)=1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19,B20)=0 (20 MHz) 3. UL/DL field in HE-SIG-A1 (B2)=1 (UL)

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				4. MCS field in HE-SIG-A1 (B3-B6)=7 (MCS 7) 5. Coding field in HE-SIG-A2 (B7)=0 (BCC) If all the above conditions are true, then PASS else FAIL.

5.28 STAUT single user MIMO with one and two spatial streams tests

5.28.1 STAUT single user MIMO with one and two spatial streams test

Objective

This test case verifies that the DUT correctly implements single user MIMO with one and two spatial streams.

Applicability: Optional. This test shall be executed only if the DUT declared support for single user MIMO with two spatial streams in Table 2.

References

Section 6.4.2.1 [1]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 198 defines the specific parameter values required for this test case.

Table 198. STAUT single user MIMO with one and two spatial streams test configuration

Parameter	STAUT value	Test bed AP1 value
Vendor	N/A	Marvell
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Number of spatial streams	Default	2

Test procedure and expected results

Table 199 provides the specific test procedure and expected results.

Table 199. STAUT single user MIMO with one and two spatial streams test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
If the STAUT supports the 2.4 GHz band, then go to Step 1, else go to Step 10.				

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 6 and Table 198 in the 2.4 GHz band.	Configure AP1 per Table 4 and Table in the 2.4 GHz band.		
2		AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If B0-B1 of the STAUT Tx and Rx MCS Map in the HE Capabilities Supported MCS Set field of HE Capabilities element = 11 (1 SS), then FAIL else CONTINUE.
4		Configure AP1 to transmit only, NSS = 1, HE-MCS= 7, GI=1.6µs.		
5		RUN: PING <STAUT_IP_ADDR> SIZE=1000, Duration= 90 seconds		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more that 10% ping failures, then FAIL else CONTINUE.
6	Disassociate the STAUT from AP1.			
If the vendor declared that the STAUT implements 2 SS, then go to Step 7. If the STAUT only supports the 2.4 GHz band, then PASS else go to Step 10.				
7	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If B0-B1 of the STAUT Tx and Rx MCS Map in the HE Capabilities Supported MCS Set field of HE Capabilities element = 11 or B2-B3 = 11, then FAIL else CONTINUE.
8		Configure AP1 to transmit only, NSS = 2, HE-MCS= 7, GI=1.6µs .		
9		RUN: PING <STAUT_IP_ADDR> SIZE=1000, Duration= 90 seconds		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more that 10% ping failures, then FAIL else CONTINUE.
If the STAUT supports the 5 GHz band, then go to Step 10 else PASS.				
10	Configure the STAUT per Table 14 and Table 198 in the 5 GHz band.	Configure AP1 per Table 4 and Table 198 in the 5 GHz band.		
11		AP1 sends Beacon and Probe Response frames to the STAUT.		
12	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If B0-B1 of the STAUT Tx and Rx MCS Map in the HE Capabilities Supported MCS Set field of HE Capabilities element = 11 then FAIL else CONTINUE.
13		Configure AP1 to transmit only, NSS = 1, HE-MCS= 7, GI=1.6µs.		
14		RUN: PING <STAUT_IP_ADDR> SIZE=1000, Duration= 90 seconds		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				If more that 10% ping failures, then FAIL else CONTINUE.
15	Disassociate the STAUT from AP1.			
If the vendor declared that the STAUT implements 2 SS, then CONTINUE else PASS.				
16	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If B0-B1 of the STAUT Tx and Rx MCS Map in the HE Capabilities Supported MCS Set field of HE Capabilities element = 11 or B2-B3= 11, then FAIL else CONTINUE.
17		Configure AP1 to transmit only NSS = 2, HE-MCS= 7, GI=1.6µs.		
18		RUN: PING <STAUT_IP_ADDR> SIZE=1000 ,Duration= 90 seconds		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more that 10% ping failures, then FAIL else PASS.

5.29 STAUT single TID A-MPDU tests

5.29.1 STAUT transmits single TID compressed BA test

Objective

This test case verifies that the STAUT correctly transmits single TID A-MPDU with up to 64 MSDUs and no fragmentation in HE SU PPDU with different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Mandatory

References

Section 6.3.1.19 [1]

Section 9.3.1.8.2 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 200 defines the specific parameter values required for this test case.

Table 200. STAUT transmits single TID compressed BA test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Broadcom
Bandwidth	20 MHz in 2.4 GHz 20 MHz, 40 MHz, and 80 MHz in 5 GHz	20 MHz in 2.4 GHz 20 MHz, 40 MHz, and 80 MHz in 5 GHz
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Preamble format	HE_SU	HE_SU
HE Capabilities: Fragmentation Support field	N/A	0
Block Ack Parameter Set field: A-MSDU supported	N/A	0

Test procedure and expected results

Table 201 provides the specific test procedure and expected results for this test case.

Table 201. STAUT transmits single TID compressed BA test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 200.	Configure AP1 per Table 4 and Table 200.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		
5	Run script HE1-DUT-AP-60.txt using to AP1.			SN: Verify the following conditions are true. 1. Fragment Number field within the Sequence Control field and the More Fragments subfield within the Frame Control field in the SU PPDUs sent by the STAUT = 0 (no fragmentation), 2. SU PPDUs sent by the STAUT contain HE-SIG-A with the following format: a. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) b. Bandwidth field in HE-SIG-A1 (B19,B20) = 0 (20 MHz) c. UL/DL field in HE-SIG-A1 (B2)=1 (UL) If all the above conditions are true, then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 7 else PASS.				
7	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT. Configure AP1's bandwidth to 20 MHz.		
8	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
9	Repeat Steps 4-5.	Repeat Steps 4-5.		If the verification in Steps 4-5 is successful, then CONTINUE else FAIL.
10	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure AP1's bandwidth to 40 MHz.		If the DUT is 20 MHz-only STAUT, then PASS else CONTINUE
11	Disassociate the STAUT from AP1. Repeat Steps 3-5.	Repeat Steps 3-5.		The verification in Steps 3-5 is the same except:

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				• BW subfield (B18:B19) = 1 (40 MHz) in Step 5 If the verification in Steps 3-5 is successful, then CONTINUE else FAIL.
12	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure AP1's bandwidth to 80 MHz.		
13	Disassociate the STAUT from AP1. Repeat Steps 3-5.	Repeat Steps 3-5.		The verification in Steps 3-5 is the same except: • BW subfield (B18:B19) = 2 (80 MHz) in Step 5 If the verification in Steps 3-5 is successful, then PASS else FAIL.

5.30 STAUT receives single TID A-MPDU tests

5.30.1 STAUT receives single TID Compressed BA test

Objective

This test case verifies that the STAUT correctly receives single TID A-MPDU with up to 64 MSDUs and no fragmentation in HE SU PPDU with different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Mandatory

References

Section 6.3.1.19 [1]

Section 9.3.1.8.2 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 202 defines the specific parameter values required for this test case.

Table 202. STAUT receives single TID Compressed BA test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Intel
Bandwidth	N/A	20 MHz in 2.4 GHz 20 MHz, 40 MHz, and 80 MHz in 5 GHz
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Preamble format	HE_SU	HE_SU
HE Capabilities: Fragmentation Support field	N/A	0
Block Ack Parameter Set field: A-MSDU supported	N/A	0

Test procedure and expected results

Table 203 provides the specific test procedure and expected results for this test case.

Table 203. STAUT receives single TID Compressed BA test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 202.	Configure AP1 per Table 4 and Table 202.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the Dynamic Fragmentation Support subfield of the HE MAC Capabilities Information field in the Association Request frame is set to a value between 0-3, then CONTINUE else FAIL. SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size ≤ 64.		SN: If the ADDBA Response frame sent by the STAUT has the following format 1. Buffer size ≤ 64 2. Dialog Token and TID fields match the values in ADDBA Request frame then CONTINUE else FAIL.
5		Run script HE1-AP-DUT-60.txt to the STAUT.		SN: If the STAUT responds with BA Type = Compressed BlockAck (BA Type field B1-B4 in BA Control field = 2) with the Fragment Number subfield (B0-B3) of the Block Ack Starting Sequence Control field within the BA information field = 0 (Fragmentation Level 3 OFF and Maximum number of MSDUs acknowledged =64), then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 7 else PASS.				
7	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT. Configure AP1's bandwidth to 20 MHz.		
8	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
9	Repeat Steps 4-5.	Repeat Steps 4-5.		If the verification in Steps 4-5 is successful, then CONTINUE else FAIL. If the DUT is 20 MHz-only STAUT, then PASS else CONTINUE

Step	STAUT	Test bed AP1	Test bed validation	Expected result
10	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure AP1's bandwidth to 40 MHz.		
11	Disassociate the STAUT from AP1. Repeat Steps 3-5.	Disassociate AP1 from the STAUT. Repeat Steps 3-5.		If the verification in Steps 3-5 is successful, then CONTINUE else FAIL.
12	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure AP1's bandwidth to 80 MHz.		
13	Disassociate the STAUT from AP1. Repeat Steps 3-5.	Disassociate AP1 from the STAUT. Repeat Steps 3-5.		If the verification in Steps 3-5 is successful, then PASS else FAIL.

5.31 STAUT receives HE Long Training field and guard interval modes tests

5.31.1 STAUT receives HE-LTF, and GI and packet extension test

Objective

This test case verifies that the STAUT correctly receives all mandatory HE-LTF + GI modes.

Applicability: Mandatory

References

Section 6.3.2.16 and 6.3.2.11 [1]

Section 27.3.10.10 and 27.3.12 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 204 defines the specific parameter values required for this test case.

Table 204. STAUT receives HE-LTF, and GI and packet extension configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Marvell
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
HE-LTF and GI	N/A	6.4µs LTF + 0.8µs GI 6.4µs LTF + 1.6µs GI 12.8µs LTF + 3.2 µs GI

Test procedure and expected results

Table 205 provides the specific test procedure and expected results for this test case.

Table 205. STAUT receives HE-LTF, and GI and packet extension procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure STAUT per Table 14 and Table 204.	Configure AP1 per Table 4 and Table 204.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 12.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL. SN: Verify the following conditions are true. 1. HE Capabilities element in the Association Request sent from the STAUT includes: a. PPE Threshold Present field in the HE PHY Capabilities Information field = 1 and the PPE Thresholds field is present in the HE Capabilities element, OR b. PPE Threshold Present field in the HE PHY Capabilities Information field = 0 and the PPE Thresholds field is not present in the HE Capabilities element. 2. If the PPE Thresholds field is present in the HE Capabilities element, then verify that: a. The value of the PPET8 subfield< value of the PPET16 subfield, except when the value of the PPET8 subfield = 7, for each NSS and RU combination for which PPET16 and PPET8 subfields are included in the PPET Threshold field If all the conditions above are true, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size ≤ 64..		
5		Configure AP1 to transmit HE PPDU using LTF=6.4µs and GI = 0.8µs.		
6		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE.
7		Configure AP1 to transmit HE PPDU using LTF=6.4µs and GI = 1.6µs.		
8		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE.
9		Configure AP1 to transmit HE PPDU using LTF=12.8µs and GI = 3.2µs.		

Step	STAUT	Test bed AP1	Test bed validation	Expected result
10		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE.
11	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 12 else PASS.				
12	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
13	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL SN: Verify the following conditions are true. 1. HE Capabilities element in the Association Request sent from the STAUT includes: a. PPE Threshold Present field in the HE PHY Capabilities Information field = 1 and the PPE Thresholds field is present in the HE Capabilities element, OR b. PPE Threshold Present field in the HE PHY Capabilities Information field = 0 and the PPE Thresholds field is not present in the HE Capabilities element. 2. If the PPE Thresholds field is not present in the HE Capabilities element, then verify: a. The value of the PPET8 subfield < the value of the PPET16 subfield, except when the value of the PPET8 subfield = 7, for each NSS and RU combination for which PPET16 and PPET8 subfields are included in the PPET Threshold field. If all the conditions above are true, then CONTINUE else FAIL.
14	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size ≤ 64..		
15		Configure AP1 to transmit HE PPDU using LTF=6.4µs and GI = 0.8µs.		
16		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE.
17		Configure AP1 to transmit HE PPDU using LTF=6.4µs and GI = 1.6µs.		
18		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
19		Configure AP1 to transmit HE PPDU using LTF=12.8µs and GI = 3.2µs.		
20		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else PASS.

5.32 STAUT transmits HE Long Training field and guard interval tests

5.32.1 STAUT transmits HE-LTF and GI test

Objective

This test case verifies that the STAUT correctly transmits all mandatory HE-LTF and GI modes.

Applicability: Mandatory

References

Section 6.3.2.16 [1]

Section 27.3.10.10 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 206 defines the specific parameter values required for this test case.

Table 206. STAUT transmits HE-LTF and GI test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Broadcom
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
HE-LTF and GI	6.4µs LTF + 0.8µs GI 6.4µs LTF + 1.6µs GI 12.8µs LTF + 3.2 µs GI	N/A

Test procedure and expected results

Table 207 provides the specific test procedure and expected results for this test case.

Table 207. STAUT transmits HE-LTF and GI test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 206.	Configure AP1 per Table 4 and Table 206.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 12.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		
5	Configure the STAUT to transmit HE PPDU using LTF=6.4µs and GI = 0.8µs.			
6	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the STAUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19,B20) = 0 (20 MHz) 3. LTF+GI field in HE-SIG-A1 (B21,B22) = 1 (LTF = 6.4µs and GI = 0.8µs) If all the above conditions are true, then CONTINUE else FAIL.
7	Configure the STAUT to transmit HE PPDU using LTF=6.4µs and GI = 1.6 µs.			
8	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the STAUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19,B20) = 0 (20 MHz) 3. LTF+GI field in HE-SIG-A1 (B21,B22) = 2 (LTF = 6.4us and GI = 1.6us)

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				If all the above conditions are true, then CONTINUE else FAIL.
9	Configure the STAUT to transmit HE PPDU using LTF=12.8µs and GI = 3.2µs.			
10	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the STAUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. Bandwidth field in HE-SIG-A1 (B19,B20) = 0 (20 MHz) 3. LTF+GI field in HE-SIG-A1 (B21,B22) = 3 (LTF = 12.8µs and GI = 3.2µs) If all the above conditions are true, then CONTINUE else FAIL.
11	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 12 else PASS.				
12	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
13	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
14	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		
15	Configure the STAUT to transmit HE PPDU using LTF=6.4µs and GI = 0.8 µs.			
16	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the STAUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. If the DUT is 20 MHz-only STAUT then, Bandwidth field in HE-SIG-A1 (B19,B20) = 2 (80 MHz) else

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				Bandwidth field in HE-SIG-A1 (B19,B20) = 2 (80 MHz) 3. LTF+GI field in HE-SIG-A1 (B21,B22)= 1 (LTF = 6.4µs and GI = 0.8µs) If all the above conditions are true, then CONTINUE else FAIL.
17	Configure the STAUT to transmit HE PPDU using LTF=6.4µs and GI = 1.6µs.			
18	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the STAUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. If the DUT is 20 MHz-only STAUT then, Bandwidth field in HE-SIG-A1 (B19,B20) = 2 (80 MHz) else Bandwidth field in HE-SIG-A1 (B19,B20) = 2 (80 MHz) 3. LTF+GI field in HE-SIG-A1 (B21,B22) = 2 (LTF = 6.4us and GI = 1.6us) If all the above conditions are true, then CONTINUE else FAIL.
19	Configure the STAUT to transmit HE PPDU using LTF=12.8µs and GI = 3.2 µs.			
20	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE. SN: Verify the HE PPDUs transmitted by the STAUT contains: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. If the DUT is 20 MHz-only STAUT then, Bandwidth field in HE-SIG-A1 (B19,B20) = 2 (80 MHz) else Bandwidth field in HE-SIG-A1 (B19,B20) = 2 (80 MHz) 3. LTF+GI field in HE-SIG-A1 (B21,B22) = 3 (LTF = 12.8µs and GI = 3.2µs) If all the above conditions are true, then PASS else FAIL.
	Disassociate the STAUT from AP1.			

5.33 STAUT DL OFDMA tests

5.33.1 STAUT DL OFDMA test

Objective

This test case verifies that the STAUT correctly receives DL OFDMA.

Applicability: Mandatory

References

Section 6.3.2.1 [1]

Section 26.5.1.1 [7]

Test environment

- STAUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed AP1
- Wireless Sniffer

Test configuration

Table 208 defines the specific parameter values required for this test case.

Table 208. STAUT DL OFDMA test configuration

Parameter	STAUT value	Test bed STA1 value	Test bed AP1 value
Test bed vendor	N/A	Broadcom98	Qualcomm
AP control channel	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	20 MHz if DUT is 20 MHz-only STAUT else 80 MHz in 5 GHz 20 MHz in 2.4 GHz	20 MHz if DUT is 20 MHz-only STAUT else 80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	N/A	N/A	HE_MU (DL OFDMA)
Number of users in each OFDMA transmission	N/A	N/A	2

Test procedure and expected results

Table 209 provides the specific test procedure and expected results for this test case.

Table 209. STAUT DL OFDMA test procedure and expected results

Step	STAUT	Testbed STA1	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 208.	Configure STA1 per Table 6and Table 208.	Configure per Table 4 and Table 208. Configure AP1 to the 2.4 GHz band.		
If the STAUT supports 2.4 GHz go to Step 2 else go to Step 14					
2	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1.		
3		STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to STA1.		
4	The STAUT sends an Association Request frame to AP1.		AP1 sends an Association Response frame to the STAUT .		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
5	The STAUT sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to STA1 with Buffer Size ≤ 64.		
6			Configure AP1 to transmit DL OFDMA with Ack Policy set to Block Ack.		
7			Run script HE1-DLOFDMA-STAUT.txt to the STAUT and STA1.		SN: If the STAUT transmits C-BA in response to BAR, then CONTINUE else FAIL.
8	Disassociate the STAUT from AP1.	Disassociate the STA1 from AP1			
9	The STAUT sends an Association Request frame to AP1.		AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
10		STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to STA1.		
11	The STAUT sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to STA1 with Buffer Size ≤ 64.		
12			Configure AP1 to transmit DL OFDMA with Ack Policy set to Normal ACK to the STAUT.		

Step	STAUT	Testbed STA1	Test bed AP1	Test bed validation	Expected result
13			Run script HE1-DLOFDMA-STAUT_24G txt to the STAUT and STA1.		SN: If the STAUT transmits C-BA or Ack after DL OFDMA PPDU, then CONTINUE else FAIL.
If the STAUT supports 5 GHz, go to Step 14 else PASS.					
14	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP!'s BSS.	Configure AP1 to the 5 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1.		
15		STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to STA1.		
	The STAUT sends an Association Request frame to AP1.		AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
16	The STAUT sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to STA1 with Buffer Size ≤ 64.		
17			Configure AP1 to transmit DL OFDMA with Ack Policy set to Block Ack.		
18			Run script HE1-DLOFDMA-STAUT.txt to the STAUT and STA1.		SN: If the STAUT transmits C-BA in response to BAR, then CONTINUE else FAIL .
19	Disassociate the STAUT from AP1.				
20	The STAUT sends an Association Request frame to AP1.	Disassociate the STA1 from AP1	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
21		STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to STA1.		
22	The STAUT sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to STA1 with Buffer Size ≤ 64.		
23			Configure AP1 to transmit DL OFDMA with Ack Policy set to Normal Ack to the STAUT.		

Step	STAUT	Testbed STA1	Test bed AP1	Test bed validation	Expected result
24			Run script HE1-DLOFDMA-STAUT.txt to the STAUT and STA1.		SN: If the STAUT transmits C-BA or Ack after DL OFDMA PPDU, then PASS else FAIL.

5.34 STAUT DL OFDMA PHY test

Objective

This test case verifies that the STAUT correctly receives DL OFDMA.

Applicability: If the STAUT declared primary device category as STA in Table 2, then test case 5.34.1, 5.34.2 and 5.34.3 are Mandatory

If the STAUT declared primary device category as 20 MHz-only STA in Table 2 , then test case 5.34.1 is Mandatory and 5.34.4 is Optional and shall be executed only if the STAUT declared support for BIT 5=1 in HE PHY capablities in Table 2.

References

Section 6.3.2.1 [1]

Section 26.5.1.1 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 210 defines the specific parameter values required for this test case.

Table 210. STAUT DL OFDMA PHY test at 20 MHz test configuration

Parameter	**STAUT value**	**Test bed STA1 value**	**Test bed STA2 value**	**Test bed STA3 value**	**Test bed AP1 value**
Test bed vendor (5.34.1)	N/A	Broadcom98	Cypress	Intel200L	Ruckus
Test bed vendor (5.34.2)	N/A	Broadcom75	Intel200L	Qualcomm	Broadcom
Test bed vendor (5.34.3)	N/A	Cypress	Intel200W	Qualcomm	Intel
Test bed vendor (5.34.4)	N/A	Broadcom 75	Intel200L	Qualcomm	Broadcom
AP control channel	N/A	N/A	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz 40 in 5 GHz for 5.34.4 only
Bandwidth	Default	N/A	N/A	N/A	80 MHz in 5 GHz 40 MHz in 5 GHz 20 MHz in 5 GHz

Parameter	STAUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed AP1 value
					20 MHz in 2.4 GHz
PPDU format	N/A	N/A	N/A	N/A	HE_MU (DL OFDMA)
Number of users in each OFDMA transmission	N/A	N/A	N/A	N/A	4

5.34.1 STAUT DL OFDMA PHY test at 20 MHz test

Test procedure and expected results

Table 211 provides the specific test procedure and expected results for this test case.

Table 211. STAUT DL OFDMA PHY test at 20 MHz procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 210.	Configure STA1, STA2, and STA3 per Table 6 and Table 210.	Configure AP1 per Table 4 and Table 210. Configure AP1 to 1SS.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 15.					
2	Configure the STAUT to join AP1's BSS.	Configure STA1-3 to join AP1's BSS.	Configure AP1 to the 2.4 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, and STA3 send an Association Request frame to the STAUT.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.	STA1, STA2, and STA3 send an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to STA1, STA2, and STA3 with Buffer Size ≤ 64.		
5			Configure AP1 to transmit using DL OFDMA,1 spatial stream, LTF=12.8µs, GI=3.2µs, BCC, and RU allocation [26 26 26 26] tones. AP1 allocates the STAUT RU in different locations.		
6			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to STAUT and STA1, STA2, and STA3.		If the throughput at the STAUT is more than 5341S6_TP_24G , then CONTINUE else FAIL.

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
7			Configure AP1 to transmit using DL OFDMA, 1 spatial stream, LTF=6.4µs, GI=1.6µs, BCC, and RU allocation [52 52 52 52] tones. AP1 allocates the STAUT RU in different locations.		
8			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to STAUT and STA1, STA2, and STA3.		If the throughput at the STAUT is more than 5341S8_TP_24G, then CONTINUE else FAIL.
Disassociate STAUT, STA1, STA2 and STA3 from AP1 Associate and setup ADDBA session between STAUT, STA1, and AP1.					
9			Configure AP1 to transmit using DL OFDMA, 1 spatial stream, LTF = 6.4 µs, GI = 0.8 µs, BCC, and RU allocation [106 106] tones. AP1 allocates the STAUT RU in different locations.		
10			Run script HE1-DLOFDMA-STAUT.txt to the STAUT and STA1.		If the throughput at the STAUT is more than 5341S10_TP_24G, then CONTINUE else FAIL.
Disassociate the STAUT and STA1, from AP1 If the STAUT supports > 1 spatial stream, then go to Step 11. Else, go to Step 14.					
11			Configure AP1 to transmit using DL OFDMA, 2 spatial streams, LTF = 12.8 µs, GI = 3.2 µs, BCC, and RU allocation [106 106] tones. AP1 allocates the STAUT RU in different locations. Associate STAUT and STA1 to AP1 using 2 spatial streams.		
12			Run script HE1-DLOFDMA-STAUT.txt to the STAUT and STA1.		If the throughput at the STAUT is more than 5341S12_TP_24G, then CONTINUE else FAIL.
13	Disassociate the STAUT from AP1.	Disassociate STA1 from AP1.			
If the STAUT supports 5 GHz, go to Step 14 else PASS.					
14	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2, and STA3 to join AP1's BSS.	Configure BSS BW to 20 MHz in 5 GHz.		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			AP1 sends an Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
15	The STAUT sends an Association Request frame to AP1.	STA1, STA2, and STA3 send an Association Request frame to the STAUT.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
16	STAUT send an ADDBA Response frame to AP1	STA1, STA2, and STA3 send an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to STAUT, STA1, STA2, and STA3 with Buffer Size ≤ 64.		
17			Configure AP1 to transmit using DL OFDMA 1 spatial stream, LTF = 6.4 µs, GI = 1.6 µs, BCC, and RU allocation [26 26 26 26] tones. AP allocates the STAUT RU in different locations.		
18			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, and STA3.		If the throughput at the STAUT is more than 5341S18_TP_5G, then CONTINUE else FAIL.
If the DUT type is 20 MHz-only STAUT Disassociate ,Terminate BSS then go to Step 19 else PASS					
19			Configure BSS BW to 40 MHz in 5 GHz. Configure AP1 to 1SS explicitly.		
20	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2 and STA3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2 and STA3		
21	The STAUT sends an Association Request frame to AP1.	Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1-3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
22	The STAUT sends an ADDBA Response frame to AP1.	ADDBA Response frame to AP1.with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT and STA1-3. with Buffer Size ≤ 64.		
23			Configure AP1 to transmit using DL OFDMA, 1 spatial stream, LTF=6.4µs, GI=0.8 µs, BCC, and RU allocation [52 52 52 52] tones. AP1 allocates the STAUT RU in different locations		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
24			Run script HE1-DLOFDMA-STAUT to STAUT and STA 1-3.		If the throughput is more than 5341S24_TP_5G then CONTINUE else FAIL.
Disassociate, Terminate BSS .					
25			Configure BSS BW to 80 MHz in 5 GHz. Configure AP1 to 1SS explicitly.		
26	Configure the STAUT to join AP1's BSS.	Configure STA1-3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1-3.		
27	The STAUT sends an Association Request frame to AP1.	Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1-3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
28	The STAUT sends an ADDBA Response frame to AP1.	ADDBA Response frame to AP1.with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT and STA1-3. with Buffer Size ≤ 64.		
29			Configure AP1 to transmit using DL OFDMA, 1 spatial stream, LTF=12.8µs, GI=3.2µs, BCC, and RU allocation [106 106 106 106] tones. AP1 allocates the STAUT RU in different locations		
30			Run script HE1-DLOFDMA-STAUT to the STAUT and STA 1-3.		If the throughput is more than 5341S30_TP_5G, then PASS else FAIL.

5.34.2 STAUT DL OFDMA PHY test at 40 MHz (5 GHz) test

Test procedure and expected results

Table 212 provides the specific test procedure and expected results for this test case.

Table 212. STAUT DL OFDMA PHY test at 40 MHz (5 GHz) test procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 210.	Configure STA1, STA2, and STA3 per Table 6 and Table 211.	Configure AP1 per Table 4 and Table 211. Configure BSS BW to 40 MHz in 5 GHz. Configure AP1 to 1SS.		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
2	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2, and STA3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, and STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA1, STA2, and STA3 send an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT and STA1, STA2, and STA3 with Buffer Size ≤ 64.		
5			Configure AP1 to transmit using DL OFDMA, 1 spatial stream, LTF=6.4µs, GI=1.6µs, LDPC, and RU allocation [52 52 52 52] tones. AP1 allocates the STAUT RU in different locations.		
6			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, and STA3.		If the throughput is at the STAUT more than 5342S6_TP_5G, then PASS else FAIL.

5.34.3 STAUT DL OFDMA PHY test at 80 MHz (5 GHz) test

Test procedure and expected results

Table 213 provides the specific test procedure and expected results for this test case.

Table 213. STAUT DL OFDMA PHY test at 80 MHz (5 GHz) procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 211.	Configure STA1, STA2, and STA3 per Table 6 and Table 210	Configure AP1 per Table 4 andTable 210. Configure BSS BW to 80 MHz in 5 GHz. Configure AP1 to 1SS.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2, and STA3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2 and STA3 sends association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT, STA1, STA2, and STA3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1 .	ADDBA Response frame to AP1.with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT and STA1, STA2, and STA3 with Buffer Size ≤ 64.		
5			Configure AP1 to transmit using DL OFDMA, 1 spatial stream, LTF=6.4µs, GI=0.8µs, LDPC, and RU allocation [106 106 106 106] tones. AP1 allocates the STAUT RU in different locations.		
6			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to STAUT and STA1, STA2, and STA3.		If the throughput at the STAUT is more than 5343S6_TP_5G, then CONTINUE else FAIL.
7			Configure AP1 to transmit using DL OFDMA, 1 spatial stream, LTF=6.4µs, GI=1.6µs, LDPC, and RU allocation [242 242 242 242] tones. AP1 allocates the STAUT RU in different locations.		
8			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to STAUT and STA1, STA2, and STA3.		If the throughput at the STAUT is more than 5343S8_TP_5G, then CONTINUE else FAIL.

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
9	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, and STA3 from AP1.			
10	The STAUT sends an Association Request frame to AP1.	STA1 sends an association Request frame to AP1	AP1 sends an Association Response frame to the STAUT and STA1.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
11	The STAUT sends an ADDBA Response frame to AP1.	ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT and STA1, STA2, and STA3 with Buffer Size ≤ 64.		
12			Configure AP1 to transmit using DL OFDMA, 1 spatial stream, LTF=12.8µs, GI=3.2µs, LDPC, and RU allocation [484 484] tones. AP1 allocates the STAUT RU in different locations.		
13			Run script HE1-DLOFDMA-STAUT.txt to the STAUT and STA1.		If the throughput at the STAUT is more than 5343S13_TP_5G, then CONTINUE else FAIL.
14	If the STAUT supports > 1 spatial stream, then disassociate the STAUT and STA1 from AP1 and go to Step 15 else PASS.				
15			Configure AP1 to transmit using DL OFDMA, 2 spatial streams, LTF=6.4µs, GI=1.6µs, LDPC, and RU allocation [484 484] tones. AP1 allocates the STAUT RU in different locations.		
16			Run script HE1-DLOFDMA-STAUT.txt to STAUT and STA1.		If the throughput at the STAUT is more than 5343S16_TP_5G, then PASS else FAIL.

5.34.4 STAUT (20 MHz-Only) downlink OFDMA PHY test for RU 242

Test procedure and expected results

Table 214 provides the specific test procedure and expected results for this test case.

Table 214. STAUT (20 MHz-Only) downlink OFDMA PHY test for RU 242 procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure STAUT per Table 14 and Table 211.	Configure STA1-3 per Table 6 and Table 210.	Configure AP1 per Table 4 and Table 211. BSS BW to 80 MHz in 5 GHz. Configure AP1 to 1SS explicitly.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1-3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1-3.		
3	The STAUT sends an Association Request frame to AP1.	Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1-3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1.	ADDBA Response frame to AP1.with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT and STA1-3. with Buffer Size ≤ 64.		
7			Configure AP1 to transmit using DL OFDMA, 1 spatial stream, LTF=6.4µs, GI=1.6µs, LDPC, and RU allocation [242 242 242 242] tones. AP1 allocates the STAUT RU in different locations.		
8			Run script HE1-DLOFDMA-STAUT to STAUT and STA 1-3.		If the throughput is more than 5344S8_TP_5G then PASS else FAIL.

5.35 STAUT receives MCS 8-9 tests

5.35.1 STAUT receives MCS 8-9 test

Objective

This test case verifies that the STAUT correctly receives MCS 8-9 with both BCC and LDPC coding and with one or two spatial streams.

Applicability: Optional. This test shall be executed only if the STAUT declared support for MCS 8-9 in Table 2.

References

Section 6.4.2.5 [1]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 215 defines the specific parameter values required for this test case.

Table 215. STAUT receives MCS 8-9 test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Marvell
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
HE-MCS	Default	HE-MCS 9
LDPC Coding in payload in 2.4 GHz	N/A	Disabled

Test procedure and expected results

Table 216 provides the specific test procedure and expected results for this test case.

Table 216. STAUT receives MCS 8-9 test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 215.	Configure AP1 per Table 4 and Table 215.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 11.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size ≤ 64..		
5		Configure AP1 to transmit 1 spatial stream.		
6		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL If no more than 10% ping failures, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.			
If the STAUT supports 2 spatial streams, go to Step 8 else go to Step 11.				
8		Reconfigure AP1 to use 2 spatial streams.		
9		Repeat Step 3, 4,and 6.		If the verification in Step 6 is successful, then CONTINUE else FAIL..
10	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 11 else PASS.				
11	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
12	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
13	The STAUT sends an ADDBA Response frame to AP1	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size ≤ 64..		
14		Configure AP1 to transmit 1 spatial stream.		
15		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If no more than 5 consecutive ping timeouts occur, then CONTINUE, else FAIL If no more than 10% ping failures, then CONTINUE else FAIL.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
16	Disassociate the STAUT from AP1.			
If the STAUT supports 2 spatial streams, go to Step 17 else PASS.				
17		Reconfigure AP1 to use 2 spatial streams.		
18		Repeat Step 12,13, and 15.		If the verification in Step 15 is successful, then PASS else FAIL..

5.36 STAUT transmits MCS 8-9 tests

5.36.1 STAUT transmits MCS 8-9 test

Objective

This test case verifies that the STAUT correctly transmits MCS 8-9 with both BCC and LDPC coding, and with one or two spatial streams.

Applicability: Optional. This test shall be executed only if the DUT declared support for MCS 8-9 in Table 2.

References

Section 6.4.2.5 [1]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 217 defines the specific parameter values required for this test case.

Table 217. STAUT transmits MCS 8-9 test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Qualcomm
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
LDPC Coding in Payload in 2.4 GHz	N/At	Disabled
Max HE-MCS for 1 SS subfield, Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field	Default	1

Test procedure and expected results

Table 218 provides the specific test procedure and expected results for this test case.

Table 218.STAUT transmits MCS 8-9 test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 217.	Configure AP1 per Table 4 and Table 217.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 11.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	Configure AP1 to use 1 spatial stream. AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response to the STAUT.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64..		
5		Configure AP1 to use 1SS.		
6	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL. SN: Verify the PPDUs transmitted by the STAUT carried in the ping request have the following format: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. MCS field in HE-SIG-A1 (B3-B6) = 9 3. Bandwidth field in HE-SIG-A1 (B19-B20) = 0 (20 MHz) 4. Coding field in HE-SIG-A2 (B7) = 0 (BCC) 5. NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 0 (1 spatial stream) If all of the above conditions are true, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.			
If the STAUT supports 2 spatial streams, go to Step 8 else go to Step 11.				
8		Reconfigure AP1 to use 2 spatial streams.		
9		Repeat Steps 3, 4, and 6.		The verification in Steps 3, 4 and 6 is the same except: • NSTs and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 1 (2 spatial streams) in Step 6 If the verification in Steps 3, 4-and 6 is successful, then CONTINUE else FAIL.
10	Disassociate the STAUT from AP1.			

Step	STAUT	Test bed AP1	Test bed validation	Expected result
If the STAUT supports 5 GHz, go to Step 11 else PASS.				
11	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
12	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
13	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64..		
14		Configure AP1 to use 1 spatial stream.		
15	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL. SN: Verify the PPDUs transmitted by the STAUT carried in the ping request have the following format: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. MCS field in HE-SIG-A1 (B3-B6) = 9 3. If DUT is 20 MHz-Only STAUT, then, Bandwidth field in HE-SIG-A1 (B19-B20) = 0 (20 MHz) else Bandwidth field in HE-SIG-A1 (B19-B20) = 2 (80 MHz) 4. Coding field in HE-SIG-A2 (B7) = 1 (LDPC) 5. NSTs and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 0 (1 spatial stream) If all of the above conditions are true, then CONTINUE else FAIL.
16	Disassociate the STAUT from AP1.			
If the STAUT supports 2 spatial streams, go to Step 17 else PASS.				
17		Reconfigure AP1 to use 2 spatial streams.		
18	Repeat Steps 12, 13, and 15			The verification in Steps 12, , and 15 is the same except: • NSTs and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 1 (2 spatial streams) in Step 15 If the verification in Steps 12, , and 15 is successful, then PASS else FAIL.

5.37 STAUT receives MCS 10-11 tests

5.37.1 STAUT receives MCS 10-11 test

Objective

This test case verifies that the STAUT correctly receives MCS 10-11 LDPC coding, and with one or two spatial streams.

Applicability: Optional. This test shall be executed only if the STAUT declared support for MCS 10-11 in Table 1.

References

Section 6.4.2.6 [1]

Test environment

- STAUT
- Test bed AP1:Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 219 defines the specific parameter values required for this test case.

Table 219. STAUT receives MCS 10-11 test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Marvell
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
HE-MCS	Default	HE-MCS 11
LDPC Coding in Payload in 2.4 GHz	Default	Enabled

Test procedure and expected results

Table 220 provides the specific test procedure and expected results for this test case.

Table 220. STAUT receives MCS 10-11 test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 219.	Configure AP1 per Table 4 and Table 219.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 11.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size ≤ 64..		
5		Configure AP1 to use 1 spatial stream.		
6		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL If no more than 10% ping failures, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.			
If the STAUT supports 2 spatial streams, go to Step 8 else go to Step 11.				
8		Reconfigure AP1 to use 2 spatial streams.		
9		Repeat step 3, 4, and 6.		If the verification in Steps 3, 4 and 6 is successful, then CONTINUE else FAIL.
10	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 11 else PASS.				
11	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
12	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
13	The STAUT sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size ≤ 64..		
14		Configure AP1 to transmit 1 spatial stream.		
15		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL If no more than 10% ping failures, then CONTINUE else FAIL.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
16	Disassociate the STAUT from AP1.			
If the STAUT supports 2 spatial streams, go to Step 17 else PASS.				
17		Reconfigure AP1 to use 2 spatial streams.		
18		Repeat Step 12, 13, and 15.		If the verification in Steps 12, and 15 is successful, then PASS else FAIL.

5.38 STAUT transmits MCS 10-11 tests

5.38.1 STAUT transmits MCS 10-11 test

Objective

This test case verifies that the STAUT correctly transmits MCS 10-11 LDPC coding, and with one or two spatial streams.

Applicability: Optional. This test shall be executed only if the STAUT declared support for MCS 10-11 in Table 1.

References

Section 6.4.2.6 [1]

Test environment

- STAUT
- Test bed AP1:Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 221 defines the specific parameter values required for this test case.

Table 221. STAUT transmits MCS 10-11 test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Broadcom
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Preamble format	HE_SU	HE_SU
LDPC Coding in payload in 2.4 GHz	Default	Enabled
Max HE-MCS for 1 SS subfield, Max HE-MCS for 2 SS subfield in Rx HE-MCS Map ≤ 80 MHz field	Default	2

Test procedure and expected results

Table 222 provides the specific test procedure and expected results for this test case.

Table 222. STAUT transmits MCS 10-11 test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 221.	Configure AP1 per Table 4 and Table 221.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 11.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64..		
5		Configure AP1 to use 1 spatial stream.		
6	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL. SN: Verify the PPDUs transmitted by the STAUT carried in the ping request have the following format: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. MCS field in HE-SIG-A1 (B3-B6) = 11 3. Bandwidth field in HE-SIG-A1 (B19-B20) = 0 (20 MHz) 4. Coding field in HE-SIG-A2 (B7) = 0 (BCC) 5. NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 0 (1 spatial stream) If all of the above conditions are true, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.			
If the STAUT supports 2 spatial streams, go to Step 8 else go to Step 11.				
8		Reconfigure AP1 to use 2 spatial streams.		
9		Repeat Steps 3, 4, and 6.		The verification in Steps 3, and 6 is the same except: • NSTs and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 1 (2 spatial streams) in Step 6 If the verification in Steps 3, and 6 is successful, then CONTINUE else FAIL.
10	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 11 else PASS.				

Step	STAUT	Test bed AP1	Test bed validation	Expected result
11	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
12	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
13	The STAUT sends an ADDBA Request frame to AP1	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64..		
14		Configure AP1 to use 1 spatial stream.		
15	RUN: PING <AP1_IP_ADDR> SIZE=1000 COUNT=90			If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL. SN: Verify the PPDUs transmitted by the STAUT carried in the ping request have the following format: 1. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) 2. MCS field in HE-SIG-A1 (B3-B6) = 11 3. If DUT is 20 MHz-Only STAUT, then, Bandwidth field in HE-SIG-A1 (B19-B20) = 0 (20 MHz) else Bandwidth field in HE-SIG-A1 (B19-B20) = 2 (80 MHz) 4. Coding field in HE-SIG-A2 (B7) = 1 (LDPC) 5. NSTS and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 0 (1 spatial stream) If all of the above conditions are true, then CONTINUE else FAIL.
16	Disassociate the STAUT from AP1.			
If the STAUT supports 2 spatial streams, go to Step 17 else PASS.				
17		Reconfigure AP1 to use 2 spatial streams.		
18	Repeat Steps 12,13,15.			The verification in Steps 12, and 15 is the same except: • NSTs and Midamble Periodicity field in HE-SIG-A1 (B23-25) = 1 (2 spatial streams) in Step 15 If the verification in Steps 12, and 15 is successful, then PASS else FAIL.

5.39 STAUT SU transmit beamforming where AP is the beamformer tests

5.39.1 STAUT SU transmit beamforming where AP is the beamformer, Sounding dimension ≤ 4 test

Objective

This test case verifies that the STAUT correctly receives HE NDPA/NDP and transmits non-trigger-based SU full BW sounding feedback.

Applicability: Mandatory

References

Section 6.3.2.7 [1]

Section 26.7.1 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 223 defines the specific parameter values required for this test case.

Table 223. STAUT SU transmit beamforming where AP is the beamformer, Sounding dimension ≤ 4 test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Qualcomm
Bandwidth	Default	20MHz in 2.4 GHz 80 MHz in 5 GHz
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
SU transmit beamformer	N/A	Enabled
Number of sounding dimensions ≤ 80 MHz in HE PHY Capabilities	N/A	3

Test procedure and expected results

Table 224 provides the specific test procedure and expected results for this test case.

Table 224. STAUT SU transmit beamforming where AP is the beamformer, Sounding dimension ≤ 4 test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 223.	Configure AP1 per Table 4 and Table 223.		
If the STAUT supports 2.4 GHz, then go to Step 2 else go to Step 10.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: Verify the following conditions are true: 1. Association between the STAUT and AP1 is successful. 2. HE PHY Capabilities Information field in the Association Request frame includes: a. SU Beamformee subfield (B32) = 1 b. Beamformee STS ≤ 80 MHz subfield (B34:B36) ≥ 3 If all of the above conditions are true, then CONTINUE else FAIL.
4		Configure the HE-LTF and GI combination setting for HE NDP to 2x LTF and 1.6 µs GI. Configure AP1 to disable trigger-based sounding for SU feedback. RUN: PING <STAUT_IP_ADDR> COUNT=90	Verify the following: 1. AP1 initiates sounding protocol against the STAUT. 2. TxBF subfield (B10) of HE-SIG-A2 in at least one HE SU PPDU transmitted by the STAUT = 1 afterSTAUT transmits an HE Compressed Beamforming And CQI frame. 3. At least one Ping request in a PPDU with TxBF=1 is successful after STAUT transmits the HE Compressed Beamforming And CQI frame.	If the ping is successful within 90 seconds, then CONTINUE else FAIL. SN: Verify the following conditions are true: 1. STAUT transmits a HE Compressed Beamforming and CQI frame as the frame that follows the HE NDP transmitted by AP1. 2. HE MIMO Control field in the HE Compressed Beamforming And CQI frame transmitted by the STAUT contains: a. Nc Index (B0:B2) ≤ Nr Index (B3:B5) b. Nr Index (B3:B5) = value of NSTS and Midamble Periodicity subfield in HE-SIG-A in the HE NDP c. BW (B6:B7) = 0 (20 MHz) d. Feedback Type (B10:B11) = 0 (SU) e. Remaining Feedback Segments (B12:B14) = 0 f. First Feedback Segment (B15) = 1 g. RU Start Index (B16:B22) = 0 h. RU End Index (B23:B29) = 8 (Full BW at 20 MHz) i. Sounding Dialog Token Number (B30:B35) = value of Sounding Dialog Token Number subfield in the corresponding HE NDP Announcement frame j. Reserved (B36:B39) = 0 3. Feedback includes only the HE Compressed Beamforming Report field and its size (excluding MAC header, excluding FCS and including Category, HE Action, and HE MIMO Control) is according to Table 229 using the following MIMO control parameters: a. Nc (Nc Index – B0:B2) b. Nr (Nr Index – B3:B5) c. Grouping (Ng – B8) d. Codebook Information (B9)

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				If all of the above conditions are true, then CONTINUE else FAIL.
5	Disassociate the STAUT from AP1.			
6	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: Verify the following conditions are true: 1. Association between the STAUT and AP1 is successful. 2. HE PHY Capabilities Information field in the Association Request frame includes: a. SU Beamformee subfield (B32) = 1 b. Beamformee STS ≤ 80 MHz subfield (B34:B36) ≥ 3 If all of the above conditions are true, then CONTINUE else FAIL.
7		Configure the HE-LTF and GI combination setting for HE NDP to 2x LTF and 0.8 µs GI.		
8		RUN: PING <STAUT_IP_ADDR> COUNT=90	Verify the following: 1. AP1 initiates sounding protocol against the STAUT. 2. TxBF subfield (B10) of HE-SIG-A2 in at least one HE SU PPDU transmitted by the STAUT = 1 after it transmits an HE Compressed Beamforming And CQI frame. 3. At least one Ping request in a PPDU with TxBF=1 is successful after STAUT transmits the HE Compressed Beamforming And CQI frame.	If the ping is successful within 90 seconds, then CONTINUE else FAIL. SN: Verify the following conditions are true: 1. STAUT transmits a HE Compressed Beamforming and CQI frame as the frame that follows the HE NDP transmitted by AP1. 2. HE MIMO Control field in the HE Compressed Beamforming And CQI frame transmitted by the STAUT contains: a. Nc Index (B0:B2) ≤ Nr Index (B3:B5) b. Nr Index (B3:B5) = value of NSTS and Midamble Periodicity subfield in HE-SIG-A in the HE NDP c. BW (B6:B7) = 0 (20 MHz) d. Feedback Type (B10:B11) = 0 (SU) e. Remaining Feedback Segments (B12:B14) = 0 f. First Feedback Segment (B15) = 1 g. RU Start Index (B16:B22) = 0 h. RU End Index (B23:B29) = 8 (Full BW at 20 MHz) i. Sounding Dialog Token Number (B30:B35) = value of Sounding Dialog Token Number subfield in the corresponding HE NDP Announcement frame j. Reserved (B36:B39) = 0 3. Feedback includes only the HE Compressed Beamforming Report field and its size (excluding MAC header, excluding FCS and including Category, HE Action, and HE MIMO Control) is according toTable 229, using the following MIMO control parameters: a. Nc (Nc Index – B0:B2) b. Nr (Nr Index – B3:B5) c. Grouping (Ng – B8) d. Codebook Information (B9) If all of the above conditions are true, then CONTINUE else FAIL.
9	Disassociate the STAUT from AP1.			

Step	STAUT	Test bed AP1	Test bed validation	Expected result
If the STAUT supports 5 GHz, then go to Step 10 else PASS.				
10	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT. Configure the channel bandwidth to 80 MHz.		
11	Repeat Steps 3-9.	Repeat Steps 3-9.		The verification is the same as Steps 3-9, except in Step 4 and Step 8: 1. In the HE MIMO Control field in the HE Compressed Beamforming And CQI frame transmitted by the STAUT: a. If the DUT is 20 MHz-Only STAUT, then RU End Index (B23:B29) = 8 (Full BW at 20 MHz) else RU End Index (B23:B29) = 36 (Full BW at 80 MHz) b. If the DUT is 20 MHz-only STAUT, then BW (B6:B7) = 0 (20 MHz) else BW (B6:B7) = 2 (80 MHz) 2. The beamforming feedback size is according toTable 229. If the verification in Steps 3-9 is successful, then PASS else FAIL.

5.39.2 STAUT SU transmit beamforming where AP is the beamformer, Sounding dimension 8

Objective

This test case verifies that the STAUT correctly receives HE NDPA/NDP and transmits non-trigger-based SU full BW sounding feedback.

Applicability: If the STAUT declared primary device category as STA in Table 2, then it is Optional. This test shall be executed only if the STAUT declared 5 GHz support and HE NDP sounding support as a Beamformee with NSTS up to 8 in Table 2.

If the STAUT declared primary device category as 20 MHz-only STA in Table 2 ,then it is not applicable.

References

Section 6.3.2.7 [1]

Section 26.7.1 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 225 defines the specific parameter values required for this test case.

Table 225. STAUT SU transmit beamforming where AP is the beamformer, Sounding dimension 8 configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Marvell
AP control channel	N/A	36 in 5 GHz
Bandwidth	Default	80 MHz in 5 GHz
SU transmit beamformer	N/A	Enabled
Number of sounding dimensions ≤ 80 MHz in HE PHY Capabilities	N/A	7

Test procedure and expected results

Table 226 provides the specific test procedure and expected results for this test case.

Table 226. STAUT SU transmit beamforming where AP is the beamformer, Sounding dimension 8 procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure STAUT t per Table 14 and Table 225.	Configure AP1 per Table 4 and Table 225.		
2	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		..
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: Verify the following conditions are true: 1. Association between the STAUT and AP1 is successful. 2. HE PHY Capabilities Information field in the Association Request frame includes: a. SU Beamformee subfield (B32) = 1 b. Beamformee STS ≤ 80 MHz subfield (B34:B36) =7 If all of the above conditions are true, then CONTINUE else FAIL
4		Configure the HE-LTF and GI combination setting for HE NDP to 2x LTF and 1.6 µs GI. Configure AP1 to disable trigger-based sounding for SU feedback. RUN: PING <STAUT_IP_ADDR> COUNT=90	Verify the following: 1. AP1 initiates sounding protocol against the STAUT. 2. TxBF subfield (B10) of HE-SIG-A2 in at least one HE SU PPDU transmitted by the STAUT = 1 after it transmits an HE Compressed Beamforming And CQI frame. 3. Ping request in a PPDU with TxBF=1 is successful after STAUT transmits the HE Compressed Beamforming And CQI frame.	If the ping is successful within 90 seconds, then CONTINUE else FAIL. SN: Verify the following conditions are true: 1. STAUT transmits a HE Compressed Beamforming and CQI frame as the frame that follows the HE NDP transmitted by AP1. 2. HE MIMO Control field in the HE Compressed Beamforming And CQI frame transmitted by the STAUT contains: a. Nc Index (B0:B2) ≤ Nr Index (B3:B5) b. Nr Index (B3:B5) = value of NSTS and Midamble Periodicity subfield in HE-SIG-A in the HE NDP c. If the DUT is 20 MHz-only STAUT, then BW (B6:B7) = 0 (20 MHz) else BW (B6:B7) = 2 (80 MHz) d. Feedback Type (B10:B11) = 0 (SU) e. Remaining Feedback Segments (B12:B14) = 0 f. First Feedback Segment (B15) = 1 g. RU Start Index (B16:B22) = 0 h. If the DUT is 20 MHz-Only STAUT, then RU End Index (B23:B29) = 8 (Full BW at 20 MHz) else RU End Index (B23:B29) = 36 (Full BW at 80 MHz) i. Sounding Dialog Token Number (B30:B35) = value of Sounding Dialog Token Number subfield in the corresponding HE NDP Announcement frame j. Reserved (B36:B39) = 0 3. Feedback includes only the HE Compressed Beamforming Report field and its size (excluding MAC header, excluding FCS and including Category, HE Action, and HE MIMO Control) is according to Table 230 using the following MIMO control parameters: a. Nc (Nc Index – B0:B2) b. Nr (Nr Index – B3:B5)

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				c. Grouping (Ng – B8) d. Codebook Information (B9) If all of the above conditions are true, then CONTINUE else FAIL.
5	Disassociate the STAUT from AP1.			
6	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: Verify the following conditions are true: 1. Association between the STAUT and AP1 is successful. 2. HE PHY Capabilities Information field in the Association Request frame includes: a. SU Beamformee subfield (B32) = 1 b. Beamformee STS ≤ 80 MHz subfield (B34:B36) =7 If all of the above conditions are true, then CONTINUE else FAIL
7		Configure the HE-LTF and GI combination setting for HE NDP to 2x LTF and 0.8 µs GI.		
8		Configure AP1 to disable trigger-based sounding for SU feedback. RUN: PING <STAUT_IP_ADDR> COUNT=90	Verify the following: 1. AP1 initiates sounding protocol against the STAUT. 2. TxBF subfield (B10) of HE-SIG-A2 in at least one HE SU PPDU transmitted by the STAUT = 1 after it transmits an HE Compressed Beamforming And CQI frame. 3. Ping request in a PPDU with TxBF=1 is successful after STAUT transmits the HE Compressed Beamforming And CQI frame.	If the ping is successful within 90 seconds, then CONTINUE else FAIL. SN: Verify the following conditions are true: 1. STAUT transmits a HE Compressed Beamforming and CQI frame as the frame that follows the HE NDP transmitted by AP1. 2. HE MIMO Control field in the HE Compressed Beamforming And CQI frame transmitted by the STAUT contains: a. Nc Index (B0:B2) ≤ Nr Index (B3:B5) b. Nr Index (B3:B5) = value of NSTS and Midamble Periodicity subfield in HE-SIG-A in the HE NDP c. If the DUT is 20 MHz-only STAUT, then BW (B6:B7) = 0 (20 MHz) else BW (B6:B7) = 2 (80 MHz) d. Feedback Type (B10:B11) = 0 (SU) e. Remaining Feedback Segments (B12:B14) = 0 f. First Feedback Segment (B15) = 1 g. RU Start Index (B16:B22) = 0 h. If the DUT is 20 MHz-Only STAUT, then RU End Index (B23:B29) = 8 (Full BW at 20 MHz) else RU End Index (B23:B29) = 36 (Full BW at 80 MHz) i. Sounding Dialog Token Number (B30:B35) = value of Sounding Dialog Token Number subfield in the corresponding HE NDP Announcement frame j. Reserved (B36:B39) = 0 3. Feedback includes only the HE Compressed Beamforming Report field and its size (excluding MAC header, excluding FCS and including Category, HE Action, and HE MIMO Control) is according to Table 230, using the following MIMO control parameters: a. Nc (Nc Index – B0:B2)

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				b. Nr (Nr Index – B3:B5) c. Grouping (Ng – B8) d. Codebook Information (B9) If all of the above conditions are true, then PASS else FAIL.
9	Disassociate the STAUT from AP1.			

5.39.3 STAUT SU transmit beamforming where AP is the beamformer, 160 MHz test

Objective

This test case verifies that the STAUT correctly receives HE NDPA/NDP and transmits non-trigger-based SU full BW sounding feedback.

Applicability: Optional. This test shall be executed only if the STAUT declared support for 160 MHz bandwidth in Table 2.

References

Section 6.3.2.7 [1]

Section 26.7.1 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 227 defines the specific parameter values required for this test case.

Table 227. STAUT SU transmit beamforming where AP is the beamformer, 160 MHz test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Broadcom
AP control channel	N/A	36 in 5 GHz
Bandwidth	Default	160 MHz
SU transmit beamformer	N/A	Enabled
Number of sounding dimensions > 80 MHz in HE PHY Capabilities	N/A	≤ 3

Test procedure and expected results

Table 228 provides the specific test procedure and expected results for this test case.

Table 228. STAUT SU transmit beamforming where AP is the beamformer, 160 MHz test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 227.	Configure AP1 per Table 4 and Table 227.		
2	Configure the STAUT to join AP1's BSS in the 5 GHz band.			
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: Verify the following conditions are true: 1. Association between the STAUT and AP1 is successful. 2. HE PHY Capabilities Information field in the Association Request frame includes: a. SU Beamformee subfield (B32) = 1 b. Beamformee STS > 80 MHz subfield (B34:B36) ≥3 If all of the above conditions are true, then CONTINUE else FAIL.
4		Configure the HE-LTF and GI combination setting for HE NDP to 2x LTF and 1.6 µs GI. Configure AP1 to disable trigger-based sounding for SU feedback. RUN: PING <STAUT_IP_ADDR> COUNT=90	Verify the following: 1. AP1 initiates sounding protocol against the STAUT. 2. TxBF subfield (B10) of HE-SIG-A2 in at least one HE SU PPDU transmitted by the AP = 1 after STAUTtransmits an HE Compressed Beamforming And CQI frame. 3. Ping request in a PPDU with TxBF=1 is successful after STAUT transmits the HE Compressed Beamforming And CQI frame.	If the ping is successful within 90 seconds, then CONTINUE else FAIL. SN: Verify the following conditions are true: 1. STAUT transmits a HE Compressed Beamforming and CQI frame as the frame that follows the HE NDP transmitted by AP1. 2. HE MIMO Control field in the HE Compressed Beamforming And CQI frame transmitted by the STAUT contains: a. Nc Index (B0:B2) ≤ Nr Index (B3:B5) b. Nr Index (B3:B5) = value of NSTS and Midamble Periodicity subfield in HE-SIG-A in the HE NDP c. BW (B6:B7) = 3 (160 MHz) d. Feedback Type (B10:B11) = 0 (SU) e. Remaining Feedback Segments (B12:B14) = 0 f. First Feedback Segment (B15) = 1 g. RU Start Index (B16:B22) = 0 h. RU End Index (B23:B29) = 73 (Full BW at 160 MHz) i. Sounding Dialog Token Number (B30:B35) = value of Sounding Dialog Token Number subfield in the corresponding HE NDP Announcement frame j. Reserved (B36:B39) = 0 3. Feedback includes only the HE Compressed Beamforming Report field and its size (excluding MAC header, excluding FCS and including Category, HE Action, and HE MIMO Control) is according to Table 231, using the following MIMO control parameters: a. Nc (Nc Index – B0:B2) b. Nr (Nr Index – B3:B5) c. Grouping (Ng – B8) d. Codebook Information (B9) If all of the above conditions are true, then CONTINUE else FAIL.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
5	Disassociate the STAUT from AP1.			
6		Configure the HE-LTF and GI combination setting for HE NDP to 2x LTF and 0.8 µs GI.		
7	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: Verify the following conditions are true: 1. Association between the STAUT and AP1 is successful. 2. HE PHY Capabilities Information field in the Association Request frame includes: a. SU Beamformee subfield (B32) = 1 b. Beamformee STS > 80 MHz subfield (B34:B36) ≥3 If all of the above conditions are true, then CONTINUE else FAIL
8		Configure the HE-LTF and GI combination setting for HE NDP to 2x LTF and 1.6 µs GI. Configure AP1 to disable trigger-based sounding for SU feedback. RUN: PING <STAUT_IP_ADDR> COUNT=90	Verify the following: 1. AP1 initiates sounding protocol against the STAUT. 2. TxBF subfield (B10) of HE-SIG-A2 in at least one HE SU PPDU transmitted by the STAUT = 1 after it transmits an HE Compressed Beamforming And CQI frame. 3. Ping request in a PPDU with TxBF=1 is successful after STAUT transmits the HE Compressed Beamforming And CQI frame.	If the ping is successful within 90 seconds, then CONTINUE else FAIL. SN: Verify the following conditions are true: 1. STAUT transmits a HE Compressed Beamforming and CQI frame as the frame that follows the HE NDP transmitted by AP1. 2. HE MIMO Control field in the HE Compressed Beamforming And CQI frame transmitted by the STAUT: a. Nc Index (B0:B2) ≤ Nr Index (B3:B5) b. Nr Index (B3:B5) = value of NSTS and Midamble Periodicity subfield in HE-SIG-A in the HE NDP c. BW (B6:B7) = 3 (160 MHz) d. Feedback Type (B10:B11) = 0 (SU) e. Remaining Feedback Segments (B12:B14) = 0 f. First Feedback Segment (B15) = 1 g. RU Start Index (B16:B22) = 0 h. RU End Index (B23:B29) = 73 (Full BW at 160 MHz) i. Sounding Dialog Token Number (B30:B35) = value of Sounding Dialog Token Number subfield in the corresponding HE NDP Announcement frame j. Reserved (B36:B39) = 0 3. Feedback includes only the HE Compressed Beamforming Report field and its size (excluding MAC header, excluding FCS and including Category, HE Action, and HE MIMO Control) is according to Table 231 using the following MIMO control parameters: a. Nc (Nc Index – B0:B2) b. Nr (Nr Index – B3:B5) c. Grouping (Ng – B8) d. Codebook Information (B9) If all of the above conditions are true, then PASS else FAIL.
9	Disassociate the STAUT from AP1.			

Table 229. HE Compressed Beamforming and CQI frame size in octets for 20MHz (excluding MAC header & FCS, including Category & Action & MIMO Control)

Nr x Nc	Feedback = SU, BW = 20MHz [octets]			
	Grouping = 0 (Ng=4) Codebook Information = 0 {4,2}	Grouping = 0 (Ng=4) Codebook Information = 1 {6,4}	Grouping = 1 (Ng=16) Codebook Information = 0 {4,2}	Grouping = 1 (Ng=16) Codebook Information = 1 {6,4}
2 x 1	56	88	23	33
2 x 2	57	89	24	34
3 x 1	104	168	38	58
3 x 2	153	249	54	84
3 x 3	154	250	55	85
4 x 1	152	248	53	83
4 x 2	249	409	84	134
4 x 3	298	490	100	160
4 x 4	299	491	101	161
8 x 1	344	568	113	183
8 x 2	633	1049	204	334
8 x 3	874	1450	280	460
8 x 4	1067	1771	341	561
8 x 5	1212	2012	387	637
8 x 6	1309	2173	418	688
8 x 7	1358	2254	434	714
8 x 8	1359	2255	435	715

Table 230. HE Compressed Beamforming and CQI frame size in octets for 80 MHz (excluding MAC header & FCS, including Category & Action & MIMO Control)

Nr x Nc	Feedback = SU, BW = 80 MHz [octets]			
	Grouping = 0 (Ng=4) Codebook Information = 0 {4,2}	Grouping = 0 (Ng=4) Codebook Information = 1 {6,4}	Grouping = 1 (Ng=16) Codebook Information = 0 {4,2}	Grouping = 1 (Ng=16) Codebook Information = 1 {6,4}
2 x 1	196	321	56	88
2 x 2	197	322	57	89

Nr x Nc	Feedback = SU, BW = 80 MHz [octets]			
	Grouping = 0 (Ng=4) Codebook Information = 0 {4,2}	Grouping = 0 (Ng=4) Codebook Information = 1 {6,4}	Grouping = 1 (Ng=16) Codebook Information = 0 {4,2}	Grouping = 1 (Ng=16) Codebook Information = 1 {6,4}
3 x 1	383	633	104	168
3 x 2	572	947	153	249
3 x 3	573	948	154	250
4 x 1	571	946	152	248
4 x 2	947	1572	249	409
4 x 3	1135	1885	298	490
4 x 4	1136	1886	299	491
8 x 1	1321	2196	344	568
8 x 2	2447	4072	633	1049
8 x 3	3385	5635	874	1450
8 x 4	4136	6886	1067	1771
8 x 5	4700	7825	1212	2012
8 x 6	5076	8451	1309	2173
8 x 7	5264	8764	1358	2254
8 x 8	5265	8765	1359	2255

Table 231. HE Compressed Beamforming and CQI frame size in octets for 160MHz (excluding MAC header & FCS, including Category & Action & MIMO Control)

Nr x Nc	Feedback = SU, BW = 160MHz [octets]			
	Grouping = 0 (Ng=4) Codebook Information = 0 {4,2}	Grouping = 0 (Ng=4) Codebook Information = 1 {6,4}	Grouping = 1 (Ng=16) Codebook Information = 0 {4,2}	Grouping = 1 (Ng=16) Codebook Information = 1 {6,4}
2 x 1	383	633	104	168
2 x 2	384	634	105	169
3 x 1	758	1258	200	328
3 x 2	1134	1884	297	489
3 x 3	1135	1885	298	490

Nr x Nc	Feedback = SU, BW = 160MHz [octets]			
	Grouping = 0 (Ng=4) **Codebook Information = 0 {4,2}**	**Grouping = 0 (Ng=4)** **Codebook Information = 1 {6,4}**	**Grouping = 1 (Ng=16)** **Codebook Information = 0 {4,2}**	**Grouping = 1 (Ng=16)** **Codebook Information = 1 {6,4}**
4 x 1	1133	1883	296	488
4 x 2	1884	3134	489	809
4 x 3	2260	3760	586	970
4 x 4	2261	3761	587	971

5.40 STAUT receives MCS 8-9 in MU PPDU tests

5.40.1 STAUT receives MCS 8-9 in MU PPDU test

Objective

This test case verifies that the STAUT correctly receives MCS 8-9 in MU PPDUs.

Applicability: Optional. This test shall be executed only if the STAUT declared support for MCS 8-9 in Table 2.

References

Section 6.4.2.5 [1]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 232 defines the specific parameter values required for this test case.

Table 232. STAUT receives MCS 8-9 in MU PPDU test configuration

Parameter	STAUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed AP1 value
Test bed vendor	N/A	Broadcom75	Cypress	Qualcomm	If DUT is 20 MHz-only STA, Use Qualcomm for 2.4 GHz and Marvell for 5 GHz Else Broadcom
AP control channel	N/A	N/A	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	N/A	N/A	N/A	N/A	HE_MU (DL OFDMA)
Number of users in each OFDMA transmission	N/A	N/A	N/A	N/A	4
HE-MCS	Default	HE-MCS 9	HE-MCS 9	HE-MCS 9	HE-MCS 9

Parameter	STAUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed AP1 value
LDPC Coding in payload in 2.4 GHz	Default	Default	Default	Default	Disabled

Test procedure and expected results

Table 233 provides the specific test procedure and expected results for this test case.

Table 233. STAUT receives MCS 8-9 in MU PPDU test procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 232.	Configure STA1, STA2, STA3 to per Table 6 and Table 232.	Configure AP1 per Table 4 and Table 232. Configure AP1 to use 1 SS for the STAUT and STA1, STA2, STA3.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 17.					
2			Configure AP1 to the 2.4 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, STA3.		
3	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	Configure STA1, STA2, STA3 to join AP1's BSS in the 2.4 GHz band.			
4	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Requests frame to AP1.	AP1 sends an Association Response to the STAUT and STA1, STA2, STA3.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
5	The STAUT sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA1, STA2, STA3 send an ADDBA Responses frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64.		
6			Configure AP1 to use RU allocation [26 26 26 26] tones. AP1 allocates the STAUT RU in different locations.		
7			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, STA3.		If the throughput at the STAUT is > 5401S7_1SS_RU26_TP_24G, then CONTINUE else FAIL.
8	Disassociate the STAUT and STA1, STA2, STA3 from AP1.				

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
	Configure AP1 to 20 MHz BSS. Configure STAUT, STA1, STA2, STA3 to join AP1's BSS. STAUT, STA1, STA2, STA3 associate with AP1, and AP1 sets up BA session.				
9			Configure AP1 to use RU allocation [52 52 52 52] tones. AP1 allocates the STAUT RU in different locations.		
10			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, STA3.		If the throughput at the STAUT > 5401S10_1SS_RU52_TP_24G, then CONTINUE else FAIL.
11	Disassociate the STAUT and STA1, STA2, STA3 from AP1. Configure AP1 to 20 MHz BSS. Configure STAUT, STA1 to join AP1's BSS.				
12			Configure AP1 to use RU allocation [106 106] tones. AP1 allocates the STAUT RU in different locations.		
13			Run script HE1-DLOFDMA-STAUT.txt to the STAUT and STA1.		If the throughput at the STAUT > 5401S13_1SS_RU106_TP_24G, then CONTINUE else FAIL.
14	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			
If the STAUT supports 2 SS, go to Step 15. Else if the STAUT supports 5 GHz, go to Step 17 else PASS.					
15		Configure STA1, STA2, STA3 for 2SS.	Reconfigure AP1 to use 2 SS for the STAUT and STA1, STA2, STA3. Configure AP1 for 2.4 GHz operation.		
16	Repeat Steps 4-14.	Repeat Steps 4-14.	Repeat Steps 4-14.		The verification in Steps 4-14 is the same except: • Throughput at the STAUT > 5401S16_2SS_RU26_TP_24G in Step 7 • Throughput at the STAUT > 5401S16_2SS_RU52_TP_24G in Step 10

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
					• Throughput at the STAUT > 5401S16_2SS_RU106_TP_24G in Step 13 If the verification in Steps 4-14 is successful, then CONTINUE else FAIL.
If the STAUT supports 5 GHz, go to Step 17 else PASS.					
17			Configure AP1 to use 1 SS for the STAUT and STA1, STA2, STA3.		
19			Configure AP1 to transmit 20 MHz BSS in the 5 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, STA3.		
19	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure STA1, STA2, STA3 to join AP1's BSS in the 5 GHz band.			
20	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
21	The STAUT sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA1, STA2, STA3 send an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64.		
22			Configure AP1 to use RU allocation [26 26 26 26] tones. AP1 allocates the STAUT RU in different locations.		
23			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, STA3.		If the throughput at the STAUT > 5401S23_1SS_RU26_TP_5G, then CONTINUE else FAIL.
24	Disassociate the STAUT and STA1, STA2, STA3 from AP1. Configure AP1 to 40 MHz BSS. Configure STAUT, STA1, STA2, STA3 to join AP1's BSS. STAUT, STA1, STA2, STA3 associate with AP1, and AP1 sets up BA session.				
25			Configure AP1 to use RU allocation [52 52 52 52] tones. AP1 allocates the STAUT RU in different locations.		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
26			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, STA3.		If the throughput at the STAUT > 5401S26_1SS_RU52_TP_5G, then CONTINUE else FAIL.
27	Disassociate the STAUT and STA1, STA2, STA3 from AP1. Configure AP1 to 80 MHz BSS. Configure the STAUT, STA1, STA2, STA3 to join AP1's BSS. STAUT, STA1, STA2, STA3 associate with AP1, and AP1 sets up BA Session.				
28			Configure AP1 to use RU allocation [106 106 106 106] tones. AP1 allocates the STAUT RU in different locations.		
29			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, STA3.		If the throughput at the STAUT > 5401S29_1SS_RU106_TP_5G, then CONTINUE else FAIL. If the DUT is 20 MHz-only STAUT, then go to step 34 else CONTINUE
30			Configure AP1 to use RU allocation [242 242 242 242] tones. AP1 allocates the STAUT RU in different locations.		
31			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, STA3.		If the throughput at the STAUT > 5401S31_1SS_RU242_TP_5G, then CONTINUE else FAIL.
32			Disassociate STA3 and STA2 before allocating RUs to the STAUT and STA1. Configure AP1 to use RU allocation [484 484] tones. AP1 allocates the STAUT RU in different locations.		
33			Run script HE1-DLOFDMA-STAUT.txt to the STAUT and STA1.		If the throughput at the STAUT > 5401S33_1SS_RU484_TP_5G, then CONTINUE else FAIL.
34	Disassociate the STAUT from AP1.	Disassociate STA1, (STA2, STA3 if the DUT is 20 MHz-only STAUT) from AP1.			
If the STAUT supports 2 SS, go to Step 35 else PASS.					

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
35		Configure STA1, STA2, STA3 for 2SS.	Reconfigure AP1 to use 2 SS for the STAUT and STA1, STA2, STA3.		
36	Repeat Steps 17-34.	Repeat Steps 17-34.	Repeat Steps 17-34.		If the DUT is 20 MHz-only STAUT, the verification in Steps 17-29 is the same else The verification in Steps 17-34 is the same except: • Throughput at the STAUT > 5401S23_2SS_RU26_TP_5G in Step 23 • Throughput at the STAUT > 5401S26_2SS_RU52_TP_5G in Step 26 • Throughput at the STAUT > 5401S29_2SS_RU106_TP_5G in Step 29 • Throughput at the STAUT > 5401S31_2SS_RU242_TP_5G in Step 31 (NA for 20 MHz-Only STAUT) • Throughput at the STAUT > 5401S33_2SS_RU484_TP_5G in Step 33 (NA for 20 MHz-Only STAUT) If the verification in Steps 17-34 is successful, then PASS else FAIL.

5.41 STAUT receives MCS 10-11 in MU PPDU tests

5.41.1 STAUT receives MCS 10-11 in MU PPDU test

Objective

This test case verifies that the STAUT correctly receives MCS 10-11 in MU PPDUs in the 5 GHz band.

Applicability: Optional. This test shall be executed only if the STAUT declared support for MCS 10-11 in Table 2.

References

Section 6.4.2.8 [1]

Test environment

- STAUT
- Test bed AP: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 234 defines the specific parameter values required for this test case.

Table 234. STAUT receives MCS 10-11 in MU PPDU test configuration

Parameter	STAUT value	Test bed STA1 value	Test bed STA2 value	Test bed STA3 value	Test bed AP1 value
Test bed vendor	N/A	Cypress	Broadcom75	Intel200W	Marvell
AP control channel	N/A	N/A	N/A	N/A	36 in 5 GHz
Bandwidth	Default	80 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz	80 MHz in 5 GHz
PPDU format	N/A	N/A	N/A	N/A	HE_MU (DL OFDMA)
Number of users in each OFDMA transmission	N/A	N/A	N/A	N/A	4
HE-MCS	Default	HE-MCS 11	HE-MCS 11	HE-MCS 11	HE-MCS 11

Test procedure and expected results

Table 235 provides the specific test procedure and expected results for this test case.

Table 235. STAUT receives MCS 10-11 in MU PPDU test procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 234.	Configure STA1, STA2, STA3 per Table 6 and Table 234.	Configure AP1 per Table 4 and Table 234. Configure AP1 to use 1 SS for the STAUT and STA1, STA2, STA3.		
2			Configure AP1 to the 5 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, STA3.		
3	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure STA1, STA2, STA3 to join AP1's BSS in the 5 GHz band.			
4	The STAUT sends an Association Request frame to AP1.	STA1-3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
5	The STAUT sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA1-3 send an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT and STA1, STA2, STA3.		
6			If the DUT is 20 MHz-only STAUT, then Configure AP1 to transmit using DL OFDMA and RU allocation [106 106 106 106] tones else Configure AP1 to transmit using DL OFDMA and RU allocation [242 242 242 242] tones. AP1 allocates the STAUT RUs in different locations.		
7			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, STA3.		If the throughput at the STAUT > 5411S7_1SS_TP_5G, then CONTINUE else FAIL. If DUT is 20 MHz-only STAUT and supports only 1SS, then PASS else CONTINUE
8			If DUT is 20 MHz-Only STAUT and supports 2 SS, go to step 10 else Disassociate STA2 and STA3 before allocating RUs to the STAUT and STA1. Configure AP1 to transmit using DL OFDMA and RU allocation [484 484] tones.		

			AP1 allocates the STAUT RUs in different locations.		
9			Run script HE1-DLOFDMA-STAUT.txt to the STAUT and STA1.		If the throughput at the STAUT > 5411S9_1SS_TP_5G, then CONTINUE else FAIL.
10	Disassociate the STAUT from AP1.	Disassociate STA1 from AP1.			
If the STAUT supports 2 SS, go to Step 11 else PASS.					
11			Reconfigure AP1 to use 2 SS for the STAUT and STA1, STA2, STA3.		
12	Repeat Steps 2-9.	Repeat Steps 2-9.	Repeat Steps 2-9.		The verification in Steps 2-9 is the same except: • Throughput at the STAUT > 5411S12_2SS_7_TP_5G in Step 7 • Throughput at the STAUT > 5411S12_2SS_9_TP_5G in Step 9 If the verification in Steps 2-9 is successful, then PASS else FAIL.

5.42 STAUT receives 160 MHz PPDU tests

5.42.1 STAUT receives 160 MHz PPDU test

Objective

This test case verifies that the STAUT correctly receives HE PPDUs using the 160 MHz bandwidth.

Applicability: Optional. This test shall be executed only if the DUT declared support for 160 MHz operation in Table 2. Not applicable if the DUT is 20 MHz-only STAUT.

References

Section 6.4.2.8 [1]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 236 defines the specific parameter values required for this test case.

Table 236. STAUT receives 160 MHz PPDU configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Intel
AP control channel	N/A	36 in 5 GHz
Channel bandwidth	Default	160 MHz in 5 GHz
Preamble format	HE_SU	HE_SU

Test procedure and expected results

Table 237 provides the specific test procedure and expected results for this test case.

Table 237. STAUT receives 160 MHz PPDU procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 236.	Configure AP1 per Table 4 and Table 236. Enable 160 MHz operation:		

Step	STAUT	Test bed AP1	Test bed validation	Expected result
		1. Supported Channel Width subfield in VHT Capabilities field = 1 2. Extended NSS BW support = 0 3. VHT Operation Information fields carried in the VHT Operation element 4. In the HE Operation Element, the subfield VHT Operation Information Present in HE Operation Parameters field = 0 a. Channel Center Frequency Segment 0 subfield = 42 b. Channel Center Frequency Segment 1 = 50		
2	Configure the STAUT to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: Verify the following conditions are true: 1. Association between the STAUT and AP1 is successful. 2. B2 of the Channel Width Set in the HE PHY Capabilities Information field within the HE Capabilities element in Association Request frame transmitted by the STAUT = 1 (support for a 160 MHz width) 3. VHT Capabilities element contains: a. Maximum NSS defined by Rx VHT-MCS Map field and Extended NSS BW Support field in the VHT Capabilities element at 160 MHz is not more than the maximum NSS defined by its Rx HE-MCS Map For 160 MHz field in the HE Capabilities element at 160 MHz b. VHT Extended NSS BW Capable bit in Supported VHT-MCS and NSS Set subfields = 1 If all of the above conditions are true, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT.		
5		Run: PING <STA1_IP_ADDR> SIZE = 1000 COUNT = 90		If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.			
7	Configure STAUT per Table 14 and Table 236.	Configure AP1 per Table 4 and Table 236. Enable 160 MHz operation: 1. Supported Channel Width subfield in the VHT Capabilities field = 0 2. Extended NSS BW support = 1	1	

Step	STAUT	Test bed AP1	Test bed validation	Expected result
		3. Center Frequency Segment 0 subfield = 42 in the VHT Operation element 4. In the HE Operation Element, the subfield VHT Operation Information Present in HE Operation Parameters field = 0 5. Center Frequency Segment2 subfield = 50 in the HT Operation element		
8		Repeat Steps 2 -5.		If the verification in Steps 2-5 is successful, then CONTINUE else FAIL.
9		Run: PING <STA1_IP_ADDR> SIZE = 1000 COUNT = 90		If no more than 10% ping failures, then PASS else FAIL.

5.43 STAUT transmits 160 MHz PPDU tests

5.43.1 STAUT transmits 160 MHz PPDU test

Objective

This test case verifies that the STAUT correctly transmits HE PPDUs using the 160 MHz bandwidth.

Applicability: Optional. This test shall be executed only if the DUT declared support for 160 MHz operation in Table 2.

References

Section 6.4.2.8 [1]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 238 defines the specific parameter values required for this test case.

Table 238. STAUT transmits 160 MHz PPDU configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Qualcomm
AP control channel	N/A	36 in 5 GHz
Channel bandwidth	Default	160 MHz in 5 GHz
Preamble format	HE_SU	HE_SU

Test procedure and expected results

Table 239 provides the specific test procedure and expected results for this test case.

Table 239. STAUT transmits 160 MHz PPDU procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 238.	Configure AP1 per Table 4 and Table 238. Enable 160 MHz by setting: 1. Supported Channel Width Subfield in the VHT Capabilities field = 1		

Step	STAUT	Test bed AP1	Test bed validation	Expected result
		2. Extended NSS BW support = 0 3. VHT Operation Information field: a. Channel Center Frequency Segment 0 subfield = 42 in the VHT Operation element b. Channel Center Frequency Segment 1 = 50 in the VHT Operation element c. In the HE Operation Element, the subfield VHT Operation Information Present in HE Operation Parameters field = 0.		
2	Configure the STAUT to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: Verify the following conditions are true: 1. Association between the STAUT and AP1 is successful. 2. B1 and B2 of the Channel Width Set in the HE PHY Capabilities Information field within the HE Capabilities element in the Association Request frame transmitted by the STAUT = 1 (support for a 160 MHz width). 3. VHT Capabilities element: a. Maximum NSS defined by the Rx VHT-MCS Map field and Extended NSS BW Support field in the VHT Capabilities element at 160 MHz is not more than the maximum NSS defined by its Rx HE-MCS Map For 160 MHz field in the HE Capabilities element at 160 MHz. b. VHT Extended NSS BW Capable bit in Supported VHT-MCS and NSS Set subfields = 1. If all the conditions above are true, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT.		
5	Run: PING <AP1_IP_ADDR> SIZE = 1000 COUNT = 90			If no more than 5 consecutive ping timeouts occur, then CONTINUE else FAIL. If no more than 10% ping failures, then CONTINUE else FAIL. SN: If the PPDUs transmitted by the STAUT contain the HE-SIG-A field with the Bandwidth field (B19-B20) = 3 (160 MHz), then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.			
7	Configure STAUT per Table 14 and Table 238.	Configure AP1 per Table 4 and Table 238. Enable 160 MHz by setting:	1	

Step	STAUT	Test bed AP1	Test bed validation	Expected result
		1. Supported Channel Width Subfield in the VHT Capabilities field = 0 2. Extended NSS BW support = 1 3. Channel Center Frequency Segment 0 subfield = 42 in the VHT Operation element 4. In the HE Operation Element, the subfield VHT Operation Information Present in HE Operation Parameters field = 0 5. Channel Center Frequency Segment2 subfield = 50 in the HT Operation element.		
8		Repeat Steps 2 -5.		If the verification in Steps 2-5 is successful, then PASS else FAIL.

5.44 STAUT UL OFDMA PHY transmit tests

Objective

This test case verifies that the STAUT correctly transmits UL OFDMA PPDUs.

Applicability: If the STAUT declared primary device category as STA in Table 2, then test case 5.44.1 to 9 are Mandatory based on 2.4 GHz and 5 GHz band support

If the STAUT declared primary device category as 20 MHz-only STA in Table 2 , then test case 5.44.1,5.44.2,5.44.3, 5.44.10 and 5.44.11 are Mandatroy based on 2.4 GHz and 5 GHz band support

References

Section 6.3.2.2 [1]

Section 26.5.3 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 240 defines the specific parameter values required for this test case.

Table 240. STAUT UL OFDMA PHY transmit test configuration

Parameter	STAUT value	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1 value
Test bed vendor (5.44.1)	N/A	Broadcom98	Cypress	Intel200W	Marvell
Test bed vendor (5.44.2)	N/A	Intel200L	Broadcom98	Cypress	Marvell
Test bed vendor (5.44.3)	N/A	Intel200W	Marvell	Cypress	Qualcomm
Test bed vendor (5.44.4)	N/A	Broadcom98	Marvell	Qualcomm	Ruckus
Test bed vendor (5.44.5)	N/A	Broadcom75	Broadcom98	Intel200W	Intel
Test bed vendor (5.44.6)	N/A	Broadcom75	Marvell	Qualcomm	Broadcom
Test bed vendor (5.44.7)	N/A	Broadcom98	Intel200L	Qualcomm	Qualcomm
Test bed vendor (5.44.8)	N/A	Intel200W	Broadcom75	Cypress	Marvell

Parameter	**STAUT value**	**Test bed STA1**	**Test bed STA2**	**Test bed STA3**	**Test bed AP1 value**
Test bed vendor (5.44.9)	N/A	Broadcom75	Intel200W	Marvell	Ruckus
Test bed vendor (5.44.10)	N/A	Broadcom98	Marvell	Qualcomm	Ruckus
Test bed vendor (5.44.11)	N/A	Broadcom75	Broadcom98	Intel200W	Broadcom
AP control channel	N/A	N/A	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Coding in payload for transmit	Default	BCC for 2.4 GHz LDPC for 5 GHz	BCC for 2.4 GHz LDPC for 5 GHz	BCC for 2.4 GHz LDPC for 5 GHz	BCC for 2.4 GHz LDPC for 5 GHz
PPDU Format	N/A	N/A	N/A	N/A	Rx HE_TRIG (UL OFDMA)
MU functionality	N/A	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA

5.44.1 STAUT UL OFDMA PHY transmits at 2.4 GHz 1SS, 20 MHz test

Table 241 provides the specific test procedure and expected results for this test case.

Table 241. STAUT UL OFDMA PHY transmits at 2.4 GHz 1SS, 20 MHz test procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure STAUT per Table 14 and Table 240.	Configure STA1, STA2, STA3 per Table 6 and Table 240.	Configure AP1 per Table 4 and Table 240. Configure AP1 MU EDCA parameters as per Table 5. Configure AP1 to use 1SS.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2, STA3 to join AP1's BSS.	Configure AP1 to the 2.4 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64.		
Test: 1 SS, BCC, RU26, MCS 7					
5			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STAUT per Table 4 and Table 240 and the following parameters: 1. Trigger Common Info field: a. BW = 0 (20 MHz) b. GI+LTF = 1 (6.4µs LTF + 1.6µs GI) 2. RU allocation [26 26 26 26] tones. AP1 allocates the STAUT RUs in different locations..		
6	Run script HE1-ULOFDMA-STAUT.txt..	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT ≥ 80%

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
					If all conditions above are true, then CONTINUE else FAIL If the throughput from the STAUT is more than 5441S6_TP_24G, then PASS else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			

5.44.2 STAUT UL OFDMA PHY transmits at 2.4 GHz 2SS, 20 MHz test

Table 242 provides the specific test procedure and expected results for this test case.

Table 242. STAUT UL OFDMA PHY transmits at 2.4 GHz 1SS, 20 MHz test procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 240.	Configure STA1 per Table 6 and Table 240.	Configure AP1 per Table 4 and Table 240. Configure AP1 MU EDCA parameters as per Table 5.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1 to operate as a 2SS STA. Configure STA1 to join AP1's BSS.	Configure AP1 to the 2.4 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	Association Response frame to the STAUT and STA1.		If the STAUT association succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	STA1 sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	ADDBA Response frame to the STAUT and STA1 with Buffer Size ≤ 64.		
Test: 2 SS, BCC, RU106, MCS 7					
5			Configure AP1 to transmit Trigger frames in SU PPDU to solicit HE TB PPDUs from STA1 and STAUT per Table 4 and Table 240 and the following parameters: 1. Trigger Common Info field: a. BW = 0 (20 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 2. SS Allocation /RA-RU Information for STA1 a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 3. If the STAUT supports 1 SS, SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			4. If the STAUT supports > 1 SS, SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 5. RU allocation [106 106] tones. AP1 allocates the STAUT RUs in different locations.		
6	Run script HE1-ULOFDMA-STAUT-STA1.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU. 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL If the throughput from the STAUT is more than 5442S6_1SS_TP_24G for 1 SS, 5442S6_2SS_TP_24G for 2SS, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1 from AP1.			
8	Configure the STAUT to join AP1's BSS.	Configure STA2 and STA3 per Table 6 and Table 240. Configure STA1, STA2, STA3 to 2 SS. Configure STA1, STA2, STA3 to join AP1's BSS.			
9	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
10	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64.		
Test: 2 SS, BCC, RU52, MCS 7					
11			Configure AP1 to transmit Trigger frames in SU PPDU to solicit HE TB PPDUs from STA1, STA2, STA3 and STAUT per Table 4 and Table 240 and the following parameters:		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			1. Trigger Common Info field: a. BW = 0 (20 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 2. SS Allocation /RA-RU Information set to: for STA1, STA2, STA3 a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 3. If the STAUT supports 1 SS, SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 4. If the STAUT supports > 1 SS,SS Allocation /RA-RU Information set to: (for STAUT) a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 5. RU allocation [52 52 52 52] tones. AP1 allocates the STAUT RUs in different locations.		
12	Run script HE1-ULOFDMA-STAUT-STA1.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. Packets from the STAUT are transmitted using HE_TRIG PPDU. 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 5442S12_1SS_TP_24G for 1 SS, 5442S12_2SS_TP_24G for 2SS, then PASS else FAIL.
13	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			

5.44.3 STAUT UL OFDMA PHY transmits at 2.4 GHz Mixed SS, 20 MHz test

Table 241 provides the specific test procedure and expected results for this test case.

Table 243. STAUT UL OFDMA PHY transmits at 2.4 GHz 1SS, 20 MHz test procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 240.	Configure STA1, STA2, STA3 per Table 6 and Table 240.	Configure AP1 per Table 4 and Table 240. Configure AP1 MU EDCA parameters as per Table 5.		
Test: 1/2 SS, BCC, RU52, MCS 7					
2	Configure the STAUT to join AP1's BSS.	Configure STA1 and STA2 to 1 SS and STA3 to 2 SS. Configure STA1, STA2, STA3 to join AP1's BSS.			
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64.		
5			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STAUT per Table 4 and Table 240 and the following parameters: 1. Trigger Common Info field: a. BW = 0 (20 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 1. SS Allocation /RA-RU Information set to: for STA1 and STA2 a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 2. SS Allocation /RA-RU Information set to: for STA3 a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			3. If the STAUT supports 1 SS, SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 4. If the STAUT supports > 1 SS,SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 5. RU allocation [52 52 52 52] tones. AP1 allocates the STAUT RUs in different locations.		
6	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. Packets from the STAUT are transmitted using HE_TRIG PPDU. 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDU packets from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL If the throughput from the STAUT is more than 5443S6_1SS_TP_24G for 1 SS, 5443S6_2SS_TP_24G for 2SS, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			
8	If the STAUT supports LDPC in 2.4 GHz go to Step 9 else PASS.				
9	Configure the STAUT to join AP1's BSS. Configure the STAUT to use LDPC as FEC coding.	Configure STA1 and STA2 to 1 SS and STA3 to 2 SS. Configure STA1, STA2, STA3 to join AP1's BSS. Configure Coding to LDPC.	Configure AP1's Coding to LDPC.		
10	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
11	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64.		
Test: 1/2 SS, LDPC, RU52, MCS 7					
12			Configure AP1 to transmit Trigger frames in SU PPDU to solicit HE TB PPDUs from STA1, STA2, STA3 and STAUT per Table 4 and Table 240 and the following parameters: 4. Trigger Common Info field: a. BW = 0 (20 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 1. SS Allocation /RA-RU Information set to: for STA1 and STA2 a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 2. SS Allocation /RA-RU Information set to: for STA3 a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 3. Coding = 1 (LDPC) (for STA1 , STA2, STA3) 4. If the STAUT supports 1 SS, SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 5. If the STAUT supports > 1 SS,SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 6. RU allocation [52 52 52 52] tones. AP1 allocates the STAUT RUs in different locations.		
13	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT to the STAUT and STA1, STA2, STA3.		Verify the following conditions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
					2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT > =80% If all conditions above are true, then CONTINUE else FAIL If the throughput from the STAUT is more than 5443S12_1SS_TP_24G for 1 SS, 5443S12_2SS_TP_24G for 2SS, then PASS else FAIL.
14	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			

5.44.4 STAUT UL OFDMA PHY transmits at 5 GHz 1SS, 80 MHz test

Table 244 provides the specific test procedure and expected results for this test case.

Table 244. STAUT UL OFDMA PHY transmits at 5 GHz 1SS, 80 MHz procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 240.	Configure STA1, STA2, STA3 per Table 6 and Table 240.	Configure AP1 per Table 4 and Table 240. Configure AP1's MU EDCA parameters as per Table 5. Configure AP1 to use 1SS.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2, STA3 to join AP1's BSS.	Configure AP1 to the 5 GHz band and 80 MHz. AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64 .		
Test: 1 SS, LDPC, RU242, MCS 7					
5			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 with the following: Trigger Common Info field: 1. BW = 2 (80 MHz) 2. GI+LTF = 1 (6.4µs LTF + 1.6µs GI) 3. SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 4. RU allocation [242 242 242 242] tones. AP1 allocates the STAUT RUs in different locations.		
6	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
					followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT > =80% If the throughput from the STAUT is more than 5444S6_1SS_TP_5G If all conditions above are true, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			

5.44.5 STAUT UL OFDMA PHY transmits at 5 GHz 2SS, 80 MHz test

Table 245 provides the specific test procedure and expected results for this test case.

Table 245. STAUT UL OFDMA PHY transmits at 5 GHz 1SS, 80 MHz procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 240.	Configure STA1, STA2, STA3 per Table 6 and Table 240.	Configure AP1 per Table 4 and Table 240. Configure AP1's MU EDCA parameters as per Table 5. Configure AP1 to use 2SS.		
2	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
3	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64 .		
Test: 2 SS, BCC, RU106, MCS 7					
4			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STAUT per Table 4 and Table 240 and the following parameters: 1. Trigger Common Info field: a. BW = 2 (80 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 2. SS Allocation /RA-RU Information for STA1, STA2, STA3 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 3. If the STAUT supports 1 SS, SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 4. If the STAUT supports > 1 SS, SS Allocation/RA-RU Information set to: (for STAUT) a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 5. RU allocation [106 106 106 106] tones. AP1 allocates the STAUT RUs in different locations.		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
5	Run script HE1-ULOFDMA-STAUT-STA1.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU. 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT ≥80% If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 5445S5_1SS_TP_5G for 1 SS, 5445S5_2SS_TP_5G for 2SS, then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			
7	Configure the STAUT to join AP1's BSS.	Configure STA1 to use 2 SS. Configure STA1 to join AP1's BSS.			
8	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.		If the STAUT association succeeds, then CONTINUE else FAIL.
9	The STAUT sends an ADDBA Request frame to AP1.	STA1 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1 with Buffer Size ≤ 64 .		
Test: 2 SS, LDPC, RU484, MCS 7					
10			Configure AP1 to transmit Trigger frames in SU PPDU to solicit HE TB PPDUs from STA1, STA2, STA3 and STAUT per Table 4 and Table 240 and the following parameters: 1. Trigger Common Info field: a. BW = 2 (80 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 2. SS Allocation/RA-RU Information for STA1 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 3. If the STAUT supports 1 SS, SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			b. Number of Spatial Streams = 0 4. If the STAUT supports > 1 SS, SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 5. RU allocation [484 484] tones. Coding = 1 (LDPC) AP1 allocates the STAUT RUs in different locations.		
11	Run script HE1-ULOFDMA-STAUT-STA1.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU. 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 5445S11_1SS_TP_5G for 1 SS, 5445S11_2SS_TP_5G for 2SS, then PASS else FAIL.
12	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			

5.44.6 STAUT UL OFDMA PHY transmits at 5 GHz Mixed SS, 80 MHz test

Table 244 provides the specific test procedure and expected results for this test case.

Table 246. STAUT UL OFDMA PHY transmits at 5 GHz 1SS, 80 MHz procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 240.	Configure STA1, STA2, STA3 per Table 6 and Table 240.	Configure AP1 per Table 4 and Table 240. Configure AP1's MU EDCA parameters as per Table 5.		
2	Configure STAUT to join AP1's BSS.	Configure STA1 and STA2 to use 1 SS and STA3 to use 2 SS. Configure STA1, STA2, STA3 to join AP1's BSS.			
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64 .		
Test: 1/2 SS, BCC, RU242, MCS 7					
5			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STAUT per Table 4 and Table 240 and the following parameters: 1. Trigger Common Info field: a. BW = 2 (80 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 2. SS Allocation /RA-RU Information for STA1 and STA2 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 3. SS Allocation /RA-RU Information for STA3 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 4. If the STAUT supports 1 SS, SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			5. If the STAUT supports > 1 SS, SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 6. RU allocation [242 242 242 242] tones. AP1 allocates the STAUT RUs in different locations.		
6	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU. 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 5446S6_1SS_TP_5G for 1 SS, 5446S6_2SS_TP_5G for 2SS, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			
8	Configure the STAUT to join AP1's BSS. Configure the STAUT to have LDPC as FEC coding.	Configure STA1 and STA2 to use 1 SS and STA3 to use 2 SS. Configure STA1, STA2, STA3 to join AP1's BSS. Configure STA1, STA2, STA3's Coding to LDPC.	Configure AP1's coding to LDPC.		
9	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
10	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64 .		
Test: 1/2 SS, LDPC, RU242, MCS 7					
11			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STAUT per Table		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			4 and Table 240 and the following parameters: 1. Trigger Common Info field: a. BW = 2 (80 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 2. SS Allocation /RA-RU Information for STA1 and STA2 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 3. SS Allocation /RA-RU Information for STA3 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 4. Coding = 1 (LDPC) (for STA1, STA2, STA3) 5. If the STAUT supports 1 SS, SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 6. If the STAUT supports > 1 SS, SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 7. RU allocation [242 242 242 242] tones. AP1 allocates the STAUT RUs in different locations.		
12	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 5446S12_1SS_TP_5G for 1 SS, 5446S12_2SS_TP_5G for 2SS, then PASS else FAIL.
13	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			

5.44.7 STAUT UL OFDMA PHY transmits at 5 GHz 1SS, 40 MHz test

Table 247 provides the specific test procedure and expected results for this test case.

Table 247. STAUT UL OFDMA PHY transmits at 5 GHz 1SS, 40 MHz procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 240.	Configure STA1, STA2, STA3 per Table 6 and Table 240.	Configure AP1 per Table 4 and Table 240.Configure AP1's MU EDCA parameters as per Table 5: Configure AP1 to use 1SS.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2, STA3 to join AP1's BSS.	Configure AP1 to the 5 GHz band and 40 MHz. AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64.		
Test: 1 SS, BCC, RU52, MCS 7					
5			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 with the Trigger Common Info Field: 1. BW = 1 (40 MHz) 2. RU allocation [52 52 52 52] tones. 3. Coding=BCC AP1 allocates the STAUT RUs in different locations.		
6	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU.

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
					2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 5447S6_1SS_TP_5G, then PASS else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			

5.44.8 STAUT UL OFDMA PHY transmits at 5 GHz 2SS, 40 MHz test

Table 248 provides the specific test procedure and expected results for this test case.

Table 248. STAUT UL OFDMA PHY transmits at 5 GHz 1SS, 40 MHz procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 240.	Configure STA1, STA2, STA3 per Table 6 and Table 240.	Configure AP1 per Table 4 and Table 240. Configure AP1's MU EDCA parameters as per Table 5: Configure AP1 to use 2SS explicitly .		
2	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2, STA3 to use 2 SS. Configure STA1, STA2, STA3 to join AP1's BSS.	Configure AP1 to use 2SS.		
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64.		
Test: 2 SS, BCC, RU106, MCS 7					
5			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STAUT per Table 4 and Table 240 and the following parameters: 1. Trigger Common Info field: a. BW = 1 (40 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 2. SS Allocation/RA-RU Information for STA1, STA2, STA3 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			3. If the STAUT supports 1 SS, SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 4. If the STAUT supports > 1 SS, SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 5. RU allocation [106 106 106 106] tones. AP1 allocates the STAUT RUs in different locations.		
6	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU. 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 5448S6_1SS_TP_5G for 1 SS, 5448S6_2SS_TP_5G for 2SS, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			
8	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2, STA3 to use 2 SS. Configure STA1 to join AP1's BSS.			
9	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
10	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64.		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
Test: 2 SS, LDPC, RU26, MCS 7					
11			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STAUT per Table 4 and Table 240 and the following parameters: 1. Trigger Common Info field: a. BW = 1 (40 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 2. SS Allocation/RA-RU Information for STA1 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 3. If the STAUT supports 1 SS, SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 4. If the STAUT supports > 1 SS, SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 5. RU allocation [26 26 26 26] tones. 6. Coding = 1 (LDPC) AP1 allocates the STAUT RUs in different locations.		
12	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. PPDUs from STAUT are transmitted using HE_TRIG PPDU. 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from APs followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT ≥ 80%

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
					If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 5448S12_1SS_TP_5G for 1 SS, 5448S12_2SS_TP_5G for 2SS, then PASS else FAIL.
13	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			

5.44.9 STAUT UL OFDMA PHY transmits at 5 GHz Mixed SS, 40 MHz test

Table 247 provides the specific test procedure and expected results for this test case.

Table 249. STAUT UL OFDMA PHY transmits at 5 GHz 1SS, 40 MHz procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 240.	Configure STA1, STA2, STA3 per Table 6 and Table 240.	Configure AP1 per Table 4 and Table 240.Configure AP1's MU EDCA parameters as per Table 5.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1 and STA2 to use 1 SS and STA3 to use 2 SS. Configure STA1, STA2, STA3 to join AP1's BSS.			
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64.		
Test: 1/2 SS, BCC, RU52, MCS 7					
5			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STAUT per Table 4 and Table 240 and the following parameters: 1. Trigger Common Info field: a. BW = 1(40 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 2. SS Allocation /RA-RU Information for STA1 and STA2 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			3. SS Allocation/RA-RU Information for STA3 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 4. If the STAUT supports 1 SS, SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 5. If the STAUT supports > 1 SS, SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 6. RU allocation [52 52 52 52] tones. AP1 allocates the STAUT RUs in different locations.		
6	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU. 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 3. Percent of TB PPDUs from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 5449S6_1SS_TP_5G for 1 SS, 5449S6_2SS_TP_5G for 2SS, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			
8	Configure STAUT to join AP1's BSS.	Configure STA1 and STA2 to use 1 SS and STA3 to use 2 SS. Configure STA1, STA2, STA3 to join AP1's BSS.	Configure AP1's coding to LDPC.		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
		Configure STA1, STA2, STA3's Coding to LDPC.			
9	The STAUT sends an Association Request frame to AP1.	STA1, STA2, STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, STA3.		If the STAUT association succeeds, then CONTINUE else FAIL.
10	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, STA3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, STA3 with Buffer Size ≤ 64.		
Test: 1/2 SS, LDPC, RU106, MCS 7					
11			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, STA3 and STAUT per Table 4 and Table 240 and the following parameters: 1. Trigger Common Info field: a. BW = 1 (40 MHz) b. GI+LTF = 2 (12.8µs LTF + 3.2 µs GI) 2. SS Allocation/RA-RU Information for STA1 and STA2 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0 3. SS Allocation/RA-RU Information for STA3 set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 4. Coding = 1 (LDPC) (for STA1, STA2, and STA3) 5. If the STAUT supports 1 SS, SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			6. If the STAUT supports > 1 SS, SS Allocation /RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 1 7. RU allocation [106 106 106 106] tones. AP1 allocates the STAUT RUs in different locations.		
12	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.			Verify the following conditions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU. 2. At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1)1 3. Percent of TB PPDUs from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 5449S12_1SS_TP_5G for 1 SS, 5449S12_2SS_TP_5G for 2SS, then PASS else FAIL.
13	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, STA3 from AP1.			

5.44.10 STAUT UL OFDMA PHY transmits at 5 GHz 1SS for 20 MHz-only STA

Table 241 provides the specific test procedure and expected results for this test case.

Table 250. STAUT UL OFDMA PHY transmits at 5 GHz 1SS for 20 MHz-only STA procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure STAUT per Table 14 and Table 240.	Configure STA1-3 per Table 6 and Table 240.	Configure AP1 per Table 4 and Table 240. Configure AP1 MU EDCA parameters as per Table 5. Configure AP1 to use 1SS explicitly.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1-3 to join AP1's BSS.	Configure AP1 to the 5 GHz band.		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			AP1 sends Beacon and Probe Response frames to the STAUT and STA1-3.		
3	The STAUT sends an Association Request frame to AP1.	STA1-3 send an Association Request frame to AP1.	Association Response frame to the STAUT and STA1-3.		If the STAUT association succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1	STA1-3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	ADDBA Response frame to the STAUT and STA1-3 with Buffer Size ≤ 64.		
Test: 1 SS, BCC, RU26, RU52 RU106 MCS 7					

5			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1-3 and STAUT per Table 4 and Table 240 and the following parameters:
			• Trigger Common Info Field:
			  ▪ BW = 0 (20 MHz)
			  ▪ GI+LTF = 1 (6.4µs LTF + 1.6µs GI)
			• RU allocation [26 26 26 26] tones.
			AP1 allocates the STAUT RUs in different locations..		

6	Run script HE1-ULOFDMA-STAUT.	Run script HE1-ULOFDMA-STAUT.			Verify the following condtions are true: 4. PPDUs from the STAUT are transmitted using HE_TRIG PPDU At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 5. Percent of TB PPDUs from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 54410S6_1SS_TP_5G for 1 SS, 54410S6_2SS_TP_5G for 2SS, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1-3 from AP1.			

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
8	• Repeat Step5 -7 with the following and re-configure the AP • LTF=12.8µs, GI=3.2 µs and RU allocation [52 52 52 52] tones, BW=40MHz • LTF=12.8µs, GI=3.2µs, BCC, and RU allocation [106 106 106 106] tones, BW=80 MHz				If the throughput from the STAUT is more than 54410S6_RU52_1SS_TP_5G for 1 SS, 54410S6_ RU52_2SS_TP_5G for 2SS 54410S6_RU106_1SS_TP_5G for 1 SS, 54410S6_ RU106_2SS_TP_5G for 2SS , then PASS else FAIL

5.44.11 STAUT UL OFDMA PHY transmits at 5 GHz 2SS for 20 MHz-only STA

Table 251 provides the specific test procedure and expected results for this test case.

Table 251. STAUT UL OFDMA PHY transmits at 2.4 GHz 1SS, 20 MHz test procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure STAUT per Table 14 and Table 240.	Configure STA1-3 per Table 6 and Table 240.	Configure AP1 per Table 4 and Table 240. Configure AP1 MU EDCA parameters as per Table 5. Configure AP1 to use 2SS explicitly.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1-3 to join AP1's BSS.	Configure AP1 to the 5 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1-3.		
3	The STAUT sends an Association Request frame to AP1.	STA1-3 send an Association Request frame to AP1.	Association Response frame to the STAUT and STA1-3.		If the STAUT association succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1	STA1-3 send an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	ADDBA Response frame to the STAUT and STA1-3 with Buffer Size ≤ 64.		
Test: 2 SS, BCC, RU26, RU52 RU106 MCS 7					
5			Configure AP1 to transmit Trigger frame with the same configuration as Step 5 in 5.44.10 except: 1. SS Allocation /RA-RU Information = 1 (for STA1-3)		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
			2. If the STAUT supports 1 SS: • SS Allocation /RA-RU Information = 0 (for the STAUT) 3. If the STAUT supports > 1 SS: • SS Allocation /RA-RU Information = 1 (for STAUT)		
6	Run script HE1-ULOFDMA-STAUT.	Run script HE1-ULOFDMA-STAUT.			Verify the following condtions are true: 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU At least one UL OFDMA flow sequence check is correct (Trigger frame from AP1 followed by TB PPDU from STAUT and M-BA from AP1) 2. Percent of TB PPDUs from STAUT ≥ 80% If all conditions above are true, then CONTINUE else FAIL. If the throughput from the STAUT is more than 54411S6_1SS_TP_5G for 1 SS, 54411S6_2SS_TP_5G for 2SS, then CONTINUE else FAIL
7	Disassociate the STAUT from AP1.	Disassociate STA1-3 from AP1.			
8	• Repeat Step5 - 7 with the following and re-configure the AP • LTF=12.8µs, GI=3.2 µs and RU allocation [52 52 52 52] tones, BW=40MHz • LTF=12.8µs, GI=3.2µs, BCC, and RU allocation [106 106 106 106] tones, BW=80 MHz				If the throughput from the STAUT is more than 54411S6_RU52_1SS_TP_5G for 1 SS, 54411S6_ RU52_2SS_TP_5G for 2SS 54411S6_RU106_1SS_TP_5G for 1 SS, 54411S6_ RU106_2SS_TP_5G for 2SS, then PASS else FAIL

5.45 STAUT basic HE UL MU frame exchange sequence tests

Objective

This test case verifies that the STAUT correctly generates TB PPDUs carrying A-MPDUs that solicit M-BA from the test bed AP.

Applicability: Mandatory

References

Section 6.3.2.2 [1]

Section 26.5.3 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 252 defines the specific parameter values required for this test case.

Table 252. STAUT basic HE UL MU frame exchange sequence test configuration

Parameter	Test bed AP1	Test bed STA1	Test bed STA2	Test bed STA3	STAUT
Test bed vendor	Broadcom	Intel200W	Cypress	Broadcom98	N/A
AP control channel	36 in 5 GHz 6 in 2.4 GHz	N/A	N/A	N/A	N/A
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	N/A
PPDU Format	Rx HE_TRIG (UL OFDMA)	N/A	N/A	N/A	N/A
MU functionality	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA	N/A
Acknowledgment	Configure AP1 to transmit M-BA in SU PPDU as the response of frames in TB PPDU	NA	NA	NA	NA

5.45.1 STAUT basic HE UL MU frame exchange sequence at 2.4 GHz, 20 MHz test

Table 253 provides the specific test procedure and expected results for this test case.

Table 253. STAUT basic HE UL MU frame exchange sequence at 2.4 GHz, 20 MHz procedure and expected results

Step	STAUT	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 252 in the 2.4 GHz band.	Configure STA1 per Table 6 and Table 252 in the 2.4 GHz band.	Configure STA2 per Table 6 and Table 252 in the 2.4 GHz band.	Configure STA3 per Table 6 and Table 252 in the 2.4 GHz band.	Configure AP1 per Table 4 and Table 240 in the 2.4 GHz band. Configure AP1's MU EDCA parameters as per Table 5.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.	Configure STA2 to join AP1's BSS.	Configure STA3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	STA2 sends an Association Request frame to AP1.	STA3 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	ADDBA Request frame to AP1 with Buffer Size ≤ 64.	ADDBA Request frame to AP1 with Buffer Size ≤ 64.	ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, and STA3.		
5					Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, and STA3 and the STAUT in non-overlapped RUs [52 52 52 52].		
6	Run script HE1-ULOFDMA-STAUT.txt to AP1 using AC_BE.	Run script HE1-ULOFDMA-STAUT.txt to the AP1 using AC_BE.	Run script HE1-ULOFDMA-STAUT.txt to AP1 using AC_BE.	Run script HE1-ULOFDMA-STAUT.txt to AP1 using AC_BE.		SN; Verify that the Test bed AP sends M-BA in response to TB PPDUs	SN: Verify the following conditions are true: 1. STAUT transmitted TB PPDU with QoS Data frames. 2. Throughput from STAUT ≥ 5451S6_1SS_TP_24G for 1 SS, 5451S6_2SS_TP_24G for 2SS 3. Aggregate throughput on AP1≥ 5451S6_ATP_24G

Step	STAUT	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1	Test bed validation	Expected result
							If all conditions above are true, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1 from AP1.	Disassociate STA2 from AP1.	Disassociate STA3 from AP1.			

5.45.2 STAUT basic HE UL MU frame exchange sequence at 5 GHz, 80 MHz test

Table 254 provides the specific test procedure and expected results for this test case.

Table 254. STAUT basic HE UL MU frame exchange sequence at 5 GHz, 80 MHz procedure and expected results

Step	STAUT	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 252 in the 5 GHz band.	Configure STA1 per Table 6 and Table 252 in the 5 GHz band.	Configure STA2 per Table 6 and Table 252 in the 5 GHz band.	Configure STA3 per Table 6 and Table 252 in the 5G Hz band.	Configure AP1 per Table 4 and Table 252 in the 5 GHz band. Configure AP1's MU EDCA parameters per Table 5.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.	Configure STA2 to join AP1's BSS.	Configure STA3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	STA2 sends an Association Request frame to AP1.	STA3 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	STA1 sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	STA2 sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	STA3 sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2, and STA3 with Buffer size ≤64.		
5					If DUT Type is 20 MHz only STAUT then Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDUs from STA1-3 in non-overlapped RUs [106 106 106 106]. else Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1, STA2, and STA3 in		

Step	STAUT	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1	Test bed validation	Expected result
					non-overlapped RUs [242 242 242 242].		
6	Run script HE1-ULOFDMA-STAUT.txt to AP1 using AC_BE.	Run script HE1-ULOFDMA-STAUT.txt to AP1 using AC_BE.	Run script HE1-ULOFDMA-STAUT.txt to AP1 using AC_BE.	Run script HE1-ULOFDMA-STAUT.txtto AP1 using AC_BE.		SN: Verify that the Test bed AP sends M-BA in response to TB PPDUs	SN: Verify the following conditions are true: 4. STAUT transmitted TB PPDU with QoS Data frames. 5. Throughput from STAUT ≥ 5452S6_1SS_TP_5G >5452S6_1SS_TP_5G for 1 SS, 5452S6_2SS_TP_5G for 2SS 6. Aggregate throughput on the AP1 ≥ 5452S6_ATP_5G If all conditions above are true, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1 from AP1.	Disassociate STA2 from AP1.	Disassociate STA3 from AP1.			

5.46 (Deleted)

5.47 STAUT Trigger frame MAC padding tests

5.47.1 STAUT Trigger frame MAC padding test

Objective

This test case verifies that the STAUT correctly accepts MAC padding in a Trigger frame as per the associated STA capability.

Applicability: Mandatory

References

Section 6.3.2.22 [1]

Section 26.5.3.2.3 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 255 defines the specific parameter values required for this test case.

Table 255. STAUT Trigger frame MAC padding test configuration

Parameter	STAUT value	Test bed AP1 value	Test bed STA1 value
Test bed vendor	N/A	Marvell	Broadcom75
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU Format	N/A	Rx HE_TRIG (UL OFDMA)	N/A
MU functionality	N/A	Enable UL OFDMA	Enable UL OFDMA

Test procedure and expected results

Table 256 provides the specific test procedure and expected results for this test case.

Table 256. STAUT Trigger frame MAC padding test procedure and expected results

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
1	If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 9.				
2	Configure the STAUT per Table 14 and Table 255 in the 2.4 GHz band.	Configure STA1 per Table 6 and Table 255 in the 2.4 GHz band. Trigger frame MAC padding duration to 16 µsec.	Configure AP1 per Table 4 and Table 255 in the 2.4 GHz band. Configure AP1 with: MU EDCA parameters per Table 5		
3			AP1 sends Beacon and Probe Response frames to the STAUT and STA1.		
4	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.			
5	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.	SN: Verify that STA1 association succeeds.	If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
6			Configure AP1 to transmit Trigger frames using non-HT PPDU format.		
7	RUN: PING <AP_IP_ADDR> CONTINUOUS=YES SIZE=1000			SN: Verify that Trigger frames are sent by AP1 using the non-HT PPDU format.	If more than 5 consecutive ping timeouts from the STAUT occur, then FAIL else CONTINUE. If more than 10% ping failures from the STAUT, then FAIL else CONTINUE.
8	If the STAUT supports 5 GHz, go to Step 9 else PASS.				
9	Configure the STAUT per Table 14 and Table 255 in the 5 GHz band.	Configure STA1 per Table 6 and Table 255 in the 5 GHz band. Trigger frame MAC padding duration to 16 µsec	Configure AP1 per Table 4 and Table 255 in the 5 GHz band. Configure AP1 with: 7. MU EDCA parameters per Table 5		
10			AP1 sends Beacon and Probe Response frames to the STAUT and STA1.		
11	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.			
12	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.	SN: Verify that STA1 association succeeds.	If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
13			Configure AP1 to transmit Trigger frames using non-HT or non-HT duplicate PPDU format. Configure AP1 to indicate in the Trigger frames that LDPC is to be used when transmitting the HE TB PPDUs.		
14	RUN: PING <AP_IP_ADDR> CONTINUOUS=YES SIZE=1000			SN: Verify that Trigger frames are sent by AP1 using the non-HT or non-HT duplicate PPDU format. (NOTE: Sniffer will show both non-HT and non-HT duplicate PPDUs as non-HT PPDUs.)	If more than 5 consecutive ping timeouts from the STAUT occur, then FAIL else CONTINUE. If more than 10% ping failures from the STAUT, then FAIL else PASS.

5.48 STAUT DL OFDMA with S-MPDU tests

5.48.1 STAUT DL OFDMA with S-MPDU test

Objective

This test case verifies that the STAUT correctly receives DL OFDMA and responds accordingly upon receiving S-MPDU.

Applicability: Mandatory

References

Section 6.3.2.1 [1]

Section 27.3 [7]

Test environment

- STAUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 257 defines the specific parameter values required for this test case.

Table 257. STAUT DL OFDMA with S-MPDU test configuration

Parameter	STAUT value	Test bed STA1 value	Test bed AP1 value
Test bed vendor	N/A	Cyperss	Qualcomm
AP control channel	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	N/A	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	N/A	N/A	HE MU PPDU (OFDMA)
Number of users in each OFDMA transmission	N/A	N/A	2
A-MPDU	N/A	N/A	Disable
BA setup	N/A	N/A	ADDBA Request with Buffer Size ≤ 64

Test procedure and expected results

Table 258 provides the specific test procedure and expected results for this test case.

Table 258. STAUT DL OFDMA with S-MPDU test procedure and expected results

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 257.	Configure STA1 per Table 6and Table 257.	Configure AP1 per Table 4 and Table 257.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 8.					
2	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.	Configure AP1 to the 2.4 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
4		STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to STA1 with Buffer Size ≤ 64.		
5			Configure AP1 to transmit DL OFDMA with Ack Policy set to Normal Ack for the STAUT.		
6			Run script HE1-DLOFDMA-STAUT_24G.txt to the STAUT and STA1.	Verify that AP1 sends S-MPDU to the STAUT.	SN: Verify the following conditions are true: 1. STAUT transmits an Ack after DL OFDMA PPDU. 2. The test script runs to completion. If all conditions above are true, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1 from AP1.			
If the STAUT supports 5 GHz, go to Step 8 else PASS.					
8	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.	Configure AP1 to the 5 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1.		
9	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
10		STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to STA1 with Buffer Size ≤ 64.		
11			Configure AP1 to transmit DL OFDMA with Ack Policy set to Normal Ack to the STAUT.		
12			Run script HE1-DLOFDMA-STAUT.txt to the STAUT and STA1.	Verify that AP1 sends S-MPDU to the STAUT.	SN: If the STAUT transmits an Ack after DL OFDMA PPDU, then PASS else FAIL.

5.49 STAUT DL OFDMA PHY at 160 MHz PHY tests

5.49.1 STAUT DL OFDMA PHY at 160 MHz (5 GHz) test

Objective

This test case verifies that the STAUT correctly receives DL OFDMA.

Applicability: Optional. This test shall be executed only if the STAUT declared support for 160 MHz operation in Table 2.

References

Section 6.3.2.1 [1]

Section 27.3 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 259 defines the specific parameter values required for this test case.

Table 259. STAUT DL OFDMA PHY at 160 MHz (5 GHz) test configuration

Parameter	**STAUT value**	**Test bed STA1 value**	**Test bed STA2 value**	**Test bed STA3 value**	**Test bed AP1 value**
Test bed vendor	N/A	Marvell	Intel200L	Intel200W	Broadcom
AP control channel	N/A	N/A	N/A	N/A	36 in 5 GHz
Bandwidth	Default	160 MHz in 5 GHz	160 MHz in 5 GHz	160 MHz in 5 GHz	160 MHz in 5 GHz
PPDU format	N/A	N/A	N/A	N/A	HE MU PPDU (OFDMA)
Number of users in each OFDMA transmission	N/A	N/A	N/A	N/A	4

Test procedure and expected results

Table 260 provides the specific test procedure and expected results for this test case.

Table 260. STAUT DL OFDMA PHY at 160 MHz (5 GHz) test procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 6 and Table 259.	Configure STA1, STA2, and STA3 per Table 6 and Table 259.	Configure AP1 per Table 4 and Table 259. Configure the AP1's BSS bandwidth to 160 MHz in 5 GHz.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2, and STA3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, and STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1.	STA1, STA2, and STA3 send an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frames to the STAUT and STA1, STA2, and STA3 with Buffer Size ≤ 64.		
5			Configure AP1 to: 1. Transmit using DL OFDMA 2. 1 spatial stream 3. LTF=12.8 µs 4. GI=3.2 µs 5. LDPC 6. RU allocation [484 484 484 484] tones. AP1 allocates the STAUT RUs in different locations.		
6			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, STA3.		If the throughput from AP1 to STA1, STA2, and STA3 and the STAUT is more than 5491S6_TP_5G, then CONTINUE else FAIL.
7			Configure AP1 to: 1. Transmit using DL OFDMA 2. 1 spatial stream 3. LTF=6.4 µs 4. GI=1.6 µs 5. LDPC 6. RU allocation [242 242 242 242] tones. AP1 allocates the STAUT Rus in different locations.		

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
8			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, and STA3.		If the throughput from AP1 to STA1, STA2, and STA3 and the STAUT > 5491S8_TP_5G, then CONTINUE else FAIL.
9	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, and STA3 from AP1.			
10	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
11	The STAUT sends an ADDBA Response frame to AP1.	STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frames to the STAUT and STA1with Buffer Size ≤ 64.		
12			Configure AP1 to: 1. Transmit using DL OFDMA 2. 1 spatial stream 3. LTF=6.4 µs 4. GI=1.6 µs 5. LDPC 6. RU allocation [996 996] tones. AP1 allocates the STAUT RUs in different locations.		
13			Run script HE1-DLOFDMA-STAUT.txt to the STAUT and STA1.		If the throughput from AP1 to STA1 > 5491S13_TP_5G, then PASS else FAIL.

5.50 STAUT DL OFDMA mixed spatial stream PHY tests

5.50.1 STAUT DL OFDMA mixed spatial stream PHY test

Objective

This test case verifies that the STAUT correctly receives DL OFDMA when the STAUT receives one spatial stream and the test bed AP transmits two spatial streams to other STAs.

Applicability: Mandatory

References

Section 6.3.2.1 [1]

Section 27.3 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 261 defines the specific parameter values required for this test case.

Table 261. STAUT DL OFDMA mixed spatial stream PHY test configuration

Parameter	**STAUT value**	**Test bed STA1 value**	**Test bed STA2 value**	**Test bed STA3 value**	**Test bed AP1 value**
Test bed vendor	N/A	Broadcom75	Intel200W	Marvell	Qualcomm
AP control channel	N/A	N/A	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	20 MHz in 2.4 GHz 80 MHz in 5 GHz	20 MHz in 2.4 GHz 80 MHz in 5 GHz	20 MHz in 2.4 GHz 80 MHz in 5 GHz	20 MHz in 2.4 GHz 80 MHz in 5 GHz
PPDU format	N/A	N/A	N/A	N/A	HE MU PPDU (OFDMA)
Number of users in each OFDMA transmission	N/A	N/A	N/A	N/A	4
Spatial streams	Default	1	2	2	Default

Test procedure and expected results

Table 262 provides the specific test procedure and expected results for this test case.

Table 262. STAUT DL OFDMA mixed spatial stream PHY test procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 261.	Configure STA1, STA2, and STA3 per Table 6 and Table 261.	Configure AP1 per Table 4 and Table 261.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 8.					
2	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2, and STA3 to join AP1's BSS.	Configure AP1 to the 2.4 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, and STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
4	STA1, STA2, and STA3 send an ADDBA Response frame to AP1	STA1, STA2, and STA3 send an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT and STA1, STA2, and STA3 with Buffer Size ≤ 64.		
5			Configure AP1 to: 1. Transmit using DL OFDMA 2. 1 spatial stream to STAUT and STA1 3. 2 spatial streams to STA2 and STA3 4. LTF=12.8 µs 5. GI=3.2 µs 6. BCC 7. RU allocation [52 52 52 52] tones. AP1 allocates the STAUT RUs in different locations.		
6			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, and STA3.		If the throughput from AP1 to STA1, STA2, and STA3 and the STAUT is > 5501S6_TP_24G, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, and STA3 from AP1.			
If the STAUT supports 5 GHz, then go to Step 8 otherwise PASS.					

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
8	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2, and STA3 to join AP1's BSS.	Configure BSS bandwidth to 80 MHz in 5 GHz. AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
9	The STAUT sends an Association Request frame to AP1.	STA1, STA2, and STA3 send an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
10	STAUT send an ADDBA Response frame to AP1	STA1, STA2, and STA3 send an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT and STA1, STA2, and STA3 with Buffer Size ≤ 64.		
11			Configure AP1 to: 1. Transmit using DL OFDMA 2. 1 spatial stream to STAUT and STA1 3. 2 spatial streams to STA2 and STA3 4. LTF = 6.4 µs 5. GI = 1.6 µs 6. LDPC 7. If DUT type is 20 MHz only STAUT then RU allocation [106 106 106 106] tones else RU allocation [242 242 242 242] tones. AP1 allocates the STAUT RUs in different locations.		
12			Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT and STA1, STA2, and STA3.		If the throughput from AP1 to STA1, STA2, and STA3 and the STAUT is > 5501S12_TP_5G, then PASS else FAIL.
13	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, and STA3 from AP1.			

5.51 STAUT DL MU MU-BAR frame for C-BA tests

5.51.1 STAUT DL MU MU-BAR frame for C-BA test

Objective

This test case verifies that the STAUT correctly receives a DL MU PPDU containing QoS Data frames with Block Ack in Ack Policy fields, and a separate MU-BAR to solicit the STAUT's C-BA response in HE TB PPDU.

Applicability: Mandatory

References

Section 6.3.2.27 [1]

Section 10.3.2.13.2 [7]

Test environment

- STAUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 263 defines the specific parameter values required for this test case.

Table 263. STAUT DL MU MU-BAR frame for C-BA test configuration

Parameter	STAUT value	Test bed STA1, STA2, and STA3	Test bed AP1 value
Test bed vendor	N/A	Broadcom75, Qualcomm, Intel200L	If DUT is 20 MHz-only STA, use Qualcomm for 2.4 GHz else Broadcom
AP control channel	Default	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	N/A	N/A	HE MU PPDU (OFDMA)
Number of users in each OFDMA transmission	N/A	N/A	4

Test procedure and expected results

Table 264 provides the specific test procedure and expected results for this test case.

Table 264. STAUT DL MU MU-BAR frame for C-BA test procedure and expected results

Step	STAUT	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 263.	Configure STA1 per Table 6 and Table 263.	Configure STA2 per Table 6 and Table 263.	Configure STA3 per Table 6 and Table 263.	Configure AP1 per Table 4 and Table 263. Configure AP1 to transmit DL OFDMA.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 8.							
2	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.	Configure STA2 to join AP1's BSS.	Configure STA3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	STA2 sends an Association Request frame to AP1.	STA3 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4					Configure AP1 to transmit MU-BAR to solicit BlockAck in HE TB PPDU from the STAUT and STA1, STA2, and STA3.		
5	The STAUT sends an ADDBA Response frame to AP1.	STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size ≤ 64.		SN: If the value in Buffer Size of the ADDBA Response frame from the STAUT is ≤ 64, then CONTINUE else FAIL.
6					Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to STAUT,STA1, STA2 and STA3 using AC_BE.	SN: Verif that 5511S6_PPDU_24G% PPDUs from AP1 are HE MU PPDU	SN: Verify the following conditions are true. 1. PPDUs from the STAUT are transmitted using HE_TRIG PPDU. 2. Throughput from the STAUT > 5511S6_TP_24G. If all the conditions above are true, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.	Disassociate STA1 from AP1.	Disassociate STA2 from AP1.	Disassociate STA3 from AP1.			

Step	STAUT	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1	Test bed validation	Expected result
If the STAUT supports 5 GHz, go to Step 8 else PASS.							
8	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.	Configure STA2 to join AP1's BSS.	Configure STA3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
9	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	STA2 sends an Association Request frame to AP1.	STA3 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
10					Configure AP1 to transmit MU-BAR to solicit BlockAck in HE TB PPDU from the STAUT and STA1, STA2, and STA3.		
11	The STAUT sends an ADDBA Response frame to AP1.	STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size ≤ 64.		SN: If the value in Buffer Size of the ADDBA Response frame from the STAUT is ≤ 64, then CONTINUE else FAIL.
12					Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to STA1, STA2, and STA3 and the STAUT using AC_BE.	SN: Verify that 5511S12_PPDU_5G% PPDUs from testbed AP are HE MU PPDU	SN: Verify the following conditions are true. 1. PPDUs from STAUT are transmitted using HE_TRIG PPDU. 2. Throughput from STAUT > 5511S12_TP_5G. If all the conditions above are true, then PASS else FAIL.

5.52 STAUT M-BA with Ack Type subfield = 1 with TID 0 to 7 for Ack context solicited by S-MPDU tests

5.52.1 STAUT M-BA with Ack Type subfield = 1 with TID 0 to 7 for Ack context solicited by S-MPDU test

Objective

This test case verifies that the STAUT correctly decodes Basic Trigger frames and responds with HE TB PPDU.

Applicability: Mandatory

References

Section 6.3.2.31 [1]

Section 9.3.1.8.7 [7]

Test environment

- STAUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 265 defines the specific parameter values required for this test case.

Table 265. STAUT M-BA with Ack Type subfield = 1 with TID 0 to 7 for Ack context solicited by S-MPDU test configuration

Parameter	STAUT value	Test bed STA1 value	Test bed AP1 value
Test bed vendor	N/A	Broadcom98	Ruckus
AP control channel	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
A-MPDU aggregation	N/A	N/A	Disable for STAUT Reject ADDBA Request frames from STAUT
MU functionality	N/A	Enable UL OFDMA	Enable UL OFDMA

Test procedure and expected results

Table 266 provides the specific test procedure and expected results for this test case.

Table 266. STAUT M-BA with Ack Type subfield = 1 with TID 0 to 7 for Ack context solicited by S-MPDU test procedure and expected results

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 265.	Configure STA1 per Table 6 and Table 265.	Configure AP1 per Table 4 and Table 265. Configure AP1's MU EDCA parameters per Table 5.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 8.					
2	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4			Configure AP1 to transmit M-BA in SU PPDU after receiving HE TB PPDU. Note: M-BA implies Basic Trigger to solicit HE TB PPDU from the STAUT and STA1		
5		Configure STA1 to sends an ADDBA Request frame to AP1with Buffer Size ≤ 64.	Configure AP1 to respond to STA1 ADDBA request with Buffer size ≤64.		
6	RUN: PING <AP_IP_ADDR> CONTINUOUS=YES SIZE=1000	RUN: PING <AP_IP_ADDR> CONTINUOUS=YES SIZE=1000	AP1 transmits M-BA. .	SN: Verify M-BA with STAUT information 1. RA is broadcast MAC address or MAC address of STAUT if AP1 is using unicast 2. Ack Type of Per AID TID Info for STAUT (AID11 being STAUT AID) = 1 3. Per AID TID Info for STAUT only includes AID TID Info field	SN: If more than 5 consecutive ping timeouts from STAUT occur, then FAIL else CONTINUE. If more than 10% ping failures from the STAUT, then FAIL else CONTINUE.
7	Disassociate the STAUT from AP1.	Disassociate the STA1 from AP1.			

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
If the STAUT supports 5 GHz, go to Step 8 else PASS.					
8	Configure the STAUT to join AP1's BSS.	Configure STA2 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1.		
9	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
10			Configure AP1 to transmit M-BA in SU PPDU after receiving HE TB PPDU. Note: M-BA implies Basic Trigger to solicit HE TB PPDU from the STAUT and STA1		
11		STA1 sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STA1.≤64		
12	RUN: PING <AP_IP_ADDR> CONTINUOUS=YES SIZE=1000	RUN: PING <AP_IP_ADDR> CONTINUOUS=YES SIZE=1000	AP1 transmits M-BA.	SN: Verify M-BA with STAUT information: 1. RA is broadcast MAC address or one MAC address of STAUT 2. Ack Type of Per AID TID Info for STAUT (AID11 being STAUT AID) =1 3. Per AID TID Info for STAUT only includes AID TID Info field	If more than 5 consecutive ping timeouts from STAUT occur, then FAIL else CONTINUE. If more than 10% ping failures from STA1, then FAIL else PASS.

5.53 STAUT HE BSR in UL OFDMA tests

5.53.1 STAUT HE BSR in UL OFDMA test

Objective

This test case verifies that the STAUT correctly receives BSRP trigger frame and transmits the Buffer Status Report in HE TB PPDU to HE AP in QoS Null frames.

Applicability: Mandatory

References

Section 6.3.2.45 [1]

Section 9.3.1.22.6 and 26.5.3.6 [7]

Test environment

- STAUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 267 defines the specific parameter values required for this test case.

Table 267. STAUT HE BSR in UL OFDMA test configuration

Parameter	STAUT value	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1 value
Test bed vendor	N/A	Cyperss	Intel200L	Marvell	Qualcomm
AP control channel	Default	N/A	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	20 MHz in 2.4 GHz 80 MHz in 5 GHz	20 MHz in 2.4 GHz 80 MHz in 5 GHz	20 MHz in 2.4 GHz 80 MHz in 5 GHz	20 MHz in 2.4 GHz 80 MHz in 5 GHz
Spatial streams	Default	Default	Default	Default	1
MU functionality	N/A	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA	Enable UL OFDMA

Test procedure and expected results

Table 268 provides the specific test procedure and expected results for this test case.

Table 268. STAUT HE BSR in UL OFDMA test procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 267.	Configure STA1, STA2, and STA3 per Table 6 and Table 267.	Configure AP1 per Table 4 and Table 267. Enable BSRP Trigger frame for UL MU OFDMA. Configure AP1 with the MU EDCA parameters per Table 5.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 11.					
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	Configure STA1, STA2, and STA3 to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3 in the 2.4 GHz band.		
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2, and STA3 send Association Request frames to AP1.	AP1 sends Association Response frames to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	STA1, STA2, and STA3 send ADDBA Request frames to AP1.	ADDBA Response frames to the STAUT and STA1, STA2, and STA3 with Buffer Size ≤ 64.		
5	Run the script HE1-ULOFDMA-STAUT_BSR.txt to generate UDP UL traffic from the STAUT covering AC_BE.	Run the script HE1-ULOFDMA-STAUT_BSR.txt to generate UDP UL traffic from STA1, STA2, and STA3 covering AC_BE.			
6			AP1 sends BSRP Tigger frames to the STAUT and STA1, STA2, and STA3.		
7		STA1, STA2, and STA3 sends QoS Null frames to AP1 with Ack Policy set to No Ack.			SN: Verify the following conditions are true. 1. HE TB PPDU is sent in the allocated RU. 2. At least 5531S7_PPDU_24G% BSRP Trigger frames out of allPPDUs sent in Step 5 are followed by the HE TB PPDU transmitted by the STAUT, where the HE TB PPDU contains at least one QoS Null frame with QoS Control parameters:

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
					Queue Size is not set to 255, and not all QoS Null frames have Queue Size fields = 0 3. Each QoS Null frame has Ack Policy=No Ack, and B4=1 for the TID that corresponds to one of the TIDs of the traffic in Step 4. If all the conditions above are true, then CONTINUE else FAIL.
8	Disassociate the STAUT from AP1.	Disassociate STA1, STA2, and STA3 from AP1.			
9	Repeat Steps 3-8 with script HE1-ULOFDMA-STAUT-BE-VI_BSR.txt, which covers two ACs, AC_BE and AC_VI.	Repeat Steps 3-8 with script HE1-ULOFDMA-STAUT-BE-VI_BSR.txt, which covers two ACs, AC_BE and AC_VI.	Repeat Steps 3-8.		The verification in Steps 3-8 is the same except: • 5531S9_PPDU_24G% BSRP Trigger frames out of all PPDUs in Step 7 If the verification in Steps 3-8 is successful, then CONTINUE else FAIL.
10	Repeat Steps 3-8 with script HE1-ULOFDMA-STAUT-BE-VI-VO-BK_BSR.txt, which covers four ACs, AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8 with script HE1-ULOFDMA-STAUT-BE-VI-VO-BK_BSR.txt, which covers four ACs, AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8.		The verification in Steps 3-8 is the same except: • 5531S10_PPDU_24G% BSRP Trigger frames out of all PPDUs in Step 7 If the verification in Steps 3-8 is successful, then CONTINUE else FAIL.
If the STAUT supports 5 GHz, go to Step 11 else PASS.					
11	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure STA1, STA2, and STA3 to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
12	The STAUT sends an Association Request frame to AP1.	STA1, STA2, and STA3 send Association Request frames to AP1.	Association Response frames to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
13	Repeat Steps 4-8.	Repeat Steps 4-8.	Repeat Steps 4-8.		The verification in Steps 3-8 is the same except: • 5531S13_PPDU_5G% BSRP Trigger frames

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed validation	Expected result
					out of all PPDUs in Step 7 If the verification in Steps 4-8 is successful, then CONTINUE else FAIL.
14	Repeat Steps 3-8 with script HE1-ULOFDMA-STAUT-BE-VI_BSR.txt, which covers two ACs, AC_BE and AC_VI.	Repeat Steps 3-8 with script HE1-ULOFDMA-STAUT-BE-VI_BSR.txt, which covers two ACs, AC_BE and AC_VI.	Repeat Steps 3-8.		The verification in Steps 3-8 is the same except: • 5531S14_PPDU_5G% BSRP Trigger frames out of all PPDUs in Step 7 If the verification in Steps 3-8 is successful, then CONTINUE else FAIL.
15	Repeat Steps 3-8 with script HE1-ULOFDMA-STAUT-BE-VI-VO-BK_BSR.txt, which covers four ACs, AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8 with script HE1-ULOFDMA-STAUT-BE-VI-VO-BK_BSR.txt, which covers four ACs, AC_BE, AC_VI, AC_VO, and AC_BK.	Repeat Steps 3-8.		The verification in Steps 3-8 is the same except: • 5531S15_PPDU_5G% BSRP Trigger frames out of all PPDUs in Step 7 If the verification in Steps 3-8 is successful, then PASS else FAIL.

5.54 STAUT transmits single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths tests

5.54.1 STAUT transmits single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths test

Objective

This test case verifies that the STAUT correctly transmits single TID A-MPDU with up to 256 MSDUs and no fragmentation in HE SU PPDU with different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Optional. This test shall be executed only if the STAUT declared support for Compressed BlockAck (C-BA) fames with up to 256 MSDUs/A-MSDUs, with no fragmentation in Table 2.

References

Section 6.4.2.11 [1]

Section 9.3.1.8.2 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 dual band AP
- Wireless Sniffer

Test configuration

Table 269 defines the specific parameter values required for this test case.

Table 269. STAUT transmits single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths test configuration

Parameter	STAUT value	AP1 value
Test bed vendor	N/A	Marvell
AP Control Channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	20 MHz in 2.4 GHz 80 MHz in 5 GHz
Preamble format	HE_SU	HE_SU
HE Capabilities: Fragmentation Support field	N/A	0
Block Ack Parameter Set field: A-MSDU supported	N/A	0
Configure to use 256 BA	Enabled	Enabled

Parameter	STAUT value	AP1 value
ADDBA Request frame includes, Block Ack Parameter Set field: Buffer Size value > 64 ADDBA Response includes, Block Ack Parameter Set field: Buffer Size > 64		

Test procedure and expected results

Table 270 provides the specific test procedure and expected results for this test case.

Table 270. STAUT transmits single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 269.	Configure AP1 per Table 4 and Table 269.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon or Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1 with Buffer Size > 64.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size > 64.	Verify that AP1's ADDBA Response frame includes a Block Ack Parameter Set Field with Buffer Size > 64.	SN: If the Buffer Size in the STAUT's ADDBA Request frame is > 64, then CONTINUE else FAIL else.
5	Run script HE1-STA-AP-60.txt AP1.		Verify that AP1 uses a BA Bitmap Length = 32 bytes.	SN: Verify the following conditions are true. 1. Fragment Number field within the Sequence Control field and the More Fragments subfield within the Frame Control field in the SU PPDUs sent by the STAUT = 0 (no fragmentation). 2. SU PPDUs sent by the STAUT contain HE-SIG-A with the following format: a. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) b. Bandwidth field in HE-SIG-A1 (B19,B20) = 0 (20 MHz) c. UL/DL field in HE-SIG-A1 (B2) = 1 (UL) 3. PPDU carrying QoS Data has an aggregate of > 64 MPDUs in at least 554S5_256_24G% of PPDUs If all the conditions above are true, then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.			

Step	STAUT	Test bed AP1	Test bed validation	Expected result
If the STAUT supports 5 GHz, go to Step 7 else PASS.				
7	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon or Probe Response frames to the STAUT.		
8	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
9	The STAUT sends an ADDBA Request frame to AP1 with Buffer Size > 64.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size > 64.	Verify that AP1's ADDBA Response frame includes a Block Ack Parameter Set Field with Buffer Size > 64.	SN: If the Buffer Size in the STAUT's ADDBA Request frame is > 64, then CONTINUE else FAIL.
10	Run script HE1-STA-AP-60.txt to AP1.		Verify that AP1 uses a BA Bitmap Length = 32 bytes.	SN: Verify the following conditions are true. 1. Fragment Number field within the Sequence Control field and the More Fragments subfield within the Frame Control field in the SU PPDUs sent by the STAUT = 0 (no fragmentation). 2. SU PPDUs sent by the STAUT contain HE-SIG-A with the following format: a. Format field in HE-SIG-A1 (B0) = 1 (HE SU PPDU) b. If the DUT is 20 MHz-Only STAUT, then Bandwidth field in HE-SIG-A1 (B19,B20) = 0 (20 MHz) else Bandwidth field in HE-SIG-A1 (B19,B20) = 2 (80 MHz) c. UL/DL field in HE-SIG-A1 (B2) = 1 (UL) 3. PPDU carrying QoS Data has an aggregate of > 64 MPDUs in at least 554S10_256_5G% of PPDUs If all the conditions above are true, then PASS else FAIL.

5.55 STAUT receives single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths tests

5.55.1 STAUT receives single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths test

Objective

This test case verifies that the STAUT correctly receives single TID A-MPDU with up to 256 MSDUs and no fragmentation in HE SU PPDU with different channel widths in the 2.4 GHz and 5 GHz bands.

Applicability: Optional. This test shall be executed only if the STAUT declared support for Compressed BlockAck (C-BA) fames with up to 256 MSDUs/A-MSDUs, with no fragmentation in Table 2.

References

Section 6.4.2.11 [1]

Section 9.3.1.8.2 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 dual band AP
- Wireless Sniffer

Test configuration

Table 271 defines the specific parameter values required for this test case.

Table 271. STAUT receives single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Qualcomm
AP Control Channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	20 MHz in 2.4 GHz 80 MHz in 5 GHz
Preamble format	HE_SU	HE_SU
HE Capabilities: Fragmentation Support field	N/A	0
Block Ack Parameter Set field: A-MSDU supported	N/A	0
Configure to use 256 BA	Enabled	Enabled

Parameter	STAUT value	Test bed AP1 value
ADDBA Request includes, Block Ack Parameter Set Field: Buffer Size value > 64 ADDBA Response includes, Block Ack Parameter Set Field: Buffer Size > 64		

Test procedure and expected results

Table 272 provides the specific test procedure and expected results for this test case.

Table 272. STAUT receives single TID compressed BA with up to 256 MSDUs, no fragmentation and channel widths test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure STAUT per Table 14 and Table 271.	Configure AP1 per Table 4 and Table 271.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 7.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and/or Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: Verify the following conditions are true. 1. Association between the STAUT and AP1 is successful. 2. In the Association Request frame transmitted by the STAUT, the Fragmentation Support field in the HE MAC Capabilities Information field within HE Capabilities element = 0 If all the conditions above are true, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size > 64.		SN: Verify the following conditions are true. 1. ADDBA Response frame sent by the STAUT has the following format a. Buffer size > 64 b. Dialog Token and TID fields match the values in ADDBA Request frame If all the above conditions are true, then CONTINUE else FAIL.
5		Run script HE1-AP1-STAUT-60.txt to STAUT.	Verify that AP1 sends PPDU carrying QoS Data with an aggregate of > 64 MPDUs in at least 5551S5_PPDU_24G% of PPDUs.	SN: Verify the following conditions are true. 1. STAUT responds with BA Type = Compressed BlockAck (BA Type field (B1-B4) in BA Control field= 2) as per Table 9-30a of [7] with the following format: a. The Fragment Number subfield (B3-B0) of the Block Ack Starting Sequence Control field within he BA information field = 4 (Fragmentation Level 3 OFF and Maximum number of MSDUs

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				acknowledged = 256) at least in 5551S5_BA_24G% of BAs If all the conditions above are true, then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, go to Step 7 else PASS.				
7	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
8	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		SN: Verify the following conditions are true. 1. Association between the STAUT and AP1 is successful. 2. In the Association Request frame transmitted by the STAUT, the Fragmentation Support field in HE MAC Capabilities Information field within HE Capabilities element = 0 If all the conditions above are true, then CONTINUE else FAIL.
9	The STAUT sends an ADDBA Response frame to AP1.	AP1 sends an ADDBA Request frame to the STAUT with Buffer Size > 64.		SN: Verify the following conditions are true. 1. ADDBA Response frame sent by the STAUT has the following format a. Buffer size > 64 b. Dialog Token and TID fields match the values in ADDBA Request frame If all the conditions above are true, then CONTINUE else FAIL.
10		Run script HE1-AP1-STAUT-60.txt to STAUT.	Verify that AP1 sends PPDU carrying QoS Data with an aggregate of > 64 MPDUs in at least 5551S10_PPDU_5G% of PPDUs.	SN: Verify the following conditions are true. 1. STAUT responds with BA Type = Compressed BlockAck (BA Type field (B1-B4) in BA Control field = 2) as per Table 9-30a of [7] with the following format: a. The Fragment Number subfield (B3-B0) of the Block Ack Starting Sequence Control field within the BA information field = 4 (Fragmentation Level 3 OFF and Maximum number of MSDUs acknowledged = 256) at least in 5551S10_BA_5G% of BAs If all the conditions above are true, then PASS else FAIL.

5.56 STAUT receives A-Control OM for ROM test

5.56.1 STAUT receives A-Control OM for ROM test

Objective

This test case verifies that the STAUT successfully receives the OM Control field within the HE Variant of HT Control field.

Applicability: Optional.This test shall be executed only if the STAUT declared support for receiving the OM Control field within the HE Variant of the HT Control field and 5 GHz in Table 2, or the STAUT declared support for receiving the OM Control field within the HE Variant of the HT Control field, 2.4 GHz and NSS > 1 in Table 2. Part of the test steps for NSS > 1 shall be executed only if the STAUT declared support for NSS > 1.

References

Section 6.4.2.17 [1]

Section 26.9.2 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 273 defines the specific parameter values required for this test case.

Table 273. STAUT receives A-Control OM for ROM test configuration

Parameter	STAUT value	AP1 value
Test bed vendor	N/A	Ruckus
Security	WPA2-Personal	WPA2-Personal
Encryption key	12345678	12345678
AP control channel	Default	6 for 2.4 GHz band 36 for 5 GHz band
Bandwidth	N/A	20 MHz in 2.4 GHz 80 MHz in 5 GHz
Spatial streams implemented	Default	Default
Transmit OM Control field in an MPDU that solicits an immediate response (Ack or BlockAck)	N/A	Enable

Test procedure and expected results

Table 274 provides the specific test procedure and expected results for this test case.

Table 274. STAUT receives A-Control OM for ROM test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	If the STAUT supports 5 GHz, go to Step 2 else go to Step 15.			
2	Configure the STAUT per Table 14 and Table 273.	Configure AP1 per Table 4 and Table 273.		
3	Configure the STAUT to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT.		
4	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame the STAUT.		SN: Verify the Association Request frame sent by the STAUT includes: 1. +HTC-HE field of the HE Capabilities element = 1 . 2. OM Control Support field of the HE Capabilities element= 1. If all the conditions above are true, then CONTINUE else FAIL.
5	If the STAUT supports > 1SS, go to Step 6 else go to Step 13.			
6	Run script DT2-DUT-AP_5.56.1.txt to AP using AC_BE for 20 seconds.			SN: If each PPDU sent by the STAUT to AP1 is 80 MHz wide and is a 2 SS PPDU, then CONTINUE else FAIL.
7	Run script DT2-DUT-AP_5.56.1.txt to AP using AC_BE for 20 seconds.	At time 2 seconds after traffic is initiated by the STAUT, configure AP1 to signal the STAUT with an OM Control field set to: 1. Rx NSS subfield= 0 (NSS = 1) 2. Channel Width subfield= 0 (BW = 20 MHz)	Verify that AP1 sends an MPDU with a OM Control field set to: 1. Rx NSS subfield = 0 (NSS = 1) 2. Channel Width subfield = 0 (BW =20 MHz	SN: Verify the following conditions are true: 1. STAUT acknowledges MPDU carrying OM Control field sent by AP1 2. The bandwidth and NSS of each PPDU sent by the STAUT to AP1 after 5561S7_TXOP_5G, following the acknowledgement of the MPDU with OMI from AP1 is: a. 20 MHz b. 1 SS 3. Measured throughput ≥ 5561S7_TP_5G / 8 If all the conditions above are true, then CONTINUE else FAIL.
8	Run script DT2-DUT-AP_5.56.1.txt to AP using AC_BE for 20 seconds.	At time 2 seconds after the traffic is initiated by the STAUT, configure AP1 to signal the STAUT OM Control field with: 1. Rx NSS subfield = 1 (NSS = 2) 2. Channel Width subfield= 0 (BW = 20 MHz)	Verify that AP1 sends MPDU with OM Control field with: 1. Rx NSS subfield = 1 (NSS = 2) 2. Channel Width subfield = 0 (BW = 20 MHz)	SN: Verify the following conditions are true: 1. STAUT acknowledges MPDU carrying OM Control field sent by AP1 2. The bandwidth and NSS of each PPDU sent by the STAUT to AP1 after 5561S8_TXOP_5G, following the acknowledgement of the MPDU with OMI from AP1 is: a. 20 MHz b. Uses no more than 2SS and there are PPDUs that are 2SS 3. Measured throughput ≥ 5561S8_TP_5G / 4. If all the conditions above are true, then CONTINUE else FAIL. If the DUT is 20 MHz-Only STAUT, then go to step 13 else CONTINUE

Step	STAUT	Test bed AP1	Test bed validation	Expected result
9	Run script DT2-DUT-AP_5.56.1.txt to AP using AC_BE for 20 seconds.	At time 2 seconds after traffic is initiated by the STAUT, configure AP1 to signal STAUT OM Control field with: 1. 1.Rx NSS subfield= 0 (NSS = 1) 2. 2.Channel Width subfield = 2 (BW = 80 MHz)	Verify that AP1 sends MPDU with OM Control field: 1. Rx NSS subfield = 0 (NSS = 1) 2. Channel Width subfield = 2 (BW = 80 MHz)	SN: Verify the following conditions are true: 1. STAUT acknowledges MPDU carrying OM Control field sent by AP1 2. The bandwidth and NSS of each PPDU sent by the STAUT to AP1 after 5561S9_TXOP_5G following the acknowledgement of the MPDU with OMI from AP1 is: a. 80 MHz b. 1 SS 3. Measured throughput ≥ 5561S9_TP_5G / 2 If all the conditions above are true, then CONTINUE else FAIL.
10	Run script DT2-DUT-AP_5.56.1.txt to AP1 using AC_BE for 20 seconds.			SN: If each PPDU sent by the STAUT to AP1 is an 80 MHz PPDU and uses 1 SS, then CONTINUE else FAIL.
11	Run script DT2-DUT-AP_5.56.1.txt to AP1 using AC_BE for 20 seconds.	At time 2 seconds after traffic is initiated by the STAUT, configure AP1 to signal STAUT an OM Control field with: 1. Rx NSS subfield = 0 (NSS = 1) 2. Channel Width subfield = 0 (BW = 20 MHz)	Verify that AP1 sends MPDU with OM Control field: 1. Rx NSS subfield = 0 (NSS = 1) 2. Channel Width subfield = 0 (BW = 20 MHz)	SN: Verify the following conditions are true: 1. STAUT acknowledges MPDU carrying OM Control field sent by AP1 2. The bandwidth and NSS of each PPDU sent by the STAUT to AP1 after 5561S11_TXOP_5G, following the acknowledgement of the MPDU with OMI from AP1 is: a. 20 MHz b. 1 SS 3. Measured throughput ≥ 5561S11_TP_5G / 8 If all the conditions above are true, then CONTINUE else FAIL.
12	Run script DT2-DUT-AP_5.56.1.txt to AP1 using AC_BE for 20 seconds.	At time 2 seconds after traffic is initiated by the STAUT, configure AP1 to signal STAUT an OM Control field with: 4. Rx NSS subfield = 0 (NSS=1) 5. Channel Width subfield = 2 (BW = 80 MHz)	Verify that AP1 sends MPDU with OM Control field: 1. Rx NSS subfield = 0 (NSS=1) 2. Channel Width subfield = 2 (BW = 80MHz)	SN: Verify the following conditions are true: 1. STAUT acknowledges MPDU carrying OM Control field sent by AP1 2. The bandwidth and NSS of each PPDU sent by the STAUT to AP1 after 5561S12_TXOP_5G, following the acknowledgement of the MPDU with OMI from AP1 is: a. 80 MHz or less but there are PPDUs at 80 MHz b. 1 SS 3. Measured throughput ≥ 5561S12_TP_5G / 2 If all the conditions above are true, then CONTINUE else FAIL.
13	If the STAUT supports 2.4 GHz and TX with NSS > 1, go to Step 14 else PASS.			
14	Configure the STAUT per Table 6 and Table 273.	Configure AP1 to operate in the 2.4 GHz band per Table 4 and Table 273.		
15	Configure STAUT to join AP1's BSS.	AP1 sends Beacon and Probe Response frames the STAUT.		
16	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame the STAUT.		SN: Verify the Association Request frame sent by the STAUT includes: 1. +HTC-HE field of the HE Capabilities element = 1. 2. OM Control Support field of the HE Capabilities element= 1.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				If all the conditions above are true, then CONTINUE else FAIL.
17				
18	Run script DT2-DUT-AP_5.56.1.txt to AP1 using AC_BE for 20 seconds.			SN: Verify the following conditions are true. If each PPDU sent by the STAUT to AP1 is 20 MHz, uses no more than 2 SS, and there are PPDUs that use 2 SS, then CONTINUE else FAIL.
19	Run script DT2-DUT-AP_5.56.1.txt to AP1 using AC_BE for 20 seconds.	At time 2 seconds after traffic is initiated by the STAUT, configure AP1 to signal STAUT OM Control field with: 1. Rx NSS subfield = 0 (NSS = 1) 2. Channel Width subfield = 0 (BW = 20 MHz)	Verify that AP1 sends MPDU with an OM Control field: 1. Rx NSS subfield = 0 (NSS = 1) 2. Channel Width subfield = 0 (BW = 20 MHz)	SN: Verify 1. STAUT acknowledges MPDU carrying OM Control field sent by AP1. 2. The bandwidth and NSS of each PPDU sent by the STAUT to AP1 after 5561S19_TXOP_24G following the acknowledgement of the MPDU with OMI from AP1 is: a. 20 MHz b. 1 SS 3. Measured throughput ≥ 5561S19_TP_24G / 2 If all the conditions above are true, then CONTINUE else FAIL..
20	Run script DT2-DUT-AP_5.56.1.txt to AP1 using AC_BE for 20 seconds.	At time 2 seconds after traffic is initiated by the STAUT, configure AP1 to signal STAUT OM Control field with: 1. Rx NSS subfield = 1 (NSS=2) 2. .Channel Width subfield = 0 (BW = 20MHz)	Verify that AP1 sends MPDU with OM Control field: 1. Rx NSS subfield = 1 (NSS=2) 2. Channel Width subfield = 0 (BW = 20MHz)	SN: Verify the following conditions are true: 1. STAUT acknowledges MPDU carrying OM Control field sent by AP1. 2. The bandwidth and NSS of each PPDU sent by the STAUT to AP1 after 5561S20_TXOP_24G, following the acknowledgement of the MPDU with OMI from AP1 is: a. 20 MHz b. 2 SS 3. Measured throughput ≥ 5561S20_TP_24G. If all the conditions above are true, then PASS else FAIL.

5.57 STAUT MU BFRP tests

5.57.1 STAUT MU BFRP for ≤4SS sounding dimension test

Objective

This test case verifies that the STAUT correctly receives NDPA/NDP and transmit full BW MU sounding feedback in HE TB PPDU after receiving a BFRP Trigger frame.

Applicability: If the STAUT declared primary device category as STA in Table 2, then it is Mandatory

If the STAUT declared primary device category as 20 MHz-only STA in Table 2 , then it is Optional and shall be executed only if the STAUT declared support for DL MU-MIMO RX in Table 2

References

Section 6.3.2.35 [1]

Section 9.3.1.22.3 and 26.7 [7]

Test environment

- STAUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 275 defines the specific parameter values required for this test case.

Table 275. STAUT MU BFRP for ≤4SS sounding dimension test configuration

Parameter	STAUT value	Test bed STA1 value	Test bed AP1 value
Test bed vendor	N/A	Qualcomm	Marvell
AP Control Channel	N/A	N/A	36 in 2.4 GHz 6 in 5 GHz
Bandwidth	Default	20 MHz in 2.4 GHz 80 MHz in 5 GHz 20 MHz in 5 GHZ if DUT Type is 20 MHz only STA	20 MHz in 2.4 GHz 80 MHz in 5 GHz
MU transmit beamformer	N/A	N/A	Enabled

Parameter	STAUT value	Test bed STA1 value	Test bed AP1 value
Number Of Sounding Dimensions ≤ 80 MHz in HE PHY Capabilities	N/A	N/A	3

Test procedure and expected results

Table 276 provides the specific test procedure and expected results for this test case.

Table 276. STAUT MU BFRP for ≤4SS sounding dimension test procedure and expected results

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 275.	Configure STA1 per Table 6 and Table 275.	Configure AP1 per Table 4 and Table 275.		
If the STAUT supports 5 GHz, go to Step 2 else go to Step 8.					
2	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure STA1 to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to STA1 and the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL. SN: If the HE PHY Capabilities Information field in the Association Request frame contains Beamformee STS ≤ 80 MHz subfield (B34:B36) ≥ 3, then CONTINUE else FAIL.
4			Configure AP1 to send a BFRP Trigger frame.		
5			Run script HE1-DLMUMIMO-STAUT.txt to the STAUT and STA1. Note that AP1 is expected to initiate MU sounding protocol against the STAUT and STA1.		
6	The STAUT sends a HE TB PPDU.	STA1 sends HE TB PPDU.		SN: Verify that in the NDPAthe value of codebook size is not set to 0 by AP1.	SN: Verify the following conditions are true: 1. HE TB PPDU from the STAUT is received after the BFRP Trigger frame. 2. HE MIMO Control field of the HE Compressed Beamforming feedback from STAUT contains the following subfields: a. Nc Index (B0:B2) ≤ Nr Index (B3:B5)

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
					b. Nc Index (B0:B2) = value of Nc field for STAUT in transmitted NDP Announcement frame c. Nr Index (B3:B5) = value of NSTS and Midamble Periodicity field in transmitted NDP d. BW (B6:B7) = value of the BW of the PPDU which carried the corresponding NDPA frame Note: HT PPDU cannot be used to transmit NDPA in 80 MHz sounding e. If NDPA was carried in non-HTPPDU without Signaling TA, then BW = 20 MHz f. If NDPA was carried in non-HT PPDU w/ Signaling TA, then BW is indicated in the scrambling seed used for NDPA g. Grouping (B8) = 0 h. Codebook Information (B9) = 1 i. Feedback type (B10:B11) = 1 j. Remaining Feedback Segments (B12:B14) = 0 k. First Feedback Segment (B15) = 1 l. RU Start Index (B16:B22) = value of RU Start Index for STAUT in transmitted NDP Announcement frame m. RU End Index (B23:B29) = value of RU End Index for STAUT in transmitted NDP Announcement frame n. Sounding Dialog Token Number (B30:B35) = value of Sounding Dialog Token Number field in the transmitted NDP Announcement frame. 3. Beamforming report Size (excluding MAC header, excluding FCS and including Category, HE Action, and HE MIMO Control) is according to Table 277, using the applicable MIMO control parameters. 4. LENGTH field in L-SIG (in BFR feedback) is identical to UL LENGTH field in BFRP TF (B4:B15). If all of the above conditions are true, then CONTINUE else FAIL.
7	The STAUT disassociates from AP1.	STA1 disassociates from AP1.			
If the STAUT supports 2.4 GHz, go to Step 8 else PASS.					

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
8	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	Configure STA2 to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to STA1 and the STAUT.		
9	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL. SN: If the HE PHY Capabilities Information field in the Association Request frame contains Beamformee STS ≤ 80 MHz subfield (B34:B36) ≥ 3, then CONTINUE, else FAIL.
10			Configure AP1 to send a BFRP Trigger frame.		
11			Run script HE1-DLMUMIMO-STAUT.txt to the STAUT and STA1. Note that AP1 is expected to initiate MU sounding protocol against the STAUT and STA1.		
12	The STAUT sends a HE TB PPDU.	STA1 sends HE TB PPDU.		Verify that in the NDPA the value of codebook size is not set to 0.	SN: Verify the following conditions are true: 1. HE TB PPDU from the STAUT is received after the BFRP Trigger frame. 2. HE MIMO Control field of the HE Compressed Beamforming feedback from STAUT contains the following subfields: a. Nc Index (B0:B2) ≤ Nr Index (B3:B5) b. Nc Index (B0:B2) = value of Nc field for STAUT in transmitted NDP Announcement frame c. Nr Index (B3:B5) = value of NSTS and Midamble Periodicity field in transmitted NDP d. BW (B6:B7) = value of the BW of the PPDU which carried the corresponding NDPA frame Note: HT PPDU cannot be used to transmit NDPA in 80 MHz sounding e. If NDPA was carried in non-HT PPDU without Signaling TA, then BW = 20 MHz f. If NDPA was carried in non-HT PPDU w/ Signaling TA, then BW is indicated in the scrambling seed used for NDPA g. Grouping (B8) = 0 h. Codebook Information (B9) = 1 i. Feedback type (B10:B11) = 1

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
					j. Remaining Feedback Segments (B12:B14) = 0 k. First Feedback Segment (B15) = 1 l. RU Start Index (B16:B22) = value of RU Start Index for STAUT in transmitted NDP Announcement frame m. RU End Index (B23:B29) = value of RU End Index for STAUT in transmitted NDP Announcement frame n. Sounding Dialog Token Number (B30:B35) = value of Sounding Dialog Token Number field in the transmitted NDP Announcement frame. 3. Beamforming report Size (excluding MAC header, excluding FCS and including Category, HE Action, and HE MIMO Control) is according to Table 277, using the applicable MIMO control parameters. 4. LENGTH field in L-SIG (in BFR feedback) is identical to UL LENGTH field in BFRP Trigger frame (B4:B15). If all of the above conditions are true, then PASS else FAIL.
13	The STAUT disassociates from AP1.	STA1 disassociate from AP1.			

Table 277. HE Compressed Beamforming and CQI frame size in octets for MU feedback and BW of 20MHz / 80MHz / 160MHz (excluding MAC header & FCS, including Category & Action & MIMO Control)

Nr x Nc	Feedback = MU [octets]		
	BW = 160MHz Grouping = 0 (Ng=4) Codebook Information = 1 {9,7}	BW = 80MHz Grouping = 0 (Ng=4) Codebook Information = 1 {9,7}	BW = 20MHz Grouping = 0 (Ng=4) Codebook Information = 1 {9,7}
2 x 1	1258	633	168
2 x 2	1510	759	201
3 x 1	2258	1133	296
3 x 2	3509	1759	457
4 x 1	3258	1633	424
4 x 2	5509	2759	713

5.57.2 STAUT MU BFRP test for 8SS sounding dimension test

Objective

This test case verifies that the STAUT correctly receives NDPA and 8 SS NDP and transmits full BW MU sounding feedback in HE TB PPDU after receiving a BFRP Trigger frame.

Applicability: Optional. This test shall be executed only if the STAUT declared support for successfully receiving HE NDPs with the number of STS up to 8 in Table 2. Not applicable for 20 MHz-Only STAUT.

References

Section 6.3.2.35 [1]

Section 9.3.1.22.3 and 26.7 [7]

Test environment

- STAUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 279 defines the specific parameter values required for this test case.

Table 278. STAUT MU BFRP test for 8SS sounding dimension test configuration

Parameter	STAUT value	Test bed STA1 value	Test bed AP1 value
Test bed vendor	N/A	Qualcomm	Qualcomm
AP Control Channel	N/A	N/A	36 in 5 GHz
Bandwidth	Default	80 MHz in 5 GHz	80 MHz in 5 GHz
MU transmit beamformer	N/A	N/A	Enabled
Beamformee STS ≤ 80 MHz	Default	7	N/A
Number Of Sounding Dimensions ≤ 80 MHz in HE PHY Capabilities	N/A	N/A	7

Test procedure and expected results

Table 279 provides the specific test procedure and expected results for this test case.

Table 279. STAUT MU BFRP test for 8SS sounding dimension test procedure and expected results

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 278.	Configure STA1 per Table 6 and Table 278.	Configure AP1 per Table 4 and Table 278 in the 5 GHz band.		
2	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure STA1 to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to STA1 and the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL. SN: If the HE PHY Capabilities Information field in the Association Request frame contains Beamformee STS ≤ 80 MHz subfield (B34:B36) = 7, then CONTINUE else FAIL.
4			Configure AP1 to send a BFRP Trigger frame.		
5			Run script HE1-DLMUMIMO-STAUT.txt. Note that AP1 is expected to initiate MU sounding protocol against the STAUT and STA1..		
6	The STAUT sends a HE TB PPDU.	STA1 sends a HE TB PPDU.			SN: Verify the following conditions are true: 1. HE TB PPDU from the STAUT is received after the BFRP Trigger frame. 2. Beamforming report feedback from STAUT is included in the TB PPDU, in its allocated RU and assigned MCS, NSS and coding. 3. HE MIMO Control field of the HE Compressed Beamforming feedback from STAUT contains the following subfields: a. Nc Index (B0:B2) ≤ Nr Index (B3:B5) b. Nc Index (B0:B2) = value of Nc field for STAUT in transmitted NDP Announcement frame c. Nr Index (B3:B5) = value of NSTS and Midamble Periodicity field in transmitted NDP d. BW (B6:B7) = value of the BW of the PPDU which carried the corresponding NDPA frame e. If NDPA was carried in HE PPDU, then BW field in the HE-SIG-A f. If NDPA was carried in VHT PPDU, then BW field in VHT-SIG-A

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
					g. If NDPA was carried in non-HT PPDU without Signaling TA, then BW = 20 MHz h. If NDPA was carried in non-HT PPDU with Signaling TA, then BW indicated in the scrambling seed used for NDPA i. Grouping (B8) = 0 j. Codebook Information (B9) = 1 k. Feedback type (B10:B11) = 1 l. Remaining Feedback Segments (B12:B14) = 0 m. First Feedback Segment (B15) = 1 n. RU Start Index (B16:B22) = value of RU Start Index for STAUT in transmitted NDP Announcement frame o. RU End Index (B23:B29) = value of RU End Index for STAUT in transmitted NDP Announcement frame p. Sounding Dialog Token Number (B30:B35) = value of Sounding Dialog Token Number field in the transmitted NDP Announcement frame. 4. Beamforming report Size (excluding MAC header, excluding FCS and including Category, HE Action, and HE MIMO Control) is according to Table 280, using the applicable MIMO control parameters. 5. LENGTH field in L-SIG (in BFR feedback) is identical to LENGTH field in BFRP Trigger frame (B4:B15). If all of the above conditions are true, then PASS else FAIL.
7	The STAUT disassociates from AP1.	STA1 disassociates from AP1.			

Table 280. HE Compressed Beamforming and CQI frame size in octets for MU feedback and BW of 20MHz / 80MHz for 8SS sounding (excluding MAC header & FCS, including Category & Action & MIMO Control)

Nr x Nc	Feedback = MU [octets]
	BW = 80MHz Grouping = 0 (Ng=4) Codebook Information = 1 {9,7}
8 x 1	3633
8 x 2	6759

Nr x Nc	Feedback = MU [octets] BW = 80MHz Grouping = 0 (Ng=4) Codebook Information = 1 {9,7}
8 x 3	9385
8 x 4	11511

5.57.3 (Deleted)

5.58 STAUT DL MU-MIMO tests

5.58.1 STAUT DL MU-MIMO test

Objective

This test case verifies that the STAUT correctly receives DL MU-MIMO PPDUs.

Applicability: If the STAUT declared primary device category as STA in Table 2, then it is Mandatory

If the STAUT declared primary device category as 20 MHz-only STA in Table 2 , then it is Optional and shall be executed only if the STAUT declared support for DL MU-MIMO RX in Table 2

References

Section 6.3.2.3 [1]

Section 27.3.3.1 [7]

Test environment

- STAUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 281 defines the specific parameter values required for this test case.

Table 281. STAUT DL MU-MIMO test configuration

Parameter	STAUT value	Test bed STA1 value	Test bed AP1 value
Test bed vendor	N/A	Intel200L	Qualcomm
AP control channel	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz 20 MHz in 5 GHZ if DUT Type is 20 MHz only STA	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	N/A	N/A	DL MU-MIMO (HE_MU)
MU transmit beamformer	N/A	N/A	Enabled

Test procedure and expected results

Table 282 provides the specific test procedure and expected results for this test case.

Table 282. STAUT DL MU-MIMO test procedure and expected results

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 281.	Configure STA1 per Table 6 and Table 281.	Configure AP1 per Table 4 and Table 281.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 9.					
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	Configure STA1 to join AP1's BSS in the 2.4 GHz band.	Configure AP1 to the 2.4 GHz band. AP1 sends Beacon and Probe Response frames to STA1 and the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
4	STAUT sends an ADDBA Response frame to AP1	STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame with Buffer Size ≤ 64.		
5			Configure AP1 to transmit DL MU-MIMO with Ack Policy set to Block Ack.		
6			At AP1, run script HE1-DLMUMIMO-STAUT.txt to the STAUT.and STA1		SN: If the STAUT transmits C-BA in response to the BAR, then CONTINUE else FAIL.
7			Configure AP1 to transmit DL MU-MIMO PPDU with Ack Policy set to Normal Ack to the STAUT.		
8			At AP1, run script HE1-DLMUMIMO-STAUT.txt to the STAUT and STA1.		SN: If the STAUT transmits C-BA or Ack after DL MU-MIMO PPDU, then CONTINUE else FAIL.
If the STAUT supports 5 GHz, go to Step 9 else PASS.					
9	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure STA1 to join AP1's BSS in the 5 GHz band.	Configure AP1 to the 5 GHz band. AP1 sends Beacon and Probe Response frames to STA1 and the STAUT.		
10	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame the STAUT and STA1.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
11	STAUT sends an ADDBA Response frame to AP1	STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame with Buffer Size ≤ 64.		
12			Configure AP1 to transmit DL MU-MIMO PPDU with Ack Policy set to Block Ack.		
13			At AP1, run script HE1-DLMUMIMO-STAUT.txt to the STAUT and STA1.		SN: If the STAUT transmits C-BA in response to BAR, then CONTINUE else FAIL.
14			Configure AP1 to transmit DL MU-MIMO with Ack Policy set to Normal Ack to the STAUT.		
15			At AP1, run script HE1-DLMUMIMO-STAUT.txt to the STAUT and STA1.		SN: If the STAUT transmits C-BA or Ack after DL MU-MIMO PPDU, then PASS else FAIL.

5.59 STAUT UL MU pre-correction test

5.59.1 STAUT UL MU pre-correction time and frequency test

Objective

This test case verifies that the STAUT performs time and frequency pre-correction for HE TB PPDU transmissions. The CTT measures the timing based on OFDM timing synchronization instead of the RF energy.

Applicability: Mandatory

References

Section 6.3.2.4 [1]

Section 17.3.9.10 [7]

Test environment

- STAUT
- CTT captures the PPDUs carrying the Trigger frame and HE TB PPDUs, and provides necessary measurement results
- Test bed AP1

  Note: If the CTT can act as an AP, then the CTT may serve the role of AP as well. Otherwise, a test bed AP (Wi-Fi CERTIFIED 6 dual band AP) shall be used as the AP.

- Wireless Sniffer

Test configuration

Table 283 defines the specific parameter values required for this test case.

Table 283. STAUT UL MU pre-correction time and frequency configuration

Parameter	STAUT value	Test bed AP1 value	CTT acting as a test bed device value
Test bed vendor	N/A	Qualcomm	CTT
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
MU functionality	N/A	Enable UL OFDMA	Enable UL OFDMA

Test procedure and expected results

Table 284 provides the specific test procedure and expected results for this test case.

Table 284. STAUT UL MU pre-correction time and frequency procedure and expected results

Step	STAUT	Test bed AP1	CTT acting as test bed device	CTT validation	Expected result
If the STAUT supports 2.4 GHz, then go to Step 1 else go to Step 7.					
1	Configure the STAUT per Table 14 and Table 283.	Configure the AP1 to the 2.4 GHz band per Table 4 and Table 283. AP1 transmits the Beacon frames	Configure the CTT to the 2.4 GHz per Table 283. Note - If the CTT is not acting as AP1, then ensure that the CTT can observe the Trigger frames and HE TB PPDUs with good signal quality to make accurate measurements.		
2	Configure the STAUT to join AP1's BSS.				SN: If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL. Note - If the CTT is also acting as the AP1, then an association failure may not necessary indicate an issue in the STAUT since the CTT is not a Wi-Fi CERTIFIED 6 AP.
3	Obtain the Beacon RSSI reported by the STAUT.				If the Beacon RSSI reported by the STAUT is within the range of -55 ~ -35 dBm, then CONTINUE. Else adjust the placement of STAUT and AP1 such that the reported Beacon RSSI from the STAUT is within the range of -55 ~ -35 dBm and then CONTINUE else FAIL.
4		Configure AP1 to transmit Trigger frames using Non-HT PPDU format to solicit HE TB PPDU from STAUT per Table 4 and the following parameters: 1. Trigger Common Info field: a. UL BW = 0 (20 MHz) b. GI And LTF Type = 1 (6.4 µs LTF + 1.6 µs GI) 2. User Info fields a. RU Allocation = 242-tone RU b. Coding = BCC c. MCS = MCS0	Configure the CTT to make 5591S4_CTT_24G measurements of the following: 1. CFO error: Carrier frequency offset difference between each Trigger frame and the corresponding HE TB PPDU 2. Timing gap: Timing gap between the end of each Trigger frame and the corresponding HE TB PPDU		

Step	STAUT	Test bed AP1	CTT acting as test bed device	CTT validation	Expected result
		d. NSS = 0 (1SS) If the CTT is acting as AP1, then the CTT may choose to send the Trigger frame when performing measurements. Otherwise, configure the AP1 to transmit Trigger frames about every 20 msec.			
5			Read back the 5591S4_CTT_24G measurements from the CTT.	Verify that at least 5591S5_CFO_24G out of the 5591S4_CTT_24G measurements of the CFO error are within -5591S5_ERR_24G~ +5591S5_ERR_24G. Verify that at least 5591S5_GAP_24G out of the 5591S4_CTT_24G measurements of the timing gap are within 15.6 ~ 16.4 µsec.	
6	Disassociate the STAUT from AP1.				
If the STAUT supports 5 GHz, then go to Step 7 else PASS.					
7	Configure the STAUT per Table 6 and Table 283.	Configure the AP1 to the 5 GHz band per Table 4 and Table 283.	Configure the CTT to the 5 GHz per Table 283.		
8	Repeat Steps 2-3.	Repeat Steps 2-3.	Repeat Steps 2-3.	Repeat Steps 2-3.	If the verification in Steps 2-3 is successful, then CONTINUE else FAIL.
9		Configure AP1 to transmit Trigger frames using Non-HT PPDU format to solicit HE TB PPDU from STAUT per Table 4 and the following parameters: 1. Trigger Common Info field: a. If the DUT is 20 MHz-only STAUT, then UL BW = 0 (20 MHz) else UL BW = 2 (80 MHz) b. GI And LTF Type = 1 (6.4 µs LTF + 1.6 µs GI) 2. User Info fields a. If the DUT is 20 MHz-only STAUT, then RU Allocation =	Configure the CTT to make 5591S9_CTT_5G measurements of the following: 1. CFO error: Carrier frequency offset difference between each Trigger frame and the corresponding HE TB PPDU 2. Timing gap: Timing gap between the end of each Trigger frame and the corresponding HE TB PPDU		

Step	STAUT	Test bed AP1	CTT acting as test bed device	CTT validation	Expected result
		106-tone RU else RU Allocation = 996-tone RU b. Coding = LDPC c. MCS = MCS0 d. NSS = 0 (1SS) If the CTT is acting as AP1, then the CTT may choose to send the Trigger frame when performing measurements. Otherwise, configure the AP1 to transmit Trigger frames about every 20 msec.			
10			Read back the 5591S9_CTT_5G measurements from the CTT.	Verify that at least 5591S10_CFO_5G out of the 5591S9_CTT_5G measurements of the CFO error are within -5591S10_ERR_5G~ +5591S10_ERR_5G. Verify that at least 5591S10_GAP_5G out of the 5591S9_CTT_5G measurements of the timing gap are within 15.6 ~ 16.4 µsec.	
11	Disassociate the STAUT from AP1.				

5.59.2 STAUT UL MU Pre-correction power test

Objective

This test case verifies that the STAUT performs TX power pre-correction for HE TB PPDU transmissions.

Note:The CTT measures the timing based on OFDM timing synchronization instead of the RF energy.

Applicability: Mandatory

References

Section 6.3.2.5 [1]

Section 27.3.14.2 [7]

Test environment

- STAUT
- CTT (Conformance Test Tool) captures the PPDUs carrying the Trigger frame and HE TB PPDUs, and provides necessary measurement results
- Test bed AP1

  Note: If the CTT can act as an AP, then the CTT may serve the role of AP as well. Otherwise, a test bed AP (Wi-Fi CERTIFIED 6 AP) shall be used as the AP.

- Wireless Sniffer

Test configuration

Table 285 defines the specific parameter values required for this test case.

Table 285. STAUT UL MU Pre-correction power test configuration

Parameter	STAUT value	Test bed AP1 value	CTT acting as a test bed device value
Test bed vendor	N/A	Broadcom	CTT
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	N/A	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Transmit Trigger frames with constant transmit power	N/A	Enabled	N/A
MU functionality	N/A	Enable UL OFDMA	Enable UL OFDMA

Test procedure and expected results

Table 286 provides the specific test procedure and expected results for this test case.

Table 286. STAUT UL MU Pre-correction power test procedure and expected results

Step	STAUT	Test bed AP1	CTT acting as test bed device	CTT and test bed validation	Expected result
If the STAUT supports 2.4 GHz, then go to Step 1 else go to Step 10.					
1	Configure the STAUT to the 2.4 GHz band per Table 14 and Table 285.	Configure the AP1 to the 2.4 GHz band per Table 4 and Table 285.	Configure the CTT to the 2.4 GHz per Table 285. Note - If the CTT is not acting as AP1, ensure that the CTT can observe the Trigger frames and HE TB PPDUs with good signal quality to be able to make accurate measurements.		
2	Configure the STAUT to join AP1's BSS.			SN: Verify the BSR Support in the HE MAC Capabilities Information field of the HE Capabilities element in Beacon frames transmitted by AP1 = 0 (not supported).	SN: Log the value of the Device Class subfield of the HE PHY Capabilities Information of the HE Capabilities element in the Association Request frame transmitted by the STAUT. If the association between the STAUT and AP1 is successful, then CONTINUE; else FAIL. Note - If the CTT is also acting as the AP1, then an association failure may not necessary indicate an issue in the STAUT since the CTT is not a Wi-Fi CERTIFIED 6 AP.
3					If the Beacon RSSI reported by the STAUT is within the range of -55 ~ -35 dBm, then CONTINUE else adjust the placement of STAUT and AP1 such that the Beacon RSSI is within the range of -55 ~ -35 dBm and then CONTINUE.
4					Let TARGET_RSSI_1 = 70 (-40 dBm).
5		Configure the AP1 to transmit Trigger frames using Non-HT PPDU format to solicit HE TB PPDU from STAUT per Table 4 and the following parameters: 1. Trigger Common Info field: a. UL BW = 0 (20 MHz) b. GI And LTF Type = 1 (6.4 µs LTF + 1.6 µs GI)	Measure the power of HE TB PPDUs transmitted by STAUT, averaged over 100 HE TB PPDUs. Let AVG_TB_PPDU_PWR_1 be this average power of HE TB PPDUs.		SN: Log the values of • UL Power Headroom subfield and • Minimum Transmit Power Flag subfield of the UPH Control subfield in 100 HE TB PPDUs transmitted by the STAUT. Let AVG_UPH_1 be the average value of these 100 UPH values.

Step	STAUT	Test bed AP1	CTT acting as test bed device	CTT and test bed validation	Expected result
		c. UL Target RSSI = TARGET_RSSI_1 2. User Info fields a. RU Allocation = 242-tone RU b. Coding = BCC c. MCS = MCS0 d. NSS = 0 (1SS) Configure the AP1 to transmit Trigger frames about every 20 msec.			If TARGET_RSSI_1= 80 (-30 dBm) and Any of the 100 HE TB PPDUs captured has the Minimum Transmit Power Flag = 1, then re-adjust the location of the devices such that there is higher pathloss between AP1 and STAUT. Go to Step 2. Else, if any of the 100 HE TB PPDUs captured has the Minimum Transmit Power Flag = 1, then update TARGET_RSSI_1 using the following equation, and re-run Step 5. TARGET_RSSI_1 = min(TARGET_RSSI_1 + 2, 80); Else if AVG_UPH_1 is < 10 (10 dB), then update TARGET_RSSI_1 using the following equation, and re-run Step 5. TARGET_RSSI_1 = max(TARGET_RSSI_1 - 13 + AVG_UP_1, 0); Else go to Step 6.
6					Let TARGET_RSSI_2 = TARGET_RSSI_1 + 10
7		Configure the AP1 to transmit Trigger frames using Non-HT PPDU format to solicit HE TB PPDU from STAUT per Table 4 and the following parameters: 3. Trigger Common Info field: a. UL BW = 0 (20 MHz) b. GI And LTF Type = 1 (6.4 µs LTF + 1.6 µs GI) c. UL Target RSSI = TARGET_RSSI_2 4. User Info fields a. RU Allocation = 242-tone RU b. Coding = BCC c. MCS = MCS0 d. NSS = 0 (1SS)	Measure the power of HE TB PPDUs transmitted by STAUT, averaged over 100 HE TB PPDUs. Let AVG_TB_PPDU_PWR_2 be this average power of HE TB PPDUs.		SN: Log the value of UL Power Headroom subfield of the UPH Control subfield in 100 HE TB PPDUs transmitted by the STAUT. Let AVG_UPH_2 be the average value of these 100 UPH values.

Step	STAUT	Test bed AP1	CTT acting as test bed device	CTT and test bed validation	Expected result
		Configure the AP1 to transmit Trigger frames about every 20 msec.			
8					Let UPH_DELTA = AVG_UPH_1 - AVG_UPH_2 TB_PWR_DELTA = AVG_TB_PPDU_PWR_2 - AVG_TB_PPDU_PWR_1 If the Device Class value logged in Step 2 = 1 (Class A), let • RSSI_DIFF_MARGIN = 5592S8_RSSI_A_24G Else (Class B), let • RSSI_DIFF_MARGIN = 5592S8_RSSI_B_24G If UPH_DELTA >10 + RSSI_DIFF_MARGIN, or UPH_DELTA < 10 - RSSI_DIFF_MARGIN then FAIL, else CONTINUE. If TB_PWR_DELTA - UPH_DELTA > 4, or TB_PWR_DELTA - UPH_DELTA < -4, then FAIL, else CONTINUE.
9	Disassociate STAUT from AP1.				
If the STAUT supports 5 GHz, then go to Step 10 else PASS.					
10	Configure the STAUT to the 5 GHz band per Table 14 and Table 285.	Configure the AP1 to the 5 GHz band per Table 4 and Table 285.	Configure the CTT to the 5 GHz per Table 285.		
9	Repeat Steps 2-4.				If the verification in Steps 2-4 is successful, then CONTINUE else FAIL.
10		Configure AP1 to transmit Trigger frames using Non-HT duplicate PPDU format. 5. Trigger Common Info field: a. If the DUT is 20 MHz-only STAUT, then UL BW = 0 (20 MHz) else UL BW = 2 (80 MHz)	Measure the power of HE TB PPDUs transmitted by STAUT, averaged over 100 HE TB PPDUs. Let AVG_TB_PPDU_PWR_1 be this average power of HE TB PPDUs.		SN: Log the values of • UL Power Headroom subfield and • Minimum Transmit Power Flag subfield of the UPH Control subfield in 100 HE TB PPDUs transmitted by STAUT.

Step	STAUT	Test bed AP1	CTT acting as test bed device	CTT and test bed validation	Expected result
		b. GI And LTF Type = 1 (6.4 µs LTF + 1.6 µs GI) c. UL Target RSSI = TARGET_RSSI_1 6. User Info fields a. If the DUT is 20 MHz-only STAUT, then RU Allocation = 106-tone RU else RU Allocation = 996-tone RU b. Coding = LDPC c. MCS = MCS0 d. NSS = 0 (1SS) Configure the AP1 to transmit Trigger frames about every 20 msec.			Let AVG_UPH_1 be the average value of these 100 UPH values. If TARGET_RSSI_1= 80 (-30 dBm) and Any of the 100 HE TB PPDUs captured has the Minimum Transmit Power Flag = 1, then re-adjust the location of the devices such that there is higher pathloss between AP1 and STAUT. Go to Step 8. Else if any of the 100 HE TB PPDUs captured has the Minimum Transmit Power Flag = 1, then update TARGET_RSSI_1 using the following equation, and re-run Step 9. Let TARGET_RSSI_1 = min(TARGET_RSSI_1 + 2, 80); Else if AVG_UPH_1 is < 10 (10 dB), then update TARGET_RSSI_1 using the following equation, and re-run Step 9. TARGET_RSSI_1 = max(TARGET_RSSI_1 - 13 + AVG_UP_1, 0); Else go to Step 10.
11					Let TARGET_RSSI_2 = TARGET_RSSI_1 + 10
12		Configure the AP1 to transmit Trigger frames using Non-HT duplicate PPDU format. 1. Trigger Common Info field: a. If the DUT is 20 MHz-only STAUT, then UL BW = 0 (20 MHz) else UL BW = 2 (80 MHz) b. GI And LTF Type = 1 (6.4 µs LTF + 1.6 µs GI) c. UL Target RSSI = TARGET_RSSI_2 2. User Info fields	Measure the power of HE TB PPDUs transmitted by STAUT, averaged over 100 HE TB PPDUs. Let AVG_TB_PPDU_PWR_2 be this average power of HE TB PPDUs.		SN: Log the value of UL Power Headroom subfield of the UPH Control subfield in 100 HE TB PPDUs transmitted by STAUT. Let AVG_UPH_2 be the average value of these 100 UPH values.

Step	STAUT	Test bed AP1	CTT acting as test bed device	CTT and test bed validation	Expected result
		a. If the DUT is 20 MHz-only STAUT, then RU Allocation = (106-tone RU) else RU Allocation = 996-tone RU b. Coding = LDPC c. MCS = MCS0 d. NSS = 0 (1SS) Configure the AP1 to transmit Trigger frames about every 20 msec.			
13	Repeat Steps 8-9.				The verification in Steps 8-9 is the same except: • RSSI_DIFF_MARGIN = 5592S12_RSSI_A_5G in Step 8 • RSSI_DIFF_MARGIN = 5592S12_RSSI_B_5G in Step 8 If the verification in Steps 8-9 is successful, then PASS else FAIL.

5.60 STAUT individual TWT tests

5.60.1 STAUT individual TWT test

Objective

This test case verifies that the STAUT correctly negotiates an individual TWT (iTWT) setup with the AP if the STAUT supports iTWT functionality.

Applicability: Optional. This test shall be executed only if the STAUT declared support for iTWT in Table 2.

References

Section 6.4.2.15 [1]

Section 26.8.1 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 287 defines the specific parameter values required for this test case.

Table 287. STAUT individual TWT test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	If DUT is 20 MHz-only STA, use Ruckus else Qualcomm
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Channel width	Default	20 MHz for 2.4 GHz 80 MHz for 5 GHz
TWT Responder Support	N/A	Enabled
Spatial streams	Default	1

Test procedure and expected results

Table 288 provides the specific test procedure and expected results for this test case.

Table 288. STAUT individual TWT test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 18.			
2	Configure the STAUT per Table 14 and Table 287 in the 2.4 GHz band. Configure the STAUT to NSS Limit of 1. Enable Power Save mode on the STAUT.	Configure AP1 per Table 4 and Table 287 in the 2.4 GHz band. Configure AP1's MU EDCA parameters per Table 5. Configure AP1 to NSS Limit of 1.		
3	Configure the STAUT to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT.		
4	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame the STAUT.		SN: Verify the following conditions are true: 1. STAUT transmits an Association Request with: a. TWT Requester Support field in the Extended Capabilities element = 1 b. TWT Requester Support of the HE Capabilities element = 1 2. STAUT association succeeds. If all of the above conditions are true, then CONTINUE else FAIL.
5	If the STAUT supports announced TWT, go to Step 6 else go to Step 11.			
6	Configure the STAUT to request an individual TWT with the following parameters: 1. Control field = 0x00 a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type =0 2. Request Type field: a. TWT Request = 1 b. TWT Setup Command = 1 (Suggest TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 0 (announced) f. TWT Flow ID = any g. TWT Wake Interval Exponent = 10 h. TWT Protection = 0 i. Target Wake Time = any j. Nominal Minimum TWT Wake Duration = 255 (65.280 ms) k. TWT Wake Interval Mantissa = 512 (512 TU) l. TWT Channel = 0	AP1 transmits a TWT Response frame with an Accept TWT.		SN: Verify the following conditions are true: 1. STAUT transmits a TWT Request with the following parameters: a. Control field: ▪ NDP Paging Indicator = 0 ▪ Responder PM Mode = 0 ▪ Negotiation Type =0 (B2:B3) b. Request Type field: ▪ TWT Request = 1 ▪ TWT Setup Command = 1 (Suggest TWT) ▪ Trigger = 1 ▪ Implicit = 1 ▪ Flow Type = 0 (announced) ▪ TWT Flow ID = Any as per [7] ▪ TWT Wake Interval Exponent = 10 ▪ TWT Protection = 0 ▪ Target Wake Time = any

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				▪ Nominal Minimum TWT Wake Duration = 255 (65.280 ms) ▪ TWT Wake Interval Mantissa = 512 (512 TU) ▪ TWT Channel = 0 2. AP1 transmits a TWT Response frame to the STAUT and capture the TWT ID from the TWT Response frame. If all of the above conditions are true, then CONTINUE else FAIL.
7		At AP1, run script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the downlink throughput at the STAUT is < 5601S7_DLTP_24G: 5601_alpha*63.75TU / 512TU * SU_Throughput, then FAIL else CONTINUE. SN: Verify the following conditions are true: 1. Within a randomly selected window of 2.097 seconds, verify that > 92% of the PPDU transmissions from AP1 to STAUT are within TWT SPs (add 5601_Tolereance_SP_Start µs margin for SP start time, and 5601_Tolereance_SP_End µs margin for SP end time) with start times separated by 512 TUs 2. At least one UL PS-Poll, UL QoS Null or UL QoS Data frame from STAUT to AP1 occurs before any DL PPDU transmissions from AP1 to STAUT within a sampled TWT SP. If all of the above conditions are true, then CONTINUE, otherwise FAIL.
8	At the STAUT, run script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE.	At AP1, turn off script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the uplink throughput at the STAUT is < 5601S8_ULTP_24G: (5601_SP_alpha*63.75TU / 512TU * SU_Throughput), then FAIL else CONTINUE. SN: Within a randomly selected window of 2.097 seconds, if > 92% of the PPDU transmissions from STAUT to AP1 are within TWT SPs (add 5601_Tolereance_SP_Start µs margin for SP start time, and 5601_Tolereance_SP_End µs margin for SP end time) with start times separated by 512 TUs, then CONTINUE else FAIL..
9	At the STAUT, turn off script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE Configure the STAUT for TWT Teardown to terminate the existing TWT agreement.			SN: Verify that the STAUT sends a TWT Teardown frame with the TWT ID corresponding to the TWT ID from the TWT Response frame that was sent in Step 5 then CONTINUE else FAIL. If the STAUT transmits a TWT Teardown frame to AP1, but some of the parameters do not correspond to

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				the description above in step 6, then FAIL else CONTINUE.
10	If the STAUT supports unannounced TWT, go to Step 11 else PASS.			
11	Configure the STAUT to request an individual TWT with the following parameters: 1. Control field = 0x00 a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type =0 2. Request Type field: a. TWT Request = 1 b. TWT Setup Command = 0 or 1 (Request TWT or Suggest TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 1 (unannounced) f. TWT Flow ID = any g. TWT Wake Interval Exponent = 0 h. TWT Protection = 0 i. Target Wake Time = any j. Nominal Minimum TWT Wake Duration = 64 (16 TU) k. TWT Wake Interval Mantissa = 32768 (32 TU) l. TWT Channel = 0	AP1 transmits a TWT Response frame with Accept TWT.		SN: Verify the following conditions are true: 1. STAUT transmits a TWT Request with the following parameters: a. Control field: ▪ NDP Paging Indicator = 0 ▪ Responder PM Mode = 0 ▪ Negotiation Type =0 b. Request Type field: ▪ TWT Request = 1 ▪ TWT Setup Command = 0 or 1 (Request or Suggest TWT) ▪ Trigger = 1 ▪ Implicit = 1 ▪ Flow Type = 1 (unannounced) ▪ TWT Flow ID = Any per [7] ▪ TWT Wake Interval Exponent = 0 ▪ TWT Protection = 0 ▪ Target Wake Time = any, if TWT Setup command value is 1, or 0, if TWT Setup command is 0 ▪ Nominal Minimum TWT Wake Duration = 64 (64 TU) ▪ TWT Wake Interval Mantissa = 32768 (32 TU) ▪ TWT Channel = 0 2. AP1 transmits a TWT Response frame to the STAUT and capture the TWT ID from the TWT Response frame. If all of the above conditions are true, then CONTINUE else FAIL.
12	At the STAUT, turn off script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE.	At AP1, run script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the downlink throughput at the STAUT is < 5601S12_DLTP_24G: (5601_alpha*16TU / 32TU * SU_Throughput), then FAIL else CONTINUE. SN: Within a randomly selected window of 0.131 seconds, if > 92% of the PPDU transmissions from AP1 to the STAUT are within TWT SPs (add 5601_Tolereance_SP_Start µs us margin for SP start time, and 5601_Tolereance_SP_End µs margin for

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				SP end time) with start times separated by 32 TU, then CONTINUE else FAIL.
13	At the STAUT, run script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE.	At AP1, turn off script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the uplink throughput at the STAUT is < 5601S13_ULTP_24G: (5601_SP_alpha*16TU / 32TU * SU_Throughput,) then FAIL else CONTINUE. SN: Within a randomly selected window of 0.131 seconds, if > 92% of the PPDU transmissions from STAUT to AP1 are within TWT SPs (add 5601_Tolereance_SP_Start µs margin for SP start time, and 5601_Tolereance_SP_End µs margin for SP end time) with start times separated by 32 TU, then CONTINUE else FAIL.
14	At the STAUT, turn off script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE. Configure the STAUT for TWT Teardown to terminate TWT agreement.			SN: If the STAUT sends a TWT Teardown frame with the TWT ID corresponding to the TWT ID of the TWT Response frame that was sent in Step 11, then CONTINUE else FAIL. If the STAUT transmits a TWT Teardown frame to AP1, but some of the parameters do not correspond to the description above, then FAIL else CONTINUE.
15	Configure the STAUT to request an individual TWT with parameters: 1. Control field = 0x00 a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type =0 2. Request Type field: a. TWT Request = 1 b. TWT Setup Command = 0 or 1 (Request TWT or Suggest TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 1 (unannounced) f. TWT Flow ID = any g. TWT Wake Interval Exponent = 1 h. TWT Protection = 0 i. Target Wake Time = any j. Nominal Minimum TWT Wake Duration = 40 (10 TU) k. TWT Wake Interval Mantissa = 51200 (100 TU) l. TWT Channel = 0	AP1 transmits a TWT Response frame with Accept TWT.		SN: Verify the following conditions are true: 1. STAUT transmits a TWT Request with the following parameters: a. Control field: ▪ NDP Paging Indicator = 0 ▪ Responder PM Mode = 0 ▪ Negotiation Type =0 (B2:B3 b. Request Type field: ▪ TWT Request = 1 ▪ TWT Setup Command = 0 or 1 (Request or Suggest TWT) ▪ Trigger = 1 ▪ Implicit = 1 ▪ Flow Type = 1 (unannounced) ▪ TWT Flow ID = Any per [7] ▪ TWT Wake Interval Exponent = 1 ▪ TWT Protection = 0 ▪ Target Wake Time = any, if TWT Setup command value is 1, or 0, if TWT Setup command is 0 ▪ Nominal Minimum TWT Wake Duration = 40 (10 TU)

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				▪ TWT Wake Interval Mantissa = 51200 (100 TU) ▪ TWT Channel = 0. If all of the above conditions are true, then CONTINUE else FAIL.
16	At the STAUT, turn off script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE.	At AP1, run script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the downlink throughput at the STAUT is < 5601S16_DLTP_24G, then FAIL else CONTINUE. SN: Within a randomly selected window of 0.410 seconds, if > 92% of the PPDU transmissions from AP1 to the STAUT are within TWT SPs (add 5601_Tolereance_SP_Start µs margin for SP start time, and 5601_Tolereance_SP_End µs margin for SP end time) with start times separated by 100 TU, then CONTINUE else FAIL.
17	At the STAUT, run script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE.	At AP1, turn off script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the uplink throughput at the STAUT is < 5601S17_ULTP_24G: (5601_alpha * 10TU / 100TU * SU_Throughput), then FAIL else CONTINUE. SN: Within a randomly selected window of 0.410 seconds, if > 92% of the PPDU transmissions from STAUT to AP1 are within TWT SPs(add 5601_Tolereance_SP_Start µs margin for SP start time, and 5601_Tolereance_SP_End µs margin for SP end time) with start times separated by 100 TU, then CONTINUE else FAIL.
18	If the STAUT supports the 5 GHz band, then go to Step 18 else PASS.			
19	Configure the STAUT per Table 6 and Table 287.Configure the STAUT in the 5 GHz band. Configure the STAUT to NSS Limit of 1. Enable Power Save mode on the STAUT.	Configure AP1 per Table 4 and Table 287. in the 5 GHz band. Configure AP1's MU EDCA parameters per Table 5. Configure AP1 to NSS Limit of 1.		
20	Configure the STAUT to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT.		
21	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame the STAUT.		SN: Verify the following conditions are true: 1. STAUT transmits an Association Request with: a. TWT Requester Support field in the Extended Capabilities element = 1 b. TWT Requester Support of the HE Capabilities element = 1 2. STAUT association succeeds. If all of the above conditions are true, then CONTINUE else FAIL.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
22	If the STAUT supports announced TWT, go to Step 23 else go to Step 27.			
23	Configure the STAUT to request an individual TWT with parameters: 1. Control field = 0x00 a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type =0 2. Request Type field: a. TWT Request = 1 b. TWT Setup Command = 1 (Suggest TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 0 (announced) f. TWT Flow ID = any g. TWT Wake Interval Exponent = 10 h. TWT Protection = 0 i. Target Wake Time = any j. Nominal Minimum TWT Wake Duration = 255 (65.280 ms) k. TWT Wake Interval Mantissa = 512 (512 TU) l. TWT Channel = 0	AP1 transmits a TWT Response frame with Accept TWT.		SN: Verify the following conditions are true: 1. STAUT transmits a TWT Request with the following parameters: a. Control field: • NDP Paging Indicator = 0 • Responder PM Mode = 0 • Negotiation Type =0 (B2:B3 2. Request Type field: a. TWT Request = 1 b. TWT Setup Command = 1 (Suggest TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 0 (announced) f. TWT Flow ID = Any per [7] g. TWT Wake Interval Exponent = 10 h. TWT Protection = 0 i. Target Wake Time = any j. Nominal Minimum TWT Wake Duration = 255 (65.280 ms) k. TWT Wake Interval Mantissa = 512 (512 TU) l. TWT Channel = 0 3. AP1 transmits a TWT Response frame to STAUT and capture the TWT ID from the TWT Response frame. If all of the above conditions are true, then CONTINUE else FAIL.
24		At AP1, run script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the downlink throughput at STAUT is < 5601S24_DLTP_5G: (5601_alpha*63.75TU / 512TU * SU_Throughput), then FAIL else CONTINUE. SN: Verify the following conditions are true: 1. Within a randomly selected window of 2.097 seconds, > 92% of the PPDU transmissions from AP1 to STAUT are within TWT SPs (add 5601_Tolereance_SP_Start µs margin for SP start time, and 5601_Tolereance_SP_End µs margin for SP end time) with start times separated by 512 TUs. 2. At least one UL PS-Poll, UL QoS Null or UL QoS Data frame from STAUT to AP1 occurs before any DL PPDU transmissions from AP1 to STAUT within a sampled TWT SP.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				If all of the above conditions are true, then CONTINUE else FAIL.
25	At the STAUT, run script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE.	At AP1, turn off script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the uplink throughput at the STAUT is < 5601S25_ULTP_5G: (5601_alpha*63.75TU / 512TU * SU_Throughput), then FAIL else CONTINUE. SN: Within a randomly selected window of 2.097 seconds, if > 92% of the PPDU transmissions from STAUT to AP1 are within TWT SPs (add 5601_Tolereance_SP_Start µs margin for SP start time, and 5601_Tolereance_SP_End µs margin for SP end time) with start times separated by 512 TUs, then CONTINUE else FAIL.
26	At the STAUT, turn off script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE. Configure the STAUT for TWT Teardown to terminate the existing TWT agreement.			SN: If the STAUT sends a TWT Teardown frame with the TWT ID corresponding to the TWT ID from the TWT Response frame that was sent in Step23, then CONTINUE else FAIL. SN: If the STAUT transmits to AP1 a TWT Teardown frame, but some of the parameters do not correspond to the description above, then FAIL else CONTINUE.
27	If the STAUT supports unannounced TWT, go to Step 28 else PASS.			
28	Configure the STAUT to request an individual TWT with parameters: 1. Control field = 0x00 a. NDP Paging Indicator = 0 b. Responder PM Mode = 0 c. Negotiation Type =0 2. Request Type field: a. TWT Request = 1 b. TWT Setup Command = 0 or 1 (Request TWT or Suggest TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 1 (unannounced) f. TWT Flow ID = any g. TWT Wake Interval Exponent = 0 h. TWT Protection = 0 i. Target Wake Time = any j. Nominal Minimum TWT Wake Duration = 64 (16 TU) k. TWT Wake Interval Mantissa = 32768 (32 TU) l. TWT Channel = 0	AP1 transmits a TWT Response frame with Accept TWT.		SN: Verify the following conditions are true: 1. STAUT transmits a TWT Request with the following parameters: a. Control field: ▪ NDP Paging Indicator = 0 ▪ Responder PM Mode = 0 ▪ Negotiation Type =0 (B2:B3) b. Request Type field: ▪ TWT Request = 1 ▪ TWT Setup Command = 0 or 1 (Request or Suggest TWT) ▪ Trigger = 1 ▪ Implicit = 1 ▪ Flow Type = 1 (unannounced) ▪ TWT Flow ID = Any per [7] ▪ TWT Wake Interval Exponent = 0 ▪ TWT Protection = 0 ▪ Target Wake Time = any, if TWT Setup command value is 1, or 0, if TWT Setup command is 0

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				▪ Nominal Minimum TWT Wake Duration = 64 (64 TU) ▪ TWT Wake Interval Mantissa = 32768 (32 TU) ▪ TWT Channel = 0 2. AP1 transmits a TWT Response frame to STAUT and capture the TWT ID from the TWT Response frame.. If all of the above conditions are true, then CONTINUE else FAIL.
29	At the STAUT, turn off script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE.	At AP, run script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the downlink throughput at the STAUT is < 5601S29_DLTP_5G: (5601_alpha*16TU / 32TU * SU_Throughput), then FAIL else CONTINUE. SN: Within a randomly selected window of 0.131 seconds, if > 92% of the PPDU transmissions from AP1 to the STAUT are within TWT SPs (add 5601_Tolereance_SP_Start µs margin for SP start time, and 5601_Tolereance_SP_End µs margin for SP end time) with start times separated by 32 TU, then CONTINUE else FAIL.
30	At the STAUT, run script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE.	At AP, turn off script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the uplink throughput at the STAUT is < 5601S30_ULTP_5G: (5601_alpha*16TU / 32TU * SU_Throughput), then FAIL else CONTINUE. SN: Within a randomly selected window of 0.131 seconds, if > 92% of the PPDU transmissions from the STAUT to AP1 are within TWT SPs (add 5601_Tolereance_SP_Start µs margin for SP start time, and 5601_Tolereance_SP_End µs margin for SP end time) with start times separated by 32 TU, then CONTINUE else FAIL.
31	At the STAUT, turn off script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE. Configure the STAUT for TWT Teardown to terminate TWT agreement.			SN: If the STAUT sends a TWT Teardown frame with the TWT ID corresponding to the TWT ID of the TWT Response frame that was sent in Step28, then CONTINUE else FAIL. If the STAUT does transmit to the AP1 a TWT Teardown frame, but some of the parameters do not correspond to the description above, then FAIL else CONTINUE.
32	Configure the STAUT to request an individual TWT with parameters: 1. Control field = 0x00 a. NDP Paging Indicator = 0	AP1 transmits a TWT Response frame with Accept TWT.		SN: Verify the following conditions are true: 1. STAUT transmits a TWT Request with the following parameters: a. Control field:

Step	STAUT	Test bed AP1	Test bed validation	Expected result
	b. Responder PM Mode = 0 c. Negotiation Type =0 2. Request Type field: a. TWT Request = 1 b. TWT Setup Command = 0 or 1 (Request TWT or Suggest TWT) c. Trigger = 1 d. Implicit = 1 e. Flow Type = 1 (unannounced) f. TWT Flow ID = any g. TWT Wake Interval Exponent = 1 h. TWT Protection = 0 i. Target Wake Time = any j. Nominal Minimum TWT Wake Duration = 40 (10 TU) k. TWT Wake Interval Mantissa = 51200 (100 TU) l. TWT Channel = 0			▪ NDP Paging Indicator = 0 ▪ Responder PM Mode = 0 ▪ Negotiation Type =0 (B2:B3) b. Request Type field: ▪ TWT Request = 1 ▪ TWT Setup Command = 0 or 1 (Request or Suggest TWT) ▪ Trigger = 1 ▪ Implicit = 1 ▪ Flow Type = 1 (unannounced) ▪ TWT Flow ID = Any per [7] ▪ TWT Wake Interval Exponent = 1 ▪ TWT Protection = 0 ▪ Target Wake Time = any, if TWT Setup command value is 1, or 0, if TWT Setup command is 0 ▪ Nominal Minimum TWT Wake Duration = 40 (10 TU) ▪ TWT Wake Interval Mantissa = 51200 (100 TU) ▪ TWT Channel = 0 If all of the above conditions are true, then CONTINUE else FAIL.
33	At STAUT, turn off script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE.	At AP, run script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the downlink throughput at the STAUT is < 5601S33_DLTP_5G: (5601_alpha * 10TU / 100TU * SU_Throughput), then FAIL else CONTINUE. SN: Within a randomly selected window of 0.410 seconds, if > 92% of the PPDU transmissions from AP1 to STAUT are within TWT SPs(add 5601_Tolereance_SP_Start µs margin for SP start time, and 5601_Tolereance_SP_End µs margin for SP end time) with start times separated by 100 TU, then CONTINUE else FAIL.
34	At STAUT, run script DT2-DUT-AP_5.60.1.txt to AP1 using AC_BE.	At AP, turn off script DT1-AP-DUT_5.60.1.txt to the STAUT using AC_BE.		If the uplink throughput at STAUT is < 5601S34_ULTP_5G: (5601_alpha * 10TU / 100TU * SU_Throughput), then FAIL else CONTINUE. SN: Within a randomly selected window of 0.410 seconds, if > 92% of the PPDU transmissions from STAUT to AP1 are within TWT SPs (add 5601_Tolereance_SP_Start µs margin for SP start time, and 5601_Tolereance_SP_End µs margin for SP

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				end time) with start times separated by 100 TU, then CONTINUE else FAIL.

5.61 STAUT HE A-MPDU construction of a HE TB PPDU tests

5.61.1 STAUT HE A-MPDU construction of HE TB PPDU test

Objective

This test case verifies that the STAUT correctly constructs A-MPDU in a HE TB PPDU w.r.t setting the TXOP_DURATION in HE-SIG_A and checking througput variation with varying MPDU MU Spacing Factor in trigger frame.

Applicability: Mandatory

References

Section 6.3.2.41 [1]

Section 26.11.5 [7]

Test environment

- STAUT
- Test bed AP: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 289 defines the specific parameter values required for this test case.

Table 289. STAUT HE A-MPDU construction of a HE TB PPDU tests configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	If DUT is 20 MHz-only STA, use Qualcomm for 5 GHz Else Intel
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Coding in payload for transmit	Default	BCC for 20 MHz LDPC for 80 MHz
Minimum MPDU Start Spacing	N/A	6[1]
MU functionality	N/A	Enable UL OFDMA
Notes: 1. Minimum MPDU Start Spacing of 6 means that the minimum MPDU start spacing supported by the test bed AP is 8 µs.		

Test procedure and expected results

Table 290 provides the specific test procedure and expected results for this test case.

Table 290. STAUT HE A-MPDU construction of a HE TB PPDU tests procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, then go to Step 1, else go to Step 13.				
1	Configure STAUT per Table 6 and Table 289 in the 2.4 GHz band.	Configure AP1 per Table 4 and Table 289 in the 2.4 GHz band. Configure AP1's MU EDCA parameters as per Table 5. Disable A-MSDU in Block Ack agreement (A-MSDU Support in ADDBA Response = 0).		
2	Configure the STAUT to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		
5		Configure AP1 to transmit a Basic Trigger frame with 20 MHz bandwidth with the parameters defined in Table 4 and in HE SU PPDU with TXOP_DURATION set to UNSPECIFIED in HE-SIG-A.	Verify that each bit in the UL HE-SIG-A2 Reserved subfield = 1.	
6	At the STAUT, run script DT2-DUT-AP_5.61.1.txt to AP using AC_BE.			SN: Verify the L-Length and the following fields of HE-SIG-A of the HE TB PPDU from the STAUT: 1. LENGTH field in L-SIG = Length in Trigger frame 2. HE-SIG-A1 (B0) = 0 3. HE-SIG-A1 (B1-B6) = BSS Color announced by AP1 4. HE-SIG-A1 (B7 - B22) = UL Spatial Reuse in Trigger frame 5. HE-SIG-A1 (B24 - B25)= BW in Trigger frame 6. HE-SIG-A2 (B0 - B6) = UNSPECIFIED 7. HE-SIG-A2 (B7 - B15) are same as UL HE-SIG-A2 Reserved in Trigger frame If all conditions are true, then CONTINUE else FAIL.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
7		Configure AP1 to transmit a Basic Trigger frame with 20 MHz bandwidth with the parameters defined in Table 4 and in a non-HT PPDU.	Verify that each bit in UL HE-SIG-A2 Reserved has value 1.	
8	At the STAUT, run script DT2-DUT-AP_5.61.1.txt to AP using AC_BE.			SN: Verify the L-Length and the following fields of HE-SIG-A of the HE TB PPDU from the STAUT: 1. LENGTH field in L-SIG = Length in Trigger frame 2. HE-SIG-A1 (B0) = 0 3. HE-SIG-A1 (B1 - B6) = BSS Color announced by AP1 4. HE-SIG-A1 (B7 - B22) = UL Spatial Reuse in Trigger frame 5. HE-SIG-A1 (B24 - B25) = BW in Trigger frame (if Sniffer supports) 6. HE-SIG-A2 (B0 - B6) set to one of the following, based on the value of [Duration in Trigger - SIFS - (ceiling((LENGTH + 3)/3)*4 + 20 + SignalExtension)]: a. Less than 512, B0 in HE-SIG-A2 = 0, B1 to B6 in HE-SIG-A2 = floor((Duration in Trigger - SIFS - (ceiling((LENGTH + 3)/3)*4 + 20 + SignalExtension))/8) b. Greater than equal to 512 and less than 8448, B0 in HE-SIG-A2 = 1, B1 to B6 in HE-SIG-A2 = floor((Duration in Trigger - SIFS - (ceiling((LENGTH + 3)/3)*4 + SignalExtension) - 512)/128) c. Greater than or equal to 8448, B0 in HE-SIG-A2 = 1, B1 to B6 in HE-SIG-A2 = floor((8448 - 512)/128) 7. HE-SIG-A2 (B7 - B15) are same as UL HE-SIG-A2 Reserved in the Trigger frame If all conditions are true, then CONTINUE else FAIL. Notes: LENGTH is the LENGTH field in L-SIG. SignalExtension is defined in Table 19-25 in [2] (HT PHY characteristics).
9		Configure AP1 to transmit a Basic Trigger frame to the STAUT once every 10 TUs with the parameters defined in Table 4 and with the following parameters: 1. MPDU MU Spacing Factor = 0 2. GI+LTF = 2 (12.8 µs LTF + 3.2 µs GI)		

Step	STAUT	Test bed AP1	Test bed validation	Expected result
		3. If the DUT is 20 MHz-only STAUT, then RU size = 106 tone, else RU size = 242 tone 4. UL LENGTH = 601 5. UL MCS = 7		
10	At the STAUT, run script DT2-DUT-AP_5.61.1.txt to AP using AC_BE.			SN: If the throughput HETBT at the AP1 > 5611S10_TP_24G, then CONTINUE else FAIL.
11		Configure AP1 to transmit a Basic Trigger frame to the STAUT once every 10 TUs with the parameters defined in Table 4 and with the following parameters: 1. MPDU MU Spacing Factor = 3 2. GI+LTF = 2 (12.8 µs LTF + 3.2 µs GI) 3. If the DUT is 20 MHz-only STAUT, then RU size = 106 tone, else RU size = 242 tone 4. UL LENGTH = 601 5. UL MCS = 7 Notes: now the minimum MPDU start spacing in STA's UL A-MPDU is 8*8*Data_Rate/8 where the first 8 is 8 µs as indicated by 7 in Minimum MPDU Start Spacing and the second 8 is defined by 3 in MPDU MU Spacing Factor.		
12	At STAUT, run script DT2-DUT-AP_5.61.1.txt to AP using AC_BE.			If the throughput at the AP1 < HETBT_pctHigh % of HETBT and > HETBT_pctLow % of HETBT, then CONTINUE else FAIL.
If the APUT supports 5 GHz, then go to Step 13, else PASS.				
13	Configure STAUT per Table 6 and Table 289 for the 5 GHz band.	Configure AP1 per Table 4 and Table 289 for the 5 GHz band. Configure AP1's MU EDCA parameters as per Table 5. Disable A-MSDU in Block Ack agreement (A-MSDU Support in ADDBA Response = 0).		
14	Repeat Steps 2-4.			If the verification in Steps 2-4 is successful, then CONTINUE else FAIL.
15		Configure AP1 to transmit a Basic Trigger frame with 20 MHz if DUT is 20 MHz-only STAUT else 80 MHz bandwidth with the	Verify that each bit in UL HE-SIG-A2 Reserved = 1.	

Step	STAUT	Test bed AP1	Test bed validation	Expected result
		parameters defined in Table 4 and if DUT is 20 MHz-only STA, coding=BCC/LDPC based on Table 2 else coding=LDPC in HE SU PPDU with UNSPECIFIED TXOP duration in HE-SIG-A.		
16	At the STAUT, run script DT2-DUT-AP_5.61.1.txt to AP1 using AC_BE.			SN: Verify the L-Length and the following fields of HE-SIG-A of the HE TB PPDU from STAUT: 1. LENGTH field in L-SIG = Length in Trigger frame 2. HE-SIG-A (B0) = 0 3. HE-SIG-A1 (B1 - B6) = BSS Color announced by AP1 4. HE-SIG-A1 (B7 - B22) = UL Spatial Reuse in Trigger frame 5. HE-SIG-A1 (B24 - B25) = BW in Trigger frame 6. HE-SIG-A2 (B0 - B6) = UNSPECIFIED 7. HE-SIG-A2 (B7 - B15) are same as UL HE-SIG-A2 Reserved in Trigger frame (if Sniffer supports) If all conditions are true, then CONTINUE else FAIL.
17		Configure AP1 to transmit a Basic Trigger frame with 20 MHz if DUT is 20 MHz-only STAUT else 80 MHz bandwidth with the parameters defined in Table 4 in non HT or non-HT duplicate PPDU	Verify that each bit in UL HE-SIG-A2 Reserved = 1.	
18	At the STAUT, run script DT2-DUT-AP_5.61.1.txt to AP1 using AC_BE.			SN: Verify the L-Length and the following fields of HE-SIG-A of the HE TB PPDU from STAUT: 1. LENGTH field in L-SIG = Length in Trigger frame 2. HE-SIG-A1 (B0) = 0 3. HE-SIG-A1 (B1 - B6) = BSS Color announced by AP1 4. HE-SIG-A1 (B7 - B22) = UL Spatial Reuse in Trigger frame 5. HE-SIG-A1 (B24 - B25) = BW in Trigger frame 6. HE-SIG-A2 (B0 to B6) set to one of the following, based on the value of [Duration in Trigger - SIFS - (ceiling((LENGTH + 3)/3)*4 + 20 + SignalExtension)]: a. Less than 512, B0 in TXOP in HE-SIG-A = 0, B1 to B6 = floor((Duration in Trigger - SIFS - (ceiling((LENGTH + 3)/3)*4 + 20 + SignalExtension))/8) b. Greater than or equal to 512 and less than 8448, B0 in TXOP in HE-SIG-A = 1, B1 to B6 = floor((Duration in Trigger - SIFS - (ceiling

Step	STAUT	Test bed AP1	Test bed validation	Expected result
				((LENGTH + 3)/3)*4 + 20 + SignalExtension) - 512)/128) c. Greater than or equal to 8448, B0 in TXOP in HE-SIG-A = 1, B1 to B6 = floor((8448 - 512)/128) 7. HE-SIG-A2 (B7 - B15) are same as UL HE-SIG-A2 Reserved in Trigger If all conditions frame are true, then CONTINUE else FAIL. Notes: LENGTH is the LENGTH field in L-SIG. SignalExtension is defined in Table 19-25 per [2] HT PHY characteristics).
19		Configure AP1 to transmit a Basic Trigger frame to the STAUT once every 10 TUs with the parameters defined in Table 4 in S-MPDU and if DUT is 20 MHz-only STA, coding=BCC/LDPC based on Table 2 else coding = LDPC in SU PPDU format with the following parameters: 1. MPDU MU Spacing Factor = 0 2. GI+LTF = 2 (12.8 µs LTF + 3.2 µs GI) 3. UL LENGTH = 601 4. UL MCS = 7 5. If the DUT is 20 MHz-only STAUT, then RU size = 106 tone, else RU size = 996 tone		
20	At the STAUT, run script DT2-DUT-AP_5.61.1.txt to AP using AC_BE.			SN: If the throughput HETBT > 5611S19_TP_5G, then CONTINUE else FAIL
21		Configure AP1 to transmit a Basic Trigger frame to the STAUT once every 10 TUs with the parameters defined in Table 4 in S-MPDU and if DUT is 20 MHz-only STA, coding=BCC/LDPC based on Table 2 else coding = LDPC in SU PPDU format with the following parameters: 1. MPDU MU Spacing Factor = 3 2. GI+LTF = 2 (12.8 µs LTF + 3.2 µs GI) 3. UL LENGTH = 601 4. UL MCS = 7		

Step	STAUT	Test bed AP1	Test bed validation	Expected result
		5. If the DUT is 20 MHz-only STAUT, then RU size = 106 tone, else RU size = 996 tone Notes: now the minimum MPDU start spacing in STA's UL A-MPDU is 8*8*Data_Rate/8 where the first 8 is 8µs as indicated by 6 in Minimum MPDU Start Spacing and the second 8 is defined by 3 in MPDU MU Spacing Factor.		
22	At the STAUT, run script DT2-DUT-AP_5.61.1.txt to AP using AC_BE.			SN: If the throughput at the AP1 < HETBT_pctHigh % of HETBT and > HETBT_pctLow % of HETBT, then CONTINUE else FAIL.

5.62 STAUT UL MU sensing rules tests

5.62.1 STAUT UL MU sensing test

Objective

This test case verifies that the STAUT correctly follows the CS Required indication, ED sensing and NAV consideration in Trigger frames.

Applicability: Mandatory

References

Section 6.3.2.42 [1]

Section 26.5.3.5 [7]

Test environment

- STAUT
- Test bed STA: Wi-Fi CERTIFIED 6 STA
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed AP2: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 291 defines the specific parameter values required for this test case.

Table 291. STAUT UL MU sensing test configuration

Parameter	**STAUT**	**Test bed STA1 value**	**Test bed AP1 value**	**Test bed AP2**
Test bed vendor	N/A	Cypress	Qualcomm	Marvell
AP control channel	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
MU functionality	N/A	Enable UL OFDMA	Enable UL OFDMA	N/A

Test procedure and expected results

Table 292 provides the specific test procedure and expected results for this test case.

Table 292. STAUT UL MU sensing test procedure and expected results

Step	STAUT	Test bed STA1	Test bed AP1	Test bed AP2	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, then go to Step 1, else go to Step 6.						
1	Configure the STAUT per Table 14 and Table 291 for the 2.4 GHz band.	Configure STA1 per Table 6 and Table 291 for the 2.4 GHz band.	Configure AP1 per Table 4 and Table 291. for the 2.4 GHz band	Configure AP2 per Table 4 and Table 291 for the 2.4 GHz band.		
2			AP1 sends Beacon frames to the STAUT and STA1.	AP2 sends Beacon frames to the STAUT and STA1.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP2.	AP1 sends an Association Response frame to the STAUT.	AP2 sends an Association Response frame to STA1.		SN: If the STAUT is successfully associated with AP1, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.		AP1 sends an ADDBA Response frame with Buffer Size ≤ 64.			
5	Run script HE1-STA1-AP-TC3.txt to AP1.		Configure AP1 to not perform NAV update. Configure AP1 to transmit one Basic Trigger frame to the STAUT every 16 ms with the following values: 1. CS Required = 1 2. BW = 20 MHz 3. If the DUT is 20 MHz-only STAUT, then RU size = 106 tone else RU size = 242 tone 4. UL MCS = 7 5. UL Length = 2251 (+/-12) 6. Starting Spatial Stream=0 7. NSS = 0	Configure AP2 to transmit one S-MPDU frame, or CTS-to-self frame, or BSRP Trigger frame, or Basic Trigger frame, or QoS Null frame to STA1 with Duration every 16 ms in TXOP once every 32ms.	Note: AP1 will transmit the Trigger frame even if NAV is not zero if set by OBSS PPDU .	SN: Verify the following are true: 1. Within 14 ms after S-MPDU transmission, the STAUTdoes not start sending HE TB PPDU 2. After 14 ms S-MPDU's transmission, the STAUT transmits HE TB PPDU If all conditions are true, then CONTINUE else FAIL.
If the APUT supports 5 GHz, then go to Step 6 else PASS.						

Step	STAUT	Test bed STA1	Test bed AP1	Test bed AP2	Test bed validation	Expected result
6	Configure the STAUT per Table 14 and Table 291 for the 5 GHz band.	Configure STA1 per Table 6 and Table 291 for the 5 GHz band.	Configure AP1 per Table 4 and Table 291. for the 5 GHz band	Configure AP2 per Table 4 and Table 291 for the 5 GHz band.		
7	Repeat Steps 2-4.					If the verification in Steps 1-4 is successful, then CONTINUE else FAIL.
8	Run script HE1-STA1-AP-TC3.txt to AP1		Configure AP1 to not perform NAV update. Configure AP1 to transmit one Basic Trigger frame in non-HE PPDU to the STAUT once every 16 ms with the following values: 1. CS Required = 1 2. If DUT type is 20 MHz only STA then BW-20 MHz else BW = 80 MHz 3. If DUT type is 20 MHz only STA then RU size =106 else RU size = 996 tone 4. UL MCS = 7 5. UL Length = 2251(+/-12) 6. Starting Spatial Stream = 0 7. NSS = 0	Configure AP2 to transmit one S-MPDU or CTS-to-self or BSRP Trigger or Basic Trigger or QoS Null to STA1 with Duration 16 ms in one TXOP once every 32ms.	Note: AP1 will transmit the Trigger frame even if NAV is not zero if set by OBSS PPDU.	SN: Verify the following are true: 1. Within 14 ms after S-MPDU transmission, the STAUT does not start sending HE TB PPDU 2. After 14 ms S-MPDU's transmission, the STAUT transmits HE TB PPDU. If all the conditions are true, then PASS else FAIL.

5.63 STAUT channel access trigger-based PPDU transmission tests

5.63.1 STAUT trigger-based PPDU transmission test

Objective

This test case verifies that the STAUT follows the rules governing OBSS Narrow Bandwidth RU in UL OFDMA Tolerance Support.

Applicability: Conditional. This test shall be mandatory if the STAUT declared support for the 5 GHz band in Table 2.

References

Section 6.3.2.43 [1]

Section 26.5.3.3.2 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 dual band AP
- Test bed AP2: Wi-Fi CERTIFIED 6 AP dual band AP operating in 11ac mode, or Wi-Fi CERTIFIED ac
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 293 defines the specific parameter values required for this test case.

Table 293. STAUT trigger-based PPDU transmission test configuration

Parameter	STAUT value	Test bed STA1, STA2, and STA3 value	Test bed AP1 value	Test bed AP2 value
Test bed vendor	N/A	Broadcom75, Intel200L, Marvell	Qualcomm	Broadcom
AP control channel	N/A	N/A	100 in 5 GHz	100 in 5 GHz
Bandwidth	N/A	20 MHz in 5 GHz	20 MHz in 5 GHz	20 MHz in 5 GHz
MU functionality	N/A	Enable UL OFDMA	Enable UL OFDMA	N/A

Test procedure and expected results

Table 294 provides the specific test procedure and expected results for this test case.

Table 294. STAUT trigger-based PPDU transmission test procedure and expected results

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed AP2	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 293.	Configure STA1 per Table 6 and Table 293.	Configure AP1 for 5 GHz operation per Table 4 and Table 293.	Configure AP2 for 5 GHz operation per Table 4 and Table 293. Configure AP2 with a different SSID than AP1.		
2	Configure the STAUT to join AP1's BSS.	Configure STA1, STA2 and STA3 to join AP1's BSS.				
3	The STAUT sends an Association Request frame to AP1.	STA1, STA2 and STA3 each sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2 and STA3.			If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
4	STAUT sends an ADDBA Request frame to AP1.	STA1, STA2 and STA3 each sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame to the STAUT and STA1, STA2 and STA3 with Buffer Size ≤64.			
5	Wait 10 seconds.					
6			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from the STAUT and STA1, STA2 and STA3 per Table 4 and Table 293, with the following parameters: 1. Trigger Common Info field: a. BW = 0 (20 MHz) b. GI+LTF = 1 (6.4 µs LTF + 1.6 µs GI) 2. RU allocation [26 26 26 26] tones. AP1 allocates the STAUT RUs in different locations.			
7	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.				SN: If the STAUT transmits any HE TB PPDU with 26-tones RU allocated to the STAUT, then FAIL else CONTINUE.

Step	STAUT	Test bed STA1, STA2, STA3	Test bed AP1	Test bed AP2	Test bed validation	Expected result
8			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STAUT and STA1, STA2 and STA3 per Table 4 and Table 293, with the following parameters: 1. Trigger Common Info Field: a. BW = 0 (20 MHz) b. GI+LTF = 1 (6.4 µs LTF + 1.6 µs GI) 2. RU allocation [52 52 52 52] tones. AP1 allocates the STAUT RUs in different locations.			
9	Run script HE1-ULOFDMA-STAUT.txt.	Run script HE1-ULOFDMA-STAUT.txt.				SN: Verify the following conditions are true: 1. STAUT transmitted TB PPDU with QoS Data frames. 2. Throughput from STAUT ≥ 5631S9_1SS_TP_5G for 1 SS 3. Aggregate throughput on AP1 ≥ 5631S9_AP1_ATP_5G If all conditions above are true, then PASS else FAIL.

5.64 STAUT channel access rules tests

5.64.1 STAUT MU EDCA Parameter Set test

Objective

This test case verifies that the STAUT correctly performs medium access per the received MU EDCA Parameters Set element.

Applicability: Mandatory

References

Section 6.3.2.44 [1]

Section 26.2.7 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 295 defines the specific parameter values required for this test case.

Table 295. STAUT MU EDCA Parameter Set test configuration

Parameter	**STAUT value**	**Test bed STA1**	**Test bed AP1 value**
Test bed vendor	N/A	Intel200W	Ruckus
AP control channel	N/A	NA	36 in 5 GHz 6 in 2.4 GHz
Number of spatial streams	N/A	Default	1
WMM Parameter element configuration for 2.4 GHz and 5 GHz	N/A	N/A	1. TXOP for AC_VI, AC_BE = 47 (1.504msec) 2. AIFSN for AC_VI, AC_BE = 2 3. ECWmax for AC_BE =4 and ECWmax for AC_VI = 3
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz 20 MHz in 5 GHz if DUT is 20 MHz-only STA	80 MHz in 5 GHz 20 MHz in 2.4 GHz

Test procedure and expected results

Table 296 provides the specific test procedure and expected results for this test case.

Table 296. STAUT MU EDCA Parameter Set test procedure and expected results

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, then go to Step 1, else go to Step 14.					
1	Configure the STAUT to Table 14 and Table 295.	Configure STA1 per Table 6 and Table 295.	Configure the AP1 per Table 4 and Table 295 in the 2.4 GHz band Configure AP1 MU EDCA parameters per Table 5		
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	Configure STA1 to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT. AP1 sends an Association Response frame to STA1.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1.	STA1 sends ADDBA Request frame to AP1 with Buffer size ≤64.	AP1 sends ADDBA Response frame with Buffer Size ≤ 64.		
5	At STAUT, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP for 60 seconds.	At STA1, run script HE1-STAUT-STA1-AP_VI_BE-60.txt for 60 seconds.			Compute the throughput: STAUT_SU_VI = STAUT throughput STA1_SU_BE = STA1 throughput
Testing AIFS = 0 and Timer Value					
6			Configure AP1 to send MU EDCA parameters with values for ECWmin, ECWmax, for each AC set to the same values of the corresponding fields in transmitted WMM parameter element.		

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
			Set AIFSN = 0 and MU EDCA Timer = 2 for all AC's. Configure AP1 to transmit one Basic Trigger frame every 40 TUs with the parameters defined in Table 4 and with: 1. BW = 20 MHz 2. GI+LTF = 2 3. RU allocation of [106, 106] tones 4. UL Length = 2251		
7	At the STAUT, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP1 for 60 seconds.	At STA1, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP1 for 60 seconds.		Verity that the STA1 throughput (STA1_Step7)/ STA1_SU_BE = 5641S7_STA1_TF_24G, and 5641S7_STA1_TF_24G ≥ 0.25 and ≤ 0.75	Verify the following conditions are true: 1. STAUT throughput is (STAUT_Step7)/ * STAUT_SU_VI ≤ 5641S7_STAUT_TF_24G 2. 5641S7_STAUT_TF_24G is ≥ 0.2 but no more than 0.70 If all the conditions are true, then CONTINUE else FAIL.
8			Disable transmission of Basic Trigger frames from AP1.		
9			Configure AP1 to send the MU EDCA parameters element with the following values: AC BE: AIFSN, ECWmin, ECWmax with the same values as AC_VI parameters in WMM Parameter element and set MU EDCA timer = 6. AC VI: AIFSN, ECWmin, ECWmax with the same values as AC BE parameters in WMM Parameter element and set MU EDCA timer = 6 AC VO: The values of MU EDCA parameters of AC_VO have the same values as the corresponding parameters in WMM		

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
			Parameter element, set timer MU EDCA time = 6 AC BK: The values of MU EDCA parameters of AC_BK have the same values of corresponding parameters in WMM Parameter element, and set MU EDCA timer = 6 Configure AP1 to transmit a Basic Trigger frame once every 40 TUs with the parameters defined in Table 4 and with: 1. BW = 20 MHz 2. GI+LTF = 2 3. RU allocation of [106, 106] tones 4. UL Length = 2251		
10	At the STAUT, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP1 for 60 seconds.	At STA1, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP1 for 60 seconds.		Verify STA1_MU_EDCA/ STA1_SU_BE ≥ 0.85	Compute the throughput: STAUT_MU_EDCA = STAUT throughput STA1_MU_EDCA = STA1 throughput STAUT_MU_EDCA/ STAUT_SU_VI = 5641S10_STAUT_MU_EDCA_24G *, Verify that 5641S10_STAUT_MU_EDCA_24G ≥ 0.2 and not more than 0.85 then CONTINUE else FAIL.
11			Disable transmission of Basic Trigger frames on AP1.		
12			Configure AP1 with a WMM Parameter element with AC_BE and AC_VI parameters set to ECWmin = ECWmax = 4		
13	At the STAUT, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP1 for 60 seconds.	At STA1, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP1 for 60 seconds.			If the throughput_STAUT_Step_13 < STAUT_SU_VI, then CONTINUE else FAIL.
If the APUT supports the 5 GHz band, then go to Step 14 else PASS.					

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
14	Configure the STAUT to Table 14 and Table 295.	Configure STA1 to Table 6 and Table 295.	ConfigureAP1 per Table 4 and Table 295 in the 5 GHz band. Configure AP1 MU EDCA parameters per Table 5		
15	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure STA1 to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.		
16	STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT. AP1 sends an Association Response frame to STA1.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
17	STAUT sends an ADDBA Request frame to AP1.	STA1 sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame with Buffer Size ≤ 64.		
18	At STAUT, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP for 60 seconds.	At STA1, run script HE1-STAUT-STA1-AP_VI_BE-60.txt for 60 seconds.			Compute the throughput: STAUT_SU_VI = STAUT throughput STA1_SU_BE = STA1 throughput
Testing AIFSN = 0 and MU EDCA Timer Value					
19			Configure AP1 to send MU EDCA parameters with values for ECWmin, ECWmax, for each AC set to the same values of the corresponding fields in transmitted WMM Parameter element. Set AIFSN = 0 and MU EDCA Timer = 2 for all AC's. Configure AP1 to transmit one Basic Trigger frame once every 40 TUs with default parameters defined in Table 4 and with: 1. If DUT is 20 MHz-only STAUT, then,		

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
			BW=20MHz else BW = 80 MHz 2. LTF+GI = 2 3. If the DUT is 20 MHz-Only STA,then Coding = BCC/LDPC else Coding = LDPC 4. If the DUT is 20 MHz-only STAUT, then RU allocation of [106, 106] else RU allocation of [484, 484] 5. UL Length = 2251 (3 msec)		
20	At STAUT, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP1 for 60 seconds.	At STA1, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP1 for 60 seconds.		Verify that STA1 throughput (STA1_Step18)/ STA1_SU_BE = 5642S20_STA1_TP_5G, and 5642S20_STA1_TP_5G ≥ 0.25 and ≤ 0.75	SN: Verify the following conditions are true: 1. STAUT throughput is (STAUT_Step18)/ STAUT_SU_VI = 5642S20_STAUT_TP_5G * 2. 5642S20_STAUT_TP_5G is ≥ 0.2 but no more than 0.70 If all conditions are true, then CONTINUE else FAIL.
21			Disable transmission of Basic Trigger frames from AP1.		
22			Configure AP1 to send MU EDCA Parameters element with the following values: AC BE: AIFSN, ECWmin, ECWmax values are the same as AC_VI parameters in WMM Parameter element and set MU EDCA timer = 6. AC VI: AIFSN, ECWmin, ECWmax values are the same as AC BE parameters in WMM Parameter element and set MU EDCA timer = 6. AC VO: The values of MU EDCA parameters of AC_VO have the same values as the corresponding parameters in WMM		

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
			Parameter element, and set MU EDCA time = 6 AC BK: The values of MU EDCA parameters of AC_BK have the same values of corresponding parameters in WMM Parameter element, and set MU EDCA timer = 6. Configure AP1 to transmit one Basic Trigger once every 40TU with parameters defined in Table 4 and with: 1. If DUT is 20 MHz-only STAUT, then, BW=20MHz else BW = 80 MHz 2. LTF+GI = 2 3. If the DUT is 20 MHz-Only STA,then Coding = BCC/LDPC else Coding = LDPC 4. If the DUT is 20 MHz-only STAUT, then RU allocation of [106, 106] else RU allocation of [484, 484] 5. UL Length = 2251 (3 msec)		
23	At STAUT, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP1 for 60 seconds.	At STA1, run script HE1-STAUT-STA1-AP_VI_BE-60.txt to AP1 for 60 seconds.		Verify STA1_MU_EDCA/ STA1_SU_BE ≥ 0.85	Compute the throughput: STAUT_Throughput = STAUT_MU_EDCA STA1_Throughput = STA1_MU_EDCA STAUT_MU_EDCA/ STAUT_SU_VI= 5642S23_STAUT_MU_EDCA_5G, Verify that 5642S23_STAUT_MU_EDCA_5G is ≥0.2 and no more than 0.85 then CONTINUE else FAIL.
24			Disable transmission of Basic Trigger frames from AP1.		
25			Configure a WMM Parameter element on AP1 with AC_BE and AC_VI parameters set to ECWmin = ECWmax = 4		
26	At STAUT, run script HE1-	At STA1, run script HE1-STAUT-STA1-			If throughput_STAUT_Step_23 < STAUT_SU_VI, then PASS else FAIL.

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
	STAUT-STA1-AP_VI_BE-60.txt to AP1 for 60 seconds.	AP_VI_BE-60.txt to AP1 for 60 seconds.			

5.65 STAUT spatial reuse operation tests

5.65.1 STAUT OBSS_PD-based test

Objective

This test case verifies that the STAUT correctly sets the UL Spatial Reuse field in HE-SIG-A to a value other than SRP_AND_NON_SRG_OBSS_PD_PROHIBITED in all transmitted frames whenever the most recently received Beacon frame from the associated AP contains the corresponding signal (the HESIGA_Spatial_reuse_value15_allowed subfield of the SR Control field of the Spatial Reuse Parameter Set element of the Beacon frame is set to zero).

Applicability: Mandatory

References

Section 6.3.2.49 [1]

Section 26.11.6 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 dual band AP
- Wireless Sniffer

Test configuration

Table 297 defines the specific parameter values required for this test case.

Table 297. STAUT OBSS_PD-based test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Intel
AP control channel	N/A	6 in 2.4 GHz 36 in 5 GHz
Bandwidth	Default	20 MHz in 2.4 GHz 80 MHz in 5 GHz

Test procedure and expected results

Table 298 provides the specific test procedure and expected results for this test case.

Table 298. STAUT OBSS_PD-based test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
If the STAUT supports 2.4 GHz, then go to Step 1 else go to Step 7.				
1	Configure the STAUT per Table 6 and Table 297 for the 2.4 GHz band.	Configure AP1 per Table 4 and Table 297 for the 2.4 GHz band.		
2		Configure AP1 to set the HESIGA_Spatial_reuse_value15_allowed subfield in the SR Control field of the Spatial Reuse Parameter Set element in Beacon, Association Response, Re-Association Response and Probe Response frames = 0.		
3	Configure the STAUT to join AP1's BSS.		SN: Verify and record the setting of the BSS Color subfield of the BSS Color Information field of the HE Operation element. Verify that the BSS Color value is in the range of 1~63. SN: Verify that Spatial Reuse Parameter Set element is present in Beacon, Association Response, Re-Association Response and Probe Response frames transmitted by AP1, and has the following setting: • In SR Control field, HESIGA_Spatial_reuse_value15_allowed = 0	If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4		RUN: PING <STAUT_IP_ADDR> SIZE=1000 COUNT=90		If more than 5 consecutive ping timeouts occur, then FAIL else CONTINUE. If more than 10% ping failures, then FAIL else CONTINUE. SN: Verify that the HE PPDUs sent by the STAUT have the following content in the HE-SIG-A: 1. BSS Color field is set to the value recorded in Step 3. 2. UL Spatial Reuse field= 0 (SRP_DISALLOWED) If all conditions are true, then CONTINUE else FAIL.
6	Disassociate the STAUT from AP1.			
If the STAUT supports 5 GHz, then go to the Step 7 else PASS.				

Step	STAUT	Test bed AP1	Test bed validation	Expected result
7	Configure the STAUT per Table 6 and Table 297 for the 5 GHz band.	Configure AP1 per Table 4 and Table 297 for the 5 GHz band.		
8	Repeat Steps 2-6.			If the verification in Steps 2-6 is successful, then PASS else FAIL.

5.66 STAUT transmits UPH A-Control tests

5.66.1 STAUT transmits UPH A-Control test

Objective

This test case verifies that the STAUT correctly transmits A-Control information for UL MU.

Applicability: Mandatory

References

Section 6.3.2.23 [1]

Section 9.2.4.6a.5 [7]

Test environment

- STAUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 299 defines the specific parameter values required for this test case.

Table 299. STAUT transmits UPH A-Control test configuration

Parameter	STAUT value	Test bed STA1 value	Test bed AP1 value
Test bed vendor	N/A	Cypress	Marvell
Security	WPA2-Personal	WPA2-Personal	WPA2-Personal
Encryption key	12345678	12345678	12345678
AP control channel	N/A	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Control channel bandwidth	Default	20 MHz for 2.4 GHz 80 MHz for 5 GHz	20 MHz for 2.4 GHz 80 MHz for 5 GHz

Test procedure and expected results

Table 300 provides the specific test procedure and expected results for this test case.

Table 300. STAUT transmits UPH A-Control test procedure and expected results

Step	STAUT	Test bed AP1	Test bed STA1	Test bed validation	Expected result
1	If the STAUT supports 5 GHz go to Step 2 else go to Step 8.				
2	Configure the STAUT per Table 14 and Table 299.	Configure AP1 for 5 MHz operation per Table 4 and Table 299. Configure AP1's MU EDCA parameters per Table 5.	Configure STA1 per Table 6 and Table 299.		
3	Configure the STAUT to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to STA1 and the STAUT.	Configure STA1 to join AP1's BSS.		
4	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.	STA1 sends an Association Request frame to AP1.		If association of the STAUT and AP1 is successful, then CONTINUE else FAIL.
5	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT and STA1 with Buffer Size ≤ 64. Configure AP1 to send a Basic Trigger frame to solicit HE TB PPDU (Basic Trigger HE Control Test) by using Coding = LDPCOr BCC if DUT is 20 MHz-only STAUT	STA1 sends an ADDBA Request frame to AP1.		If the BA session is successful to the STAUT, then CONTINUE else FAIL.
6	Configure the STAUT to run script UT1-STAUT-STA1-AP.txt to AP1 using AC_BE for 20 seconds.		Configure STA1 to run script UT1-STAUT-STA1-AP.txt to AP1 using AC_BE for 20 seconds.		SN: Verify that the following conditions are true: 1. Each HE TB PPDU sent by the STAUT in response to Basic Trigger frames contains MPDU(s) other than Control frames have: a. Order/+HTC field in Frame Control field = 1 b. HT Control field present in the MAC header c. VHT and HE subfields in the HT Control field = 1 d. Exactly one of the Control ID subfield = 4 (UPH Control) 2. All MPDUs that have an HT Control field within each HE TB PPDU contain the same values for the HT Control field. If all the conditions above are true, then CONTINUE else FAIL.
7	If the STAUT supports 2.4 GHz, go to Step 8 else PASS.				

Step	STAUT	Test bed AP1	Test bed STA1	Test bed validation	Expected result
8	Configure the STAUT per Table 6 and Table 299.	Configure AP1 for 2.4 MHz operation per Table 4 and Table 299. Configure AP1's MU EDCA parameters per Table 5.	Configure STA1 per Table 6 and Table 299.		
9	Configure the STAUT to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to STA1 and the STAUT.	Configure STA1 to join AP1's BSS.		
10	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1.	STA1 sends an Association Request frame to AP1.		If association of the STAUT and AP1 is successful, then CONTINUE else FAIL.
11	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT and STA1. Configure AP1 to send a Basic Trigger frame to solicit HE TB PPDU (Basic Trigger HE Control Test).	STA1 sends an ADDBA Request frame to AP1.		If the BA session setup is successful to the STAUT, then CONTINUE else FAIL.
12	Configure the STAUT to run script UT1-STAUT-STA1-AP.txt to AP1 using AC_BE for 20 seconds.		Configure STA1 to run script UT1-STAUT-STA1-AP.txt to AP1 using AC_BE for 20 seconds.		SN: Verify that the following conditions are true: 1. Each HE TB PPDU sent by the STAUT in response to Basic Trigger frames contains MPDU(s) other than Control frames have: a. Order/+HTC field in Frame Control field = 1 b. HT Control field present in the MAC header c. VHT and HE subfields in the HT Control field = 1 d. Exactly one of the Control ID subfields = 4 (UPH Control) 2. All MPDUs that have an HT Control field within each HE TB PPDU contain the same values for the HT Control field. If all the conditions above are true, then PASS else FAIL.

5.67 (Deleted)

5.68 STAUT acknowledgement to DL MU PPDU which solicits in HE TB PPDU response containing Ack/C-BA tests

5.68.1 STAUT acknowledgement to DL MU PPDU which solicits in HE TB PPDU response containing Ack/C-BA test

Objective

This test case verifies that the STAUT correctly receives a DL MU PPDU containing QoS Data frames with HTP Ack in Ack Policy fields and Basic Trigger in A-MPDU to solicit STAUT's C-BA/Ack response in HE TB PPDU.

Applicability: Mandatory

References

Section 6.3.2.28 [1]

Section 10.3.2.13.2 [7]

Test environment

- STAUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Test bed STA2: Wi-Fi CERTIFIED 6 STA
- Test bed STA3: Wi-Fi CERTIFIED 6 STA
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 301 defines the specific parameter values required for this test case.

Table 301. STAUT acknowledgement to DL MU PPDU which solicits in HE TB PPDU response containing Ack/C-BA test configuration

Parameter	STAUT value	Test bed STA1, STA2, and STA3	Test bed AP1 value
Test bed vendor	N/A	Broadcom75, Broadcom98, Intel200W	Qualcomm
AP control channel	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
PPDU type	N/A	N/A	HE_MU (DL OFDMA)
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Number of users in each OFDMA transmission	N/A	N/A	4
MU functionality	N/A	Enable UL OFDMA	Enable UL OFDMA

Test procedure and expected results

Table 302 provides the specific test procedure and expected results for this test case.

Table 302. STAUT acknowledgement to DL MU PPDU which solicits in HE TB PPDU response containing Ack/C-BA test and expected results

Step	STAUT	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1	Test bed validation	Expected result
1	Configure the STAUT per Table 14 and Table 301.	Configure STA1 per Table 6 and Table 301.	Configure STA2 per Table 6 and Table 301.	Configure STA3 per Table 6 and Table 301.	Configure AP1 per Table 4 and Table 301. Configure AP1 to transmit DL OFDMA.		
If the STAUT supports 2.4 GHz, go to Step 2 else go to Step 8.							
2	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.	Configure STA2 to join AP1's BSS.	Configure STA3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
3	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	STA2 sends an Association Request frame to AP1.	STA3 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
4					Configure AP1 to transmit Basic Trigger frame in A-MPDU with HTP Ack in QoS Data frames in A-MPDU to solicit BlockAck in HE TB PPDU from the STAUT and STA1, STA2, and STA3.		
5	The STAUT sends an ADDBA Response frame to AP1.	STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT, STA1, STA2, and STA3 with Buffer Size ≤ 64.		SN: If the value in Buffer Size of the ADDBA Response frame from the STAUT is ≤ 64, then CONTINUE else FAIL.
6					Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT, STA1, STA2 and STA3 using AC_BE.	Verify 5681S6_PPDU_24G% PPDUs from AP1 are HE MU PPDU.	SN: If 5681S6_PKTS_24G% packets from the STAUT are transmitted using HE_TRIG PPDU, then CONTINUE else FAIL.

Step	STAUT	Test bed STA1	Test bed STA2	Test bed STA3	Test bed AP1	Test bed validation	Expected result
7	Disassociate the STAUT from AP1.	Disassociate STA1 from AP1.	Disassociate STA2 from AP1.	Disassociate STA3 from AP1.			
If the STAUT supports 5 GHz, go to Step 8 else PASS.							
8	Configure the STAUT to join AP1's BSS.	Configure STA1 to join AP1's BSS.	Configure STA2 to join AP1's BSS.	Configure STA3 to join AP1's BSS.	AP1 sends Beacon and Probe Response frames to the STAUT and STA1, STA2, and STA3.		
9	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	STA2 sends an Association Request frame to AP1.	STA3 sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT and STA1, STA2, and STA3.		If the association between the STAUT and AP1 is successful, then CONTINUE else FAIL.
10					Configure AP1 to transmit Basic Trigger frame in A-MPDU with HTP Ack in QoS Data frames in A-MPDU to solicit BlockAck in HE TB PPDU from the STAUT and STA1, STA2, and STA3.		
11	The STAUT sends an ADDBA Response frame to AP1.	STA1 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA2 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	STA3 sends an ADDBA Response frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Request frame to the STAUT, STA1, STA2 and STA3 with Buffer Size ≤ 64.		SN: If the value in Buffer Size of the ADDBA Response frame from the STAUT is ≤ 64, then CONTINUE else FAIL.
12					Run script HE1-DLOFDMA-STAUT_STA1-STA3.txt to the STAUT, STA1, STA2 and STA3 using AC_BE.	Verify 5681S12_PPDU_5G% PPDUs from AP1 are HE MU PPDU.	SN: If 5681S12_PKTS_5G% packets from STAUT are transmitted using HE_TRIG PPDU, then PASS else FAIL.

5.69 STAUT transmits MCS 8-9 in HE TB PPDU tests

5.69.1 STAUT transmits MCS 8-9 in HE TB PPDU test

Objective

This test case verifies that the STAUT implements transmission of MCS 8-9 in HE TB PPDUs using one spatial stream.

Applicability: Optional. This test shall be executed only if the STAUT declared support for MCS 8-9 in Table 2.

References

Section 6.4.2.5 [1]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 303 defines the specific parameter values required for this test case.

Table 303. STAUT transmits MCS 8-9 in HE TB PPDU test configuration

Parameter	STAUT value	STA1 value	AP1 value
Test bed vendor	N/A	Qualcomm	Intel
AP control channel	N/A	N/A	36 (in 5 GHz) 6 (in 2.4 GHz)
Bandwidth	N/A	80 MHz in 5 GHz 20 MHz in 2.4 GHz	80 MHz in 5 GHz 20 MHz in 2.4 GHz
PPDU format	N/A	N/A	Rx HE_TRIG (UL OFDMA)
HE-MCS	Default	HE-MCS 9	HE-MCS 9
LDPC Coding in Payload in 2.4 GHz	N/A	Disabled	Disabled
MU functionality	N/A	Enable UL OFDMA	Enable UL OFDMA

Test procedure and expected results

Table 304 provides the specific test procedure and expected results for this test case.

Table 304. STAUT transmits MCS 8-9 in HE TB PPDU test procedure and expected results

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
If the APUT supports the 2.4 GHz band, then go to Step 1, else go to Step 9.					
1	Configure the STAUT per Table 14 and Table 303.	Configure STA1 per Table 6 and Table 303.	Configure AP1 per Table 4 and Table 303 in the 2.4 GHz band. Configure AP1 to use 1 SS for STAUT and STA1. Configure AP1 to the MU EDCA parameters per Table 5.		
2			AP1 sends Beacon and Probe Response frames to the STAUT.		
3	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	Configure STA1 to join AP1's BSS in the 2.4 GHz band.			
4	The STAUT sends an Association Request frame to AP1.	STA1 sends an Association Request frame to AP1.	AP1 sends Association Response frames to the STAUT and STA1.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL. SN: If the Max HE-MCS for 1 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Request frame= 1 or 2, then CONTINUE else FAIL.
5	The STAUT sends an ADDBA Request frame to AP1.	STA1 sends an ADDBA Request frame with Buffer Size ≤ 64.	AP1 sends ADDBA Response frame with Buffer Size ≤ 64.		
Test: 1 SS, RU106					
6			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1 and STAUT with the following parameters: 1. Trigger Common Info field 2. BW = 0 (20 MHz) 3. RU allocation [106 106] tones. 4. The Number of Spatial Streams subfields: 0 (1 SS) AP1 allocates the STAUT RU in different locations.		

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
7	Run script HE1-ULOFDMA-STAUT-STA1.txt.	Run script HE1-ULOFDMA-STAUT-STA1.txt.		Verify at least one Trigger frame transmitted by AP1 has two User Info fields containing: 1. AID12 = STA1's AID, STA2's AID 2. UL HE-MCS subfields (B21:B24) corresponding to 2 STA's User Info fields = 9 3. SS Allocation/RA-RU Informationset to: a. Number of Spatial Streams = 0	SN: If the throughput of STAUT > 5691S7_1SS_TP_24G, then CONTINUE else FAIL. SN: Verify the PPDUs transmitted by the STAUT contains: 1. HE-SIG-A, Format field (B0) = 0 (HE TB PPDU), Bandwidth field (B24, B25) = 0 (20 MHz) 2. At least 5691S7_1SS_HETB_PPDU_24G% of captured HE PPDUs are HE TB PPDUs 3. At least 5691S7_1SS_TF_24G% of all the HE TB PPDUs transmitted by the STAUT followed by the Trigger frame requesting MCS 9 in the UL are acknowledged 4. The HE TB PPDUs transmitted by the STAUT include UL Power Headroom field with valid values. If all the above conditions are true, then CONTINUE, else FAIL.
8	Disassociate the STAUT from AP1.	Disassociate			
If the STAUT supports the 5 GHz band, then go to Step 9 else PASS.					
9	Configure STAUT per Table 14 and Table 303.	Configure STA1 per Table 6 and Table 303.	Configure AP1 per Table 4 and Table 303 in the 5 GHz band. Configure AP1 to use 1 SS for STAUT and STA1. Configure AP1 MU EDCA parameters as per Table 5.		
10			AP1 sends Beacon and Probe Response frames.		
11	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure STA1 to join AP1's BSS in the 5 GHz band.			
12	Repeat Steps 4-5.				If the verification in Steps 4-5 is successful, then CONTINUE else FAIL.
Test: 1 SS, RU484					

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
13			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1 and STAUT with the following parameters: 1. Trigger Common Info field: 2. BW = 2 (80 MHz) 3. If the DUT is 20 MHz-Only STAUT,then RU allocations are [106] [106] tones else RU allocations are [484 484] tones. 4. The Number of Spatial Streams subfields: 0 (1 SS) AP1 allocates the STAUT RU in different locations.		
14	Run script HE1-ULOFDMA-STAUT-STA1.txt.	Run script HE1-ULOFDMA-STAUT-STA1.txt.		Verify at least one Trigger frame transmitted by AP1 has two User Info fields containing: 1. AID12 = STA1's AID, STAUT's AID 2. UL HE-MCS subfields (B21:B24) corresponding to two STA's User Info fields = 9 3. SS Allocation/RA-RU Information set to: a. Number of Spatial Streams = 0	SN: If the throughput of STAUT > 5692S14_1SS_TP_5G, then CONTINUE else FAIL. SN: Verify the PPDUs transmitted by the STAUT contains: 1. HE-SIG-A, Format field (B0) = 0 (HE TB PPDU), Bandwidth field (B24, B25) = 2 (80 MHz) 2. At least 5692S14_1SS_HETB_PPDU_5G% of captured HE PPDUs are HE TB PPDUs 3. At least 5692S14_1SS_TF_5G% of all the HE TB PPDUs transmitted by the STAUT followed by the Trigger frame requesting MCS 9 in the UL are acknowledged 4. The HE TB PPDUs transmitted by the STAUT include UL Power Headroom field with valid values. If all the conditions are true, then PASS else FAIL.
15	Disassociate	Disassociate			

5.70 STAUT transmits MCS 10-11 in HE TB PPDU test

Objective

This test case verifies that the STAUT correctly transmits MCS 10-11 in HE TB PPDUs.

Applicability: Optional. This test shall be executed only if the STAUT declared support for MCS 10-11 in Table 2. Not applicable for 20 MHz-Only STAUT.

References

Section 6.4.2.6 [1]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 305 defines the specific parameter values required for this test case.

Table 305. STAUT transmits MCS 10-11 in HE TB PPDU test configuration

Parameter	STAUT value	Test bed STA1 value	Test bed AP1 value
Test bed vendor	N/A	Intel200W	Broadcom
AP control channel	N/A	N/A	36 (in 5 GHz)
Bandwidth	N/A	80 MHz in 5 GHz	80 MHz in 5 GHz
PPDU format	N/A	N/A	Rx HE_TRIG (UL OFDMA)
HE-MCS	Default	HE-MCS 11	HE-MCS 11
MU functionality	N/A	Enable UL OFDMA	Enable UL OFDMA

5.70.1 STAUT transmits MCS 10-11 in HE TB PPDU at 5 GHz using one spatial stream test

Test procedure and expected results

Table 306 provides the specific test procedure and expected results for this test case.

Table 306. STAUT transmits MCS 10-11 in HE TB PPDU at 5 GHz using one spatial stream test procedure and expected results

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
1	Configure STAUT per Table 14 and Table 305.	Configure STA1 per Table 6 and Table 305.	Configure AP1 per Table 4 and Table 305. Configure AP1 to use 1 SS for STAUT and STA1. Configure AP1 to receive using UL OFDMA. Configure AP1 MU EDCA parameters as per Table 5.		
2			Configure AP1 to the 5 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT and STA1.		
3	Configure the STAUT to join AP1's BSS in the 5 GHz band.	Configure STA1 to join AP1's BSS in the 5 GHz band.			
4	The STAUT sends an Association Request frame to AP1.	Association Request frame to AP1.	AP1 sends an Association Response frames to the STAUT and STA1.		If the association between the STAUT and AP1succeeds, then CONTINUE else FAIL. SN: If the Max HE-MCS for 1 SS subfield in Tx HE-MCS Map ≤ 80 MHz field within HE Capabilities element in the Association Request frame = 2, then CONTINUE else FAIL.
5	The STAUT sends an ADDBA Request frame to AP1.	ADDBA Requests frame to AP1 with Buffer Size ≤ 64.	AP1 sends an ADDBA Response frame with Buffer Size ≤ 64.		
Test: 1 SS, RU484					
6			Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from STA1 and		

Step	STAUT	Test bed STA1	Test bed AP1	Test bed validation	Expected result
			STAUT with the following parameters: 1. Trigger Common Info field: 2. BW = 2 (80 MHz) 3. If the DUT is 20 MHz-Only STAUT, then RU allocations are [106 106] tones else RU allocations are [484 484] tones. 4. The Number of Spatial Streams subfields: 0 (1 SS) AP1 allocates the STAUT RU in different locations.		
7	Run script HE1-ULOFDMA-STAUT-STA1.txt.	Run script HE1-ULOFDMA-STAUT-STA1.txt.		Verify at least one Trigger frame transmitted by AP1 has two User Info fields containing: 1. AID12 = STA1's AID, STAUT's AID 2. UL HE-MCS subfields (B21:B24) corresponding to two STA's User Info fields = 11 3. SS Allocation/RA-RU Information set to: a. Number of Spatial Streams = 0(1SS) b.	SN: If the throughput of STAUT > 5702S7_1SS_TP_5G, then CONTINUE else FAIL. SN: Verify the PPDUs transmitted by the STAUT contains: 1. HE-SIG-A, Format field (B0) = 0 (HE TB PPDU), Bandwidth field (B24, B25) = 2 (80 MHz) 2. At least 5702S7_1SS_HETB_PPDU_5G% of captured HE PPDUs are HE TB PPDUs 3. At least 5702S7_1SS_TF_5G% of all the HE TB PPDUs transmitted by the STAUT followed by the Trigger frame requesting MCS 11 in the UL are acknowledged 4. The HE TB PPDUs transmitted by the STAUT include UL Power Headroom field with valid values. If all of the conditions are true, then PASS else FAIL.
8	Disassociate	Disassociate			

5.71 STAUT RTS exchange based on TXOP Duration RTS Threshold value tests

5.71.1 STAUT RTS exchange based on TXOP Duration RTS Threshold value test

Objective

This test case verifies that the STAUT initiates an RTS/CTS exchange before transmission when the TXOP or PPDU duration carried in the TXOP is greater than the value of the TXOP Duration RTS Threshold field in HE Operation Parameters field.

Applicability: Mandatory

References

Section 6.3.2.39 [1]

Section 26.2.1 [7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 307 defines the specific parameter values required for this test case.

Table 307. STAUT RTS exchange based on TXOP Duration RTS Threshold value test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Marvell
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Configure to advertise TXOP RTS Threshold in HE Operation Element (value other than 0)	NA	Enabled

Test procedure and expected results

Table 308 provides the specific test procedure and expected results for this test case.

Table 308. STAUT RTS exchange based on TXOP Duration RTS Threshold value test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure STAUT per Table 14 and Table 308.	Configure AP1 per Table 4 and Table 308. Set the TXOP Duration RTS Threshold value in HE Operation Parameters field = 1		
If the STAUT supports 2.4 GHz go to Step 2, else go to Step 9.				
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	Configure AP1 to the 2.4 GHz band. AP1 sends Beacon and Probe Response frames to the STAUT.		
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
4	The STAUT sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64. Run PING (1000 bytes) for 30 seconds.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		SN: Verify the following: 1. STAUT sends PPDUs that initiate a TXOP (can be the only PPDU as well) always preceded with RTS/CTS exchange. 2. Ping is successful. If all conditions are true, then CONTINUE else FAIL.
5		Configure AP1 with the TXOP Duration RTS Threshold value in HE Operation Parameters field = 12.		
6	The STAUT sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64. Run PING (1000 bytes) for 30 seconds.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		SN: Verify the following: 1. STAUT sends PPDUs that initiate a TXOP (can be the only PPDU as well) with the PPDU duration + Duration value carried in the MPDUs in the PPDU > 384 µsec, is always preceded by RTS/CTS. 2. Ping is successful. If all conditions are true, then CONTINUE else FAIL.
7	The STAUT sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64. Run traffic HE1-STA1-AP1-24G.txt.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		SN: Verify the following: 1. STAUT sends PPDUs that initiate a TXOP (can be the only PPDU as well) with “PPDU duration + Duration value carried in the MPDUs in the PPDU” > 384 µsec, is always preceded by RTS/CTS. 2. Test script runs to completion without errors. If all conditions are true, then CONTINUE else FAIL.
8	Disassociate the APUT from AP1.			
If the STAUT supports 5 GHz go to Step 9, else PASS.				
9	Configure the STAUT to join AP1's BSS.	Configure AP1 as per Table 4 and Table 308 for the 5 GHz band.		

Step	STAUT	Test bed AP1	Test bed validation	Expected result
		Set the TXOP Duration RTS Threshold value in HE Operation Parameters field = 1. AP1 sends a Beacon and Probe Response frames to the STAUT		
10	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
11	The STAUT sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64. Run PING (1000 bytes) for 30 seconds.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		SN: Verify the following: 1. STAUT sends PPDUs that initiate a TXOP (can be the only PPDU as well) is preceded with RTS/CTS exchange. 2. Ping is successful. If all conditions are true, then CONTINUE else FAIL.
12		Configure TXOP Duration RTS Threshold value in HE Operation Parameters field = 12		
13	The STAUT sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64. Run PING (1000 bytes) for 30 seconds.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		SN: Verify the following: 1. STAUT sends PPDUs that initiate a TXOP (can be the only PPDU as well) with “PPDU duration + Duration value carried in the MPDUs in the PPDU” > 384 µsec, is always preceded by RTS/CTS. 2. Ping is successful. If all conditions are true, then CONTINUE else FAIL.
14	The STAUT sends an ADDBA Request frame to AP1 with Buffer Size ≤ 64. Run traffic HE1-STA1-AP1-5G.txt.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		SN: Verify the following: 1. STAUT sends PPDUs that initiate a TXOP (can be the only PPDU as well) with “PPDU duration + Duration value carried in the MPDUs in the PPDU” > 384 µsec, is always preceded by RTS/CTS. 2. Test script runs to completion without errors. If all conditions are true, then PASS else FAIL.

5.72 STAUT Multi-BSSID tests

5.72.1 STAUT Multi-BSSID test

Objective

This test case verifies that the STAUT is able to support Multi-BSSID operation by decoding the Beacon frame and associating and receiving data from the transmitted and non-transmitted BSSID BSS.

Applicability: Mandatory

References

Section 6.3.2.48 [1]

Section 9.4.2.46 [2]

Test environment

- STAUT
- Test bed STA1: Wi-Fi CERTIFIED 6 STA
- Testbed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 309 defines the specific parameter values required for this test case.

Table 309. STAUT Multi-BSSID test configuration

Parameter	**Test bed STA1 value**	**STAUT value**	**Test bed AP1 value**
Test bed vendor	Broadcom98	N/A	Intel
AP control channel	N/A	N/A	36 in 5 GHz 6 in 2.4 GHz
Bandwidth	80 MHz in 5 GHz 20 MHz in 2.4 GHz	Default	80 MHz in 5 GHz 20 MHz in 2.4 GHz
Maximum number of BSSIDs in M-BSSID (Default is 1 i.e., no M-BSSID support) Note: This is used to enable the Capability bit to signal support for M-BSSID and also the number of BSSs supported	N/A	N/A	2
Security	WPA2-Personal	WPA2-Personal	WPA2-Personal
SSID of M-BSSID			Transmitted BSSID with SSID of Prefix with five additional random characters appended for reference Tx_SSID, Security key: 1234567890

Parameter	Test bed STA1 value	STAUT value	Test bed AP1 value
			Non-transmitted BSSID_1 with SSID of Prefix with five additional random characters appended, for reference nonTx_SSID (assure nonTx_SSID is different from Tx_SSID), Security Key: 8901234567
Spatial streams	Default (1)	N/A	1

Test procedure and expected results

Table 310 provides the specific test procedure and expected results for this test case.

Table 310. STAUT Multi-BSSID test procedure and expected results

Step	Test bed STA1	STAUT	Test bed AP1	Test bed validation	Expected result
1	Configure STA1 per Table 6 and Table 309.	Configure STAUT per Table 14 and Table 309.	Configure the AP1 per Table 4 and Table 309. Configure AP1 for M-BSSID support		
If the STAUT supports 2.4 GHz go to Step 2, else go to Step 15.					
2			Configure AP1 to the 2.4 GHz band.		
3		The STAUT is requested to return a list of scan results. These results should include all the SSID and BSSID seen.			Verify the following conditions are true: 1. Tx_SSID is included in the returned list. 2. The BSSID of the Tx_SSID in the returned list matches the transmitted BSSID. 3. NonTx_SSID is included in the returned list. 4. The BSSID of the nonTx_SSID in the returned list matches the non-transmitted BSSID_1. If all conditions are true, then CONTINUE else FAIL.
4	STA1 sends an Association Request frame to BSSID_1.	The STAUT sends an Association Request frame to Tx_SSID with Transmitted BSSID.	AP1 sends an Association Response frame to STA1 and STAUT.	SN: Verify that the association between AP1 and STA1 is successful.	SN: Verify the following conditions are true: 1. RA field of Association Request frame sent by STAUT is set to the transmitted BSSID 2. SSID for Association Request frame corresponds to Tx_SSID 3. Extended Capabilities Element sent in Association Request frame from STAUT has Multiple BSSID bit = 1 4. Association between the AP1 and STAUT is successful

Step	Test bed STA1	STAUT	Test bed AP1	Test bed validation	Expected result
					If all conditions are true, then CONTINUE else FAIL. Note: Sniffer records the AIDs assigned to STAUT and STA1.
5	STA1 sends an ADDBA Response frame to the STAUT.	STAUT sends an ADDBA Response frame to AP1.	AP1 sends ADDBA Request frames to STAUT and STA1 with Buffer size ≤64.	SN: Verify that the BA agreement between AP1 and STA1 is established.	SN: If the BA agreement is established with STAUT, then CONTINUE else FAIL.
6	Configure STA1 to PS mode.	Configure STAUT to PS mode.			SN: If the PM bit =1 (STAUT in PS mode), then CONTINUE else FAIL.
7		.	Run script HE1-AP-STA1_24GHz_M-BSSID-STAUT-STA1.txt to STA1 and STAUT for 30 seconds.		SN: After traffic is initiated and there is data for the STAUT verify the following: 1. If the Beacon frame has TIM bit = 1 corresponding to AID of STAUT, then STAUT sent PS-Poll/QoS Null to AP1 2. If the STAUT changes to active mode (as indicated by QoS Null with PM bit =0 sent by STAUT in step above) for the buffered frame reception, after the STA change to active mode to receive the buffered frames from the AP, then STAUT transitions into PS mode (STAUT sends frame with PM bit =1 and is acknowledged by AP1) 3. Throughput of STAUT > 5721S7_TP_24G If all the conditions are true, then CONTINUE else FAIL.
8			Run script HE1-AP-STA1_24GHz_M-BSSID_STAUT-STA1.txt. to STA1 for 30seconds.		SN: Verify the following conditions are true: 1. There is no PS-Poll/QoS Null frame from STAUT after the Beacon frame that does not signal traffic for the STAUT (setting the AID field in the TIM element that corresponds to STAUT to 0) 2. After data is sent by AP1 to STAUT, STAUT transitions into PS mode (STAUT sends frame with PM bit = 1 and is acknowledged by AP1) If all conditions are true, then CONTINUE else FAIL
9	Disassociate STA1	Disassociate STAUT			
10	STA1 sends an Association Request	STAUT sends an Association Request frame to nonTx_SSID with BSSID_1.	AP1 sends an Association Response frame to STA1 and STAUT.	SN: Verify that the association between AP1 and STA1 is successful.	SN: Verify the following conditions are true: 1. RA field of Association Request frame sent by STAUT corresponds to BSSID_1

Step	Test bed STA1	STAUT	Test bed AP1	Test bed validation	Expected result
	frame to the transmitted BSSID.				2. SSID for Association Request frame corresponds to nonTx_SSID 3. Extended Capabilities Element sent in Association Request frame from STAUT has Multiple BSSID bit = 1 4. Association between the AP1 and STAUT is successful If the conditions are true, then CONTINUE else FAIL Note: Sniffer records the AIDs assigned to STAUT and STA1.
11	STA1 sends an ADDBA Response frame to the STAUT.	STAUT sends an ADDBA Response frame to AP1.	AP1 sends ADDBA Request frames to STAUT and STA1.	SN: Verify that the BA agreement between AP1 and STA1 is established.	SN: If a BA agreement is established with STAUT, then CONTINUE else FAIL.
12	Configure STA1 to PS mode.	Configure STAUT to PS mode.			SN: If the PM bit =1 (STAUT in PS mode), then CONTINUE, else FAIL.
13			Run script HE1-AP-STA1_24GHz_M-BSSID_STAUT-STA1.txt to the STAUT and STA1 for 30 seconds.		SN: After traffic is initiated and there is data for the STAUT verify the following: 1. If the Beacon frame has TIM bit = 1 corresponding to AID of STAUT, then STAUT sent PS-Poll/QoS Null frame to AP1 2. If the STAUT changes to active mode (as indicated by QoS Null with PM bit =0 sent by STAUT in step above) for the buffered frame reception after data is sent by AP1 to STAUT then STAUT transitioned into PS mode (STAUT sends frame with PM bit 1 and is acknowledged by AP1) 3. Throughput of STAUT > 5721S13_TP_24G If all the above conditions are true, then CONTINUE else FAIL
14			Run script HE1-AP-STA1_24GHz_M-BSSID_STAUT-STA1.txt to STA1 for 30 seconds		SN: Verify the following conditions are true: 1. There is no PS-Poll/QoS Null frame from STAUT after Beacon frame(s) that do not signal traffic for STAUT(setting the AID field in the TIM element that corresponds to STAUT to 0) 2. If the STAUT changes to active mode for the buffered frame reception after data is sent by AP1 to STAUT, STAUT transitions into PS mode (STAUT sends frame with PM bit = 1 and is acknowledged by AP1) If all conditions are true, then CONTINUE else FAIL.
If the STAUT supports 5 GHz, go to Step 15 else PASS.					

Step	Test bed STA1	STAUT	Test bed AP1	Test bed validation	Expected result
15			Configure AP1 to operate in the 5 GHz band.		
16	Repeat Steps 3 to 6.				If the verification in Steps 3-6 is successful, then CONTINUE else FAIL.
17			Run script HE1-AP-STA1_5GHz_M-BSSID_STAUT.txt to STAUT and STA1 for 30 seconds.		SN: After traffic is initiated and there is data for the STAUT verify the following: 1. If the Beacon frame has TIM bit = 1 corresponding to AID of STAUT, then STAUT sent PS-Poll/QoS Null to AP1 2. If the STAUT changes to active mode (as indicated by QoS Null with PM bit =0 sent by STAUT in step above) for the buffered frame reception, after the STA change to active mode to receive the buffered frames from the AP, then, STAUT transitions into PS mode (STAUT sends frame with PM bit =1 and is acknowledged by AP1) 3. Throughput of STAUT > 5721S17_TP_5G If all the conditions are true, then CONTINUE else FAIL.
18			Run script HE1-AP-STA1_5GHz_M-BSSID_STAUT.txt to STA1 for 30 seconds.		SN: Verify the following conditions are true: 1. There is no PS-Poll/QoS Null frame from STAUT after the Beacon frame that does not signal traffic for the STAUT (setting the AID field in the TIM element that corresponds to STAUT to 0) 2. After data is sent by AP1 to STAUT, STAUT transitions into PS mode (STAUT sends frame with PM bit = 1 and is acknowledged by AP1) If all conditions are true, then CONTINUE else FAIL
19	Repeat Steps 9-12.				If the verification in Steps 9-12 is successful, then CONTINUE else FAIL.
20			Run script HE1-AP-STA1_5GHz_M-BSSID_STAUT.txt to the STAUT and STA1 for 30 seconds.		SN: After traffic is initiated and there is data for the STAUT verify the following: 1. If the Beacon frame has TIM bit = 1 corresponding to AID of STAUT, then STAUT sent PS-Poll/QoS Null frame to AP1 2. If the STAUT changes to active mode (as indicated by QoSNull with PM bit =0 sent by STAUT in step above) for the buffered frame reception after data is sent by AP1 to STAUT then STAUT transitioned into PS mode (STAUT sends frame with PM bit = 1 and is acknowledged by AP1)

Step	Test bed STA1	STAUT	Test bed AP1	Test bed validation	Expected result
					3. Throughput of STAUT > 5721S20_TP_5G If all the above conditions are true, then CONTINUE else FAIL
21			Run script HE1-AP-STA1_5GHz_M-BSSID_STAUT.txt to STA1 for 30 seconds.		SN: Verify the following conditions are true: 1. There is no PS-Poll/QoS Null frame from STAUT after Beacon frame(s) that do not signal traffic for STAUT(setting the AID field in the TIM element that corresponds to STAUT to 0) 2. If the STAUT changes to active mode for the buffered frame reception after data is sent by AP1 to STAUT, STAUT transitions into PS mode (STAUT sends frame with PM bit = 1 and is acknowledged by AP1) If all conditions are true, then PASS else FAIL.

5.73 STAUT HE MU-RTS/CTS tests

5.73.1 STAUT HE MU-RTS/CTS test

Objective

This test case verifies that the STAUT correctly receives MU-RTS and responds with CTS.

Applicability: Mandatory

References

Section 6.3.2.37 and 6.3.2.38 [1]

Section 26.2.6[7]

Test environment

- STAUT
- Test bed AP1: Wi-Fi CERTIFIED 6 AP
- Wireless Sniffer

Test configuration

Table 311 defines the specific parameter values required for this test case.

Table 311. STAUT HE MU-RTS/CTS test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Qualcomm
Bandwidth	N/A	20 MHz in 2.4 GHz 80 MHz in 5 GHz
AP control channel	N/A	36 in 5 GHz 6 in 2.4 GHz

Test procedure and expected results

Table 312 provides the specific test procedure and expected results for this test case.

Table 312. STAUT HE MU-RTS/CTS test procedure and expected results

Step	STAUT	Test bed AP1	Expected result
1	Configure STAUT per Table 14 and Table 311.	Configure AP1 per Table 4 and Table 311.	
If the STAUT supports the 2.4 GHz band, then go to Step 2 otherwise go to Step 8.			

Step	STAUT	Test bed AP1	Expected result
2	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.	
3	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frameto the STAUT.	If the association between the STAUT and AP1 succeeds, then CONTINUE else FAIL.
4		Configure AP1 to send MU-RTS to the STAUT.	
5		Run DT1-AP-DUT.txt script from AP to STAUT to generate the Downlink traffic	
6			If a CTS was sent after MU-RTS, then CONTINUE else FAIL. SN: Verify the following setting in the CTS: 1. RA set to the address from the TA field of the MU-RTS Trigger frame 2. Duration = (Duration field in from MAC header from MU-RTS) - SIFS - (transmission time length of CTS) If all of the conditions are true, then CONTINUE else FAIL.
7	Disassociate the STAUT from AP1.		
If the STAUT supports the 5 GHz band, then go to Step 8 otherwise PASS.			
8	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.	
9	Repeat Steps 3-7.		If the verification in Steps 3-7 is successful, then PASS else FAIL.

5.74 STAUT transmits operating mode tests

5.74.1 STAUT transmits operating mode test

Objective

This test case verifies that the DUT properly transmits OM A-Control information.

Applicability: Optional. This test shall be executed only if the STAUT declared support for transmitting the OM Control field within the HE Variant of the HT Control field and 5 GHz in Table 2, or the STAUT declared support for transmitting the OM Control field within the HE Variant of the HT Control field, 2.4 GHz and NSS > 1 in Table 2. Part of the test steps on NSS > 1 shall be executed only if the STAUT declared support for NSS > 1.

References

Section 6.4.2.18 [1]

Section 26.9.3 [7]

Test environment

- STAUT
- Test bed AP: Wi-Fi CERTIFIED 6 STA
- Wireless Sniffer

Test configuration

Table 313 defines the specific parameter values required for this test case.

Table 313. STAUT transmits operating mode test configuration

Parameter	STAUT value	Test bed AP1 value
Test bed vendor	N/A	Broadcom
Security	WPA2-Personal	WPA2-Personal
Encryption key	12345678	12345678
AP control channel	N/A	6 for 2.4 GHz band 36 for 5 GHz band
Spatial streams implemented	N/A	2
Transmit OM Control subfield in MPDU(s) sent in a PPDU when signaled by the script. The MPDU(s) in the PPDU solicit an immediate response (Ack or BlockAck)) The PPDU is sent in HE TB PPDU if the STAUT is not configured to Disable MU in OMI Control field, otherwise it is	Enable	NA

Parameter	STAUT value	Test bed AP1 value
sent in an SU PPDU (there is no UPH when sent in SU PPDU)..		
BW	Default	80 MHz on 5 GHz 20 MHz on 2.4 GHz
UL OFDMA	N/A	Enable

Test procedure and expected results

Table 314 provides the specific test procedure and expected results for this test case.

Table 314. STAUT transmits operating mode test procedure and expected results

Step	STAUT	Test bed AP1	Test bed validation	Expected result
1	If the STAUT supports 5 GHz, go to Step 2 else go to Step 17. In 5 GHz band, if the DUT is 20 MHz-only STAUT, then go to Step 10 else Step 2.			
2	Configure STAUT per Table 14 and Table 313. Configure the STAUT to operate in 5 GHz.	Configure AP1 per Table 4, and Table 313. Configure MU EDCA parameters per Table 5.		
3	Configure the STAUT to join AP1's BSS in the 5 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.	Verify that within Beacon frames and Probe Response frames: 1. +HTC HE Support subfield of the HE Capabilities element =1 2. OM Control Support subfield of the HE Capabilities element = 1	
4	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the STAUT's association succeeds, then CONTINUE else FAIL.
5	The STAUT sends an ADDBA Request frame to AP1.	AP1 sends an ADDBA Response frame to the STAUT with Buffer Size ≤ 64.		SN: If the BA setup is successful, then CONTINUE else FAIL.
6		Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from the STAUT.		
7	Configure the STAUT to run the script UT1-DUT-AP_5.74.X.txt to AP1 for 20 seconds.		Verify that the common Info subfield in the Basic Trigger frame has: 1. Trigger Type = 0 (Basic) 2. UL BW = 2 (80 MHz) and contains a User Info field with:	Compute the throughput between the STAUT and AP1. If the throughput > 5741S7_1SS_80M_5G, then CONTINUE else FAIL.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
			1. AID12 subfield set to the AID of the STAUT and 2. SS Allocation/RA-RU Information set to: a. Starting Spatial Stream = 0 b. Number of Spatial Streams = 0	
8	Configure the STAUT to run the script UT1-DUT-AP-OMCtrl.txt t to AP1 for 30 seconds. After 2 seconds, configure the STAUT to include the OM Control subfield in transmitted MPDU(s) in a PPDU with: 1. Channel Width subfield = 0 (BW=20 MHz) 2. UL MU Disable subfield = 0 3. UL MU Data Disable = 0 4. Tx NSTS subfield = 0 (actual Tx NSTS=1) Note: only change 80M→20MHz.		After AP1 acknowledges the HE TB PPDU that has MPDUs carrying UPH Control subfield and the OMI Control field, the Basic Trigger frame is sent by the AP1 after the 5741S8_TF_5G th Basic Trigger frame and within 5741S8_TF_TIME_5G TXOPs with the following settings: 1. Common Info subfield: a. Trigger Type = 0 (Basic) b. BW = 0 (20 MHz) 2. Basic Trigger frame contains a User Info field with a. AID12 subfield set to the AID of the STAUT and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 0	SN: Verify the following conditions are true: 1. The HE TB PPDU or HE SU PPDU from the STAUT is carrying MPDUs that have the HT Control field carrying the OMI Control field, verify the following settings: a. Channel Width subfield = 0 (BW=20MHz) b. UL MU Disable subfield = 0 c. UL MU Data Disable = 0 d. Tx NSTS subfield = 0 (actual Tx NSTS=1) 2. Computed throughput > 5741S8_TP_1SS_5G / 4, If all the conditions above are true, then CONTINUE else FAIL.
9	Note: only change 20M→80MHz. Configure the STAUT to run the script UT1-DUT-AP-OMCtrl.txt to AP1 for 20 seconds. At time 2 seconds after the traffic initiated by AP1, configure the STAUT to include the UPH Control subfield and the OM Control field in transmitted MPDU(s) with: 1. Channel Width = 2 (BW=80MHz) 2. UL MU Disable subfield = 0		After AP1 acknowledges HE TB PPDU that has MPDUs carrying the UPH Control subfield and the OMI Control field, the Basic Trigger frame sent by the AP1, after the 5741S9_TF_5G th Basic Trigger frame and within 5741S9_TF_TIME_5G TXOP with the following settings: 1. Common Info subfield has: a. Trigger Type = 0 (Basic) b. BW = 2 (80 MHz) 2. Basic Trigger frame contains one User Info field with: a. AID12 subfield set to the AID of the AP1 and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0	SN: Verify the following conditions are true: 1. The HE TB PPDU or HE SU PPDU from the STAUT is carrying MPDUs that have HT Control field carrying the OMI Control field has the following settings: a. Channel Width = 2 (BW=80 MHz) b. UL MU Disable subfield = 0 c. UL MU Data Disable = 0 d. Tx NSTS = 0 (actual Tx NSTS=1) 2. The computed throughput > 5741S9_TP_1SS_80M_5G If all the conditions above are true, then CONTINUE else FAIL.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
	3. UL MU Data Disable = 0 4. Tx NSTS = 0 (actual Tx NSTS=1)		• Number of Spatial Streams = 0	
10	If the STAUT supports > 1SS, go to Step 11, else go to Step 16.			
11	Note: Tx NSTS from 1→2 Configure the STAUT to run the script UT1-DUT-AP-OMCtrl.txt to AP1 for 20 seconds. At time 2 seconds after the traffic initiated by AP1, configure the STAUT to include the UPH Control subfield and the OM Control field in transmitted MPDU(s) with: 1. If the DUT is 20 MHz-only STAUT, then Channel Width = 0 (BW=20MHz) else Channel Width = 2 (BW=80MHz) 2. UL MU Disable subfield = 0 3. UL MU Data Disable = 0 4. Tx NSTS = 1 (actual Tx NSTS=2)		After AP1 acknowledges the HE TB PPDU that has MPDUs carrying the UPH Control subfield and the OMI Control field, the Basic Trigger frame sent by the AP1, after the 5741S11_TF_5G th Basic Trigger frame and within 5741S11_TF_TIME_5G TXOP has the following settings: 1. Common Info subfield has: a. Trigger Type = 0 (Basic) b. If the DUT is 20 MHz-only STAUT, then BW = 0 (20MHz) else BW = 2 (80MHz) 2. Basic Trigger frame contains one User Info field with: a. AID12 subfield set to the AID of the AP1 and b. SS Allocation/RA-RU Information set to • Starting Spatial Stream = 0 • Number of Spatial Streams = 1	SN Verify the following conditions are true: 1. The HE TB PPDU or HE SU PPDU from the STAUT is carrying MPDUs that have the HT Control field carrying the OMI Control field with the following settings: a. If the DUT is 20 MHz-only STAUT, then Channel Width = 0 (BW=20MHz) else Channel Width = 2 (BW=80MHz) b. UL MU Disable subfield = 0 c. UL MU Data Disable = 0 d. Tx NSTS = 1 (actual Tx NSTS=2) 2. Computed throughput > 5741S11_TP_1SS_80M_5G * 2 If all the conditions above are true, then CONTINUE else FAIL
12	Note: Tx NSTS from 2→1 Configure the STAUT to run the script UT1-DUT-AP-OMCtrl.txt to AP1 for 20 seconds. At time 2 seconds after the traffic initiated by AP1, configure the STAUT to include the UPH Control subfield and the OM Control field in transmitted MPDU(s) with: 1. If the DUT is 20 MHz-only STAUT, then Channel Width = 0 (BW=20 MHz) else		After AP1 acknowledges the HE TB PPDU that has MPDUs carrying the UPH Control subfield and the OMI Control field, the Basic Trigger frame sent by the AP1 after the 5741S12_TF_5G th Basic Trigger frame and within 5741S12_TF_TIME_5G TXOP has the following settings: 1. Common Info subfield has: a. Trigger Type = 0 (Basic) b. If the DUT is 20 MHz-only STAUT, then BW = 0 (20MHz) else BW = 2 (80 MHz) 2. Basic Trigger frame contains one User Info field with	SN Verify the following conditions are true: 1. The HE TB PPDU or HE SU PPDU from the STAUT is carrying MPDUs that have HT Control field carrying the OMI Control field with the following settings: a. If the DUT is 20 MHz-only STAUT, then Channel Width = 0 (BW=20MHz) else Channel Width = 2 (BW=80 MHz) b. UL MU Disable subfield = 0 c. UL MU Data Disable = 0 d. Tx NSTS = 0 (actual Tx NSTS=1) 2. Computed throughput > 5741S12_TP_1SS_80M_5G If all the conditions above are true, then CONTINUE, else FAIL

Step	STAUT	Test bed AP1	Test bed validation	Expected result
	Channel Width = 2 (BW=80 MHz) 2. UL MU Disable subfield = 0 3. UL MU Data Disable = 0 4. Tx NSTS = "0" (actual Tx NSTS=1)		a. AID12 subfield set to AP1's AID and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 0	
13	Note: UL MU Enable→Disable test Configure the STAUT to run the script UT1-DUT-AP-OMCtrl.txt to AP1 for 20 seconds. At time 2 seconds after the traffic initiated by AP1, configure the STAUT to include the UPH Control subfield and the OM Control field in transmitted MPDU(s) with: 1. If the DUT is 20 MHz-only STAUT, then Channel Width = 0 (BW=20 MHz) else Channel Width = 2 (BW=80 MHz) 2. UL MU Disable subfield = 1 3. UL MU Data Disable = 0 4. Tx NSTS = 0 (actual Tx NSTS=1)		Verify that after successful reception of HE TB PPDU carrying the OMI signaling, no Trigger frames are sent from AP1 after 5741S13_TF_5G TXOP period there are no Trigger frames from AP1	SN: If the last captured HE TB PPDU is carrying MPDUs that have an HT Control field carrying OMI, and the OMI Control field has: 1. If the DUT is 20 MHz-only STAUT, then Channel Width = 0 (BW=20 MHz) else Channel Width = 2 (BW=80 MHz) 2. UL MU Disable subfield = 1 3. UL MU Data Disable = 0 4. Tx NSTS = 0 (actual Tx NSTS=1) then CONTINUE else FAIL.
14	Note: UL MU Disable->Enable test Configure the STAUT to run the script UT1-DUT-AP-OMCtrl.txt to AP1 for 20 seconds. After time 10 seconds after traffic is initiated, configure the STAUT to include the OM Control field in transmitted MPDU(s) to AP1 with: 1. If the DUT is 20 MHz-only STAUT, then Channel Width = 0		Verify that after successful reception of MPDUs carrying the OMI signaling, there is at least one Basic Trigger frame sent by AP1 after 5741S14_TF_5G TXOP with the following settings: 1. Common Info has: a. Trigger Type = 0 (Basic) b. If the DUT is 20 MHz-only STAUT, then BW = 0 (20 MHz) else BW =2 (80 MHz) 2. Contains one User Info field with a. AID12 subfield = the AID of the STAUT and	SN: If the PPDU sent by the STAUT to AP1 is carrying MPDUs that have HT Control field carrying the OMI Control field, verify that OMI Control field has: 1. If the DUT is 20 MHz-only STAUT, then Channel Width = 0 (BW=20MHz) else Channel Width = 2 (BW=80 MHz) 2. UL MU Disable subfield = 0 3. UL MU Data Disable = 0 4. Tx NSTS = 0 (actual Tx NSTS=1) The computed throughput > 5741S14_TP_1SS_80M_5G If all the conditions above are true, then CONTINUE, else FAIL

Step	STAUT	Test bed AP1	Test bed validation	Expected result
	(BW=20MHz) else Channel Width = 2 (BW=80 MHz) 2. UL MU Disable subfield = 0 3. UL MU Data Disable = 0 4. Tx NSTS = 0 (actual Tx NSTS=1)		b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 0	
15		AP1 disassociates from the STAUT.		
16	If the STAUT supports 2.4 GHz, go to Step 17, else PASS.			
17	Configure the STAUT to per Table 14 and Table 313.	Configure AP1 per Table 4 and Table 313. Configure the AP1 MU EDCA parameters as per Table 5.		
18	Configure the STAUT to join AP1's BSS in the 2.4 GHz band.	AP1 sends Beacon and Probe Response frames to the STAUT.	Verify that within Beacon frames and Probe Response frames: 1. +HTC HE Support subfield of the HE Capabilities element = 1 2. OM Control Support subfield of the HE Capabilities element = 1	
19	The STAUT sends an Association Request frame to AP1.	AP1 sends an Association Response frame to the STAUT.		If the STAUT's association succeeds, then CONTINUE else FAIL. SN: Verify the following in the Association Request frame: 1. +HTC-HE field of the HE Capabilities element = 1. 2. OM Control Support field of the HE Capabilities element = 1 If all the conditions above are true, then CONTINUE else FAIL.
20	STAUT sends an ADDBA Request frame to AP1.	ADDBA Response from AP1 to STA1.		SN: If BA setup is successful, then CONTINUE else FAIL.
21		Configure AP1 to transmit Trigger frames in SU PPDU to solicit TB PPDU from the STAUT.		
22	Configure the STAUT to run the script UT1-DUT-AP_5.74.X.txt to STAUT for 20 seconds.		1. Verify the following from AP1:Common Info field in the Basic Trigger frame contains: a. Trigger Type = 0 (Basic) b. BW = 0 (20 MHz) 2. User Info field with: a. AID12 subfield set to the AID of the STAUT and b. SS Allocation/RA-RU Information set to:	If the computed throughput > 5741S22_1SS_20M_24G, then CONTINUE else FAIL.

Step	STAUT	Test bed AP1	Test bed validation	Expected result
			• Starting Spatial Stream = 0 • Number of Spatial Streams = 0	
23	If the STAUT supports > 1SS, go to Step 24 else go to Step 26.			
24	Note: Tx NSTS from 2→1 Configure the STAUT to run the script UT1-DUT-AP-OMCtrl.txt to AP1 for 20 seconds. At time 2 seconds after the traffic is initiated by AP1, configure the STAUT to include the UPH Control subfield and the OM Control field in transmitted MPDU(s) with: 1. Channel Width = 0 (BW=20 MHz) 2. UL MU Disable subfield = 0 3. UL MU Data Disable = 0 4. Tx NSTS = 0 (actual Tx NSTS=1)		After AP1 acknowledges the HE TB PPDU that has MPDUs carrying the UPH Control subfield and the OMI signaling, the Basic Trigger frame sent by the AP1 after the 5741S24_TF_24G Trigger frame and within 5741S24_TF_TIME_24G time has the following settings: 1. Common Info subfield has: a. Trigger Type = 0 (Basic) b. BW = 0 (20 MHz) 2. Basic Trigger frame contains one User Info field with a. AID12 subfield set to AP1 AID and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0 • Number of Spatial Streams = 0	SN: Verify the following conditions are true: 1. The HE TB PPDU or HE SU PPDU from the STAUT is carrying MPDUs that have HT Control field carrying the OMI Control field, verify that OMI field has: a. Channel Width = 0 (BW=20 MHz) b. UL MU Disable subfield = 0 c. UL MU Data Disable = 0 d. Tx NSTS = 0 (actual Tx NSTS=1) 2. Computed throughput > 5741S24_TP_20M_24G If all the conditions above are true, then CONTINUE, else FAIL
25	Note: Tx NSTS from 1→2 Configure the STAUT to run the script UT1-DUT-AP-OMCtrl.txt to AP1 for 20 seconds. At time 2 seconds after the traffic is initiated by AP1, configure the STAUT to include the UPH Control subfield and the OM Control field in transmitted MPDU(s) with: 1. Channel Width = 0 (BW=20MHz) 2. UL MU Disable subfield = 0 3. UL MU Data Disable = 0 4. Tx NSTS = 1 (actual Tx NSTS=2)		After AP1 acknowledges the HE TB PPDU that has MPDUs carrying the UPH Control subfield and the OMI Control field, the Basic Trigger frame sent by the AP1 after the 5741S25_TF_24G th Basic Trigger frame and within 5741S25_TF_TIME_24G TXOP has the following settings: 1. Common Info subfield has: a. Trigger Type = 0 (Basic) b. BW = 0 (20 MHz) 2. Basic Trigger frame contains one User Info field with a. AID12 subfield set to the AID of the AP1 and b. SS Allocation/RA-RU Information set to: • Starting Spatial Stream = 0	SN Verify the following conditions are true:: 1. The HE TB PPDU or HE SU PPDU from the STAUT is carrying MPDUs that have HT Control field carrying the OMI Control field with the following settings: a. Channel Width = 0 (BW=20 MHz) b. UL MU Disable subfield = 0 c. UL MU Data Disable = 0 d. Tx NSTS = 1 (actual Tx NSTS=2) 2. Computed throughput > 5741S25_TP_1SS_20M_24G * 2 If all the conditions above are true, then CONTINUE, else FAIL

Step	STAUT	Test bed AP1	Test bed validation	Expected result
			• Number of Spatial Streams = 1	
26	Note: UL MU Enable→Disable test Configure the STAUT to run the script UT1-DUT-AP-OMCtrl.txt to AP1 for 20 seconds. At time 2 seconds after the traffic is initiated by AP1, configure the STAUT to include UPH Control subfield and the OM Control field in transmitted MPDU(s) with: 1. Channel Width = 0 (BW=20 MHz) 2. UL MU Disable subfield = 1 3. UL MU Data Disable = 0 4. Tx NSTS = 0 (actual Tx NSTS=1)		After successful reception of the HE TB PPDU from the STAUT carrying the OMI signaling change, verify that AP1 does not send any Trigger frames after 5741S26_TF_24G * TXOP time.	SN: If the last captured HE TB PPDU or HE SU PPDU from the STAUT is carrying MPDUs that have an HT Control field carrying the OMI Control field, and the OMI field has: 1. Channel Width = 0 (BW=20 MHz) 2. UL MU Disable subfield = 1 3. UL MU Data Disable = 0 4. Tx NSTS = 0 (actual Tx NSTS=1) then CONTINUE else FAIL.
27	Configure the STAUT to run the script UT1-DUT-AP-OMCtrl.txt to AP1 for 20 seconds. After time 10 seconds after traffic is initiated, configure the STAUT to include the OM Control field in transmitted MPDU(s) to AP1 with: 1. Channel Width = 0 (BW=20 MHz) 2. UL MU Disable subfield = 0 3. UL MU Data Disable = 0 4. Tx NSTS = 0 (actual Tx NSTS=1)		After successful reception of MPDUs carrying the OMI signaling from the STAUT, verify that a Basic Trigger frame is sent by AP1 after 5741S27_TF_24G * TXOP time with the following settings: 1. Common Info has: a. Trigger Type = 0 (Basic) b. BW =0 (20 MHz) 2. Contains one User Info field with a. AID12 subfield set to the AID of the STAUT and b. SS Allocation/RA-RU Information: • Starting Spatial Stream = 0 • Number of Spatial Streams = 0	SN: Verify the following conditions are true: 1. HE TB PPDU sent by STAUT to AP1 in response to the Trigger frame contains MPDUs that have the HT Control field carrying the OMI Control field configured with: a. Channel Width = 0 (BW=20 MHz) b. UL MU Disable subfield = 0 c. UL MU Data Disable = 0 d. Tx NSTS = 0 (actual Tx NSTS=1) 2. Computed throughput > 5741S27_TP_1SS_20M_24G If all the conditions above are true, then PASS, else FAIL

Appendix A (Normative) Test bed products

A.1 Approved test bed vendors

All test bed equipment is available exclusively from:

Tessco Technologies

11126 McCormick Road

Hunt Valley, Maryland 21031

wifialliance@tessco.com

Note that the distributor does not supply technical support and cannot answer technical questions regarding this equipment. A contact person for each device is listed herein that may be able to direct technical questions to the correct resource.

The current list of all approved test bed equipment for all Wi-Fi Alliance test beds may be accessed at the ftp site: https://www.wi-fi.org/members/certification-testing/test-bed-information.

A.2 Approved test bed equipment

Table 315 and Table 316 provide the approved test bed equipment listed in this test plan.

Table 317 provide the approved test bed tools listed in the test plan

Table 315. Approved test bed Access Points

Vendor	Product	Software version(s)	Contact
Broadcom	BCM94908R43684AX	2_55_54_777550 17.10.79.9	wfa-support-list@broadcom.com
Intel	AXE6000WFA	Sigma-CAPI-10.2.135-PF8-06.01.00.217_PF8_38 06.01.00.217_PF8_38	wfa.11ax.support@intel.com
Marvell	RD-88W-AP4800-DR-WIFI-S0	PCEDUT-SIGMA-8.3.0 WFA_10.20.18.100-W906x,firmware,1.20.21.100,installer,Wi-Fi6_AP_1105	wifilab-support@marvell.com
Qualcomm	CA-65-YC633-1000	IPQ8074.ILQ.10.0.6-00061-P-1	wfa.external.support@qti.qualcomm.com
Ruckus	979-R750-US00	version_8c65e61_09Aug2019 final_candidate_0802	#ruckus_11ax_wfa_support@commscope.com

Table 316. Approved test bed Stations

Vendor	Product	Software version(s)	Contact
Broadcom	BCM94375FCPAESL	WTS-HE-R1-1.3 18.35.319.13-r-833007:01-95c64df6	wfa-support-list@broadcom.com
Broadcom	BCM943698FCPAESL	WTS-HE-R1-1.3 18.20.8.23-r-833096:01-e5546584	wfa-support-list@broadcom.com
Cypress	CYW989650-WFA-TB-01	WiFi6_CYSIGMA_26JUN19 18.36.67	wfa-11ax-support@cypress.com
Intel	AX200.NGWG.NV (Windows)	WTS-1.0.13-HE 21.20.1.1-f72f973b-fwca8bdd89	wfa.external.support@intel.com
Intel	AX200.NGWG.NV (Linux)	WTS-1.0.13-HE ga18642d9-48.ca8bdd89.0	wfa.external.support@intel.com
Marvell	RD-88W-AP4800-DR-WIFI-S0	PCEDUT-SIGMA-8.3.0 10.17.4.100-W906x,firmware,1.17.6.1,installer_version,Wi-Fi6_STA_0809-2	wifilab-support@marvell.com
Qualcomm	CA-WIFI6STA-50	Package version: 280.7-2, version,drv=/wpas=v2.8-devel-hostap_2_7-684-g9af1eea/wlan=version:Host SW:5.2.02.3, FW:0.3.0.135.2, HW:HW_VERSION=0., Board ver: 8 Ref design id: 0, Customer id: 0, Project id/sigma=v1.11-609-g2939210	wfa.external.support@qti.qualcomm.com

Table 317. Approved test tools

Vendor	Product	Software version(s)	Contact
Intel	Sniffer/ AX200.NGWG.NV	SnifferDvSTA,16586F74E8CA0B8C2F70845,SnifferFwSTA,46.a783be01.0,SwInfo,_4.10.0-28-generic,WiresharkVersion,2.6.2-WFA-01,MapConfVersion,MapConfig_HEv1.2	support@wi-fi.org

Appendix B Script files

Table 318 lists the script files that command actions toward the target device and verifies the results.

Table 318. APUT test case script files

Test case	File name	Frame size	Number of pairs	Throughput	Duration	Start delay
4.2.2	APUT-STA1-10.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
4.2.3	APUT-STA1-10.txt					
4.5.2, 4.5.3	DT1-APUT-STA1.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
	DT2-STA1-APUT.txt					
	DT3-APUT-STA1.txt	1000 bytes	1	11.5 Mbps	60 seconds	0 seconds
4.7.1	DT1-STA1-STA2.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
	DT2-STA2-STA1.txt					
	HE-prereq-STA1-STA2-AP.txt					
4.12.1	HE1-STA1-AP-TID-0-30.txt	16K bytes	1	Unlimited	30 seconds	0 seconds
4.13.1	HE1-STA1-AP-90.txt	16K bytes	3	Unlimited	90 seconds	0 seconds
	HE1-STA2-AP-90.txt					
4.14.1	HE1-APUT-STA1_STA2-60.txt	16K bytes	2	Unlimited	60 seconds	0 seconds
4.16.1	HE1-AP-STA1-TID-0.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
4.25.1	HE1-STA1-AP-60.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
4.26.1	HE1-AP-STA1-TID-0.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
4.29.1	HE1-DLOFDMA-APUT.txt	16K bytes	2	Unlimited	90 seconds	0 seconds
4.30.1	HE1-DLOFDMA-APUT.txt					
4.36.1	HE1-DLOFDMA-APUT.txt					
4.37.1	HE1-DLOFDMA-APUT.txt					
4.40.1	HE1-ULOFDMA-APUT.txt	16K bytes	4	Unlimited	60	0 seconds
4.40.2	HE1-ULOFDMA-APUT.txt					
4.40.3	HE1-ULOFDMA-APUT.txt					
4.40.4	HE1-ULOFDMA-APUT.txt					

Test case	File name	Frame size	Number of pairs	Throughput	Duration	Start delay
4.40.5	HE1-ULOFDMA-APUT.txt					
4.41.1	HE1-ULOFDMA-APUT.txt					
4.41.2	HE1-ULOFDMA-APUT.txt					
4.43.1	HE1-ULOFDMA-APUT-STA1-STA2.txt	UDP 1500 Uplink	3	Unlimited	20 seconds	0 seconds
4.44.1	HE1-DLOFDMA-APUT.txt	Transmit: UDP1_BE: 1000 bytes	2	Unlimited	90 seconds	0 seconds
4.45.1	HE1-DLOFDMA-APUT.txt					
4.46.1	HE1-STA1_STA2-APUT-60.txt	Transmit: UDP1_BE – 1000 bytes	2	10	60 seconds	0 seconds
4.49.1	HE1-ULOFDMA-APUT-BE.txt	Transmit: UDP1_BE 200 bytes in 2.4 GHz 800 bytes in 5 GHz	3	85	60 seconds	0 seconds
	HE1-ULOFDMA-APUT-BE-VI.txt	Transmit: UDP1_BE DP1_VI 200 bytes in 2.4 GHz 800 bytes in 5 GHz	3	85	60 seconds	0 seconds
	HE1-ULOFDMA-APUT-BE-VI-VO-BK.txt	Transmit: UDP1_BE UDP1_VI UDP1_VO UDP1_BK 200 bytes in 2.4 GHz 800 bytes in 5 GHz	3	85	60 seconds	0 seconds
4.50.1	HE1-STA-AP-60.txt	200 for 2.4 GHz 800 for 5 GHz	4	Unlimited	60 seconds	0 seconds
4.51.1	HE1-APUT-STA1-60.txt	200 for 2.4 GHz 800 for 5 GHz	4	Unlimited	60 seconds	0 seconds
4.52.1	DT1-APUT-STA1_4.52.X.txt	1500	1	Unlimied	60 seconds	0 seconds
4.52.2	DT1-APUT-STA1_4.52.X.txt					
4.53.1	HE1-DLMUMIMO-APUT.txt	Receive UDP1_BE: 1400 bytes	4	Unlimited	60 seconds	0 seconds
4.53.2	HE1-DLMUMIMO-APUT.txt					
4.53.3	HE1-DLMUMIMO-APUT.txt					
4.54.1	HE1-DLMUMIMO-APUT.txt					

Test case	File name	Frame size	Number of pairs	Throughput	Duration	Start delay
4.56.1	DT1-APUT-STA_4.56.1.txt	Transmit UDP1_BE: 1400 Bytes			60 seconds	0
	UT1-STA-APUT_4.56.1.txt	16K bytes	4	Unlimited	90 seconds	0 seconds
4.58.1	UT1-STA1-APUT_4.58.X.txt	UDP 1400 Uplink	3	Unlimited	20 seconds	0 seconds
	UT1-STA1-APUT-OMCtrl.txt					
	UT1-STA1-APUT-OMCtrl-MUEDCA.txt					
4.60.1	HE1-ULOFDMA-APUT.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
4.62.1	HE1-DLOFDMA-APUT-no-thrpchk.txt	16K bytes	2	Unlimited	90 seconds	0 seconds
4.63.1	HE1-ULOFDMA-APUT-STA1-STA2.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
4.64.1	HE1-ULOFDMA-APUT-STA1-STA2.txt					
4.67.1	HE1-AP-STA1_24GHz_M-BSSID_APUT.txt	UDP_BE – 1400 bytes	1	12 mbps	30 seconds	0 seconds
	HE1-AP-STA1_5GHz_M-BSSID_APUT.txt	Transmit UDP_BE – 1400 bytes	1	75 mbps	30 seconds	0 seconds
4.68.1	DT1-APUT-STA1.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
4.69.1	HE1-DLOFDMA-APUT_4.69.1.txt	16K bytes	8	Unlimited	90 seconds	0 seconds

Table 319. STAUT test case script files

Test case	File name	Frame size	Number of pairs	Throughput	Duration	Start delay
5.2.3	DUT-AP1-10.txt	1000	1	1 kbps	10	0 seconds
5.5.1	DT1-AP-DUT.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
	DT2-DUT-AP.txt					
5.5.2	HE-prereq-DT1-AP-DUT.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
	HE-prereq-DT2-DUT-AP.txt					
5.6.1	HE-gensec-DT1-AP-DUT.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
	HE-gensec-DT2-DUT-AP.txt					
	HE-gensec-DT3-AP-DUT.txt	1000 bytes	1	11.5 Mbps	60 seconds	0 seconds
5.15.1	HE1-AP-DUT-60.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
5.16.1	HE1-AP-DUT-60.txt					
5.17.1	HE1-DUT_STA-AP-60.txt	16K bytes	2	Unlimited	60 seconds	0 seconds

Test case	File name	Frame size	Number of pairs	Throughput	Duration	Start delay
5.18.1	HE1-DUT_STA-AP-60.txt					
5.19.1	HE1-DUT-AP-60.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
5.29.1	HE1-DUT-AP-60.txt					
5.30.1	HE1-AP-DUT-60.txt					
5.33.1	HE1-DLOFDMA-STAUT.txt	16K bytes	3	Unlimited	90 seconds	0 seconds
	HE1-DLOFDMA-STAUT_24G.txt	16K bytes	1	Unlimited	90 seconds	0 seconds
5.34.1	HE1-DLOFDMA-STAUT_STA1-STA3.txt	16K bytes	2	Unlimited	90 seconds	0 seconds
	HE1-DLOFDMA-STAUT.txt					
5.40.1	HE1-DLOFDMA-STAUT_STA1-STA3.txt	16K bytes	2	Unlimited	90 seconds	0 seconds
	HE1-DLOFDMA-STAUT.txt					
5.41.1	HE1-DLOFDMA-STAUT_STA1-STA3.txt	16K bytes	2	Unlimited	90 seconds	0 seconds
	HE1-DLOFDMA-STAUT.txt					
5.44.1	HE1-ULOFDMA-STAUT.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
5.44.2	HE1-ULOFDMA-STAUT-STA1.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
	HE1-ULOFDMA-STAUT.txt	16K bytes	4	Unlimited	60 seconds	0 seconds
5.44.3	HE1-ULOFDMA-STAUT.txt	16K bytes	4	Unlimited	60 seconds	0 seconds
5.44.4	HE1-ULOFDMA-STAUT.txt					
5.44.5	HE1-ULOFDMA-STAUT.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
	HE1-ULOFDMA-STAUT-STA1.txt	16K bytes	3	Unlimited	90 seconds	0 seconds
5.44.6	HE1-ULOFDMA-STAUT.txt	16K bytes	4	Unlimited	60 seconds	0 seconds
5.44.7	HE1-ULOFDMA-STAUT.txt					
5.44.8	HE1-ULOFDMA-STAUT.txt					
5.44.9	HE1-ULOFDMA-STAUT.txt					
5.45.1	HE1-ULOFDMA-STAUT.txt					
5.45.2	HE1-ULOFDMA-STAUT.txt					
5.48.1	HE1-DLOFDMA-STAUT_24G.txt	1000	2	Unlimited	60 seconds	0 seconds
	HE1-DLOFDMA-STAUT.txt	16K bytes	2	Unlimited	90 seconds	0 seconds

Test case	File name	Frame size	Number of pairs	Throughput	Duration	Start delay
5.49.1	HE1-DLOFDMA-STAUT_STA1-STA3.txt	16K bytes	2	Unlimited	90 seconds	0 seconds
	HE1-DLOFDMA-STAUT.txt	Transmit: UDP1_BE:1000 bytes	2	Unlimited	90 seconds	0 seconds
5.50.1	HE1-DLOFDMA-STAUT_STA1-STA3.txt	16K bytes	2	Unlimited	90 seconds	0 seconds
5.51.1	HE1-DLOFDMA-STAUT_STA1-STA3.txt	16K bytes	2	Unlimited	90 seconds	0 seconds
5.53.1	HE1-ULOFDMA-STAUT_BSR.txt	Transmit: UDP1_BE – 200 bytes in 2.4 GHz 800 bytes in 5 GHz	3	85	60 seconds	0 seconds
	HE1-ULOFDMA-STAUT-BE-VI_BSR.txt	Transmit: UDP1_BE DP1_VI 200 bytes in 2.4 GHz 800 bytes in 5 GHz	3	85	60 seconds	0 seconds
	HE1-ULOFDMA-STAUT-BE-VI-VO-BK_BSR.txt	Transmit: UDP1_BE UDP1_VI UDP1_VO UDP1_BK 200 bytes in 2.4 GHz 800 bytes in 5 GHz	3	85	60 seconds	0 seconds
5.54.1	HE1-STA-AP-60.txt	200 for 2.4 GHz 800 for 5 GHz	4	Unlimited	60 seconds	0 seconds
5.55.1	HE1-AP1-STAUT-60.txt	200 for 2.4 GHz 800 for 5 GHz	4	Unlimited	60 seconds	0 seconds
5.56.1	DT2-DUT-AP_5.56.1.txt	1500	1	Unlimited	60 seconds	0 seconds
5.57.1	HE1-DLMUMIMO-STAUT.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
5.57.2	HE1-DLMUMIMO-STAUT.txt					
5.58.1	HE1-DLMUMIMO-STAUT.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
5.60.1	DT1-AP-DUT_5.60.1.txt	Transmit UDP1_BE: 1400 bytes	3	Unlimited	60 seconds	0 seconds
	DT2-DUT-AP_5.60.1.txt	Receive UDP1_BE: 1400 bytes	3	Unlimited	60 seconds	0 seconds
5.61.1	DT2-DUT-AP_5.61.1.txt	250 for 2.4 GHz 1000 for 5 GHz	1	Unlimited	60 seconds	0 seconds
5.62.1	HE1-STA1-AP-TC3.txt	1400	3	Unlimited	60 seconds	0 seconds

Test case	File name	Frame size	Number of pairs	Throughput	Duration	Start delay
5.63.1	HE1-ULOFDMA-STAUT.txt	16K bytes		Unlimited	60 seconds	0 seconds
5.64.1	HE1-STAUT-STA1-AP_VI_BE-60.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
5.66.1	UT1-STAUT-STA1-AP.txt	1500	1	Unlimited	60 seconds	0 seconds
5.68.1	HE1-DLOFDMA-STAUT_STA1-STA3.txt	Receive: UDP1_BE: 1000 bytes	2	Unlimited	60 seconds	0 seconds
5.69.1	HE1-ULOFDMA-STAUT-STA1.txt	16K bytes	2	Unlimited	60 seconds	0 seconds
5.70.1	HE1-ULOFDMA-STAUT-STA1.txt	16K bytes	2	Unlimited	60 seconds	0 seconds
5.71.1	HE1-STA1-AP1-24G.txt	1400	2	Unlimited	60 seconds	0 seconds
	HE1-STA1-AP1-5G.txt	1400	4	Unlimited	60 seconds	0 seconds
5.72.1	HE1-AP-STA1_24GHz_M-BSSID_STAUT.txt	UDP_BE – 1400 bytes	1	19 mbps	30 seconds	0 seconds
	HE1-AP-STA1_5GHz_M-BSSID_STAUT.txt	Transmit UDP_BE – 1400 bytes	1	75 mbps	30 seconds	0 seconds
	HE1-AP-STA1_24GHz_M-BSSID_STAUT-STA1.txt	UDP_BE – 1400 bytes	1	12 mbps	30 seconds	0 seconds
	HE1-AP-STA1_5GHz_M-BSSID_STAUT-STA1.txt	Transmit UDP_BE – 1400 bytes	1	50 mbps	30 seconds	0 seconds
5.73.1	DT1-AP-DUT.txt	16K bytes	3	Unlimited	60 seconds	0 seconds
5.74.1	UT1-DUT-AP_5.74.X.txt	UDP 1400 Uplink	1	Unlimited	20 seconds	0 seconds
	UT1-DUT-AP-OMCtrl.txt					

Appendix C Threshold values

Table 320 lists the threshold values that are used in the APUT tests in this test plan.

The rubric for decoding the first segment of the threshold names is as follows:

The numbers before the letter "S" are the test case section number without the periods.

The letter "S" stands for the word step. The number following the letter "S" is the step number.

For example, "453S4" represents test case 4.5.3 step 4.

Table 320. APUT test case threshold values

Test case	Threshold name	Value(AP)	Value(Mobile AP)
4.5.3	453S3_TP_1SS_24G	27	21.6
	453S4_TP_1SS_24G	37	29.6
	453S5_TP_1SS_24G	5	4
	453S9_TP_2SS_24G	42	33.6
	453S10_TP_2SS_24G	37	29.6
	453S13_3_TP_1SS_5G	110	88
	453S13_4_TP_1SS_5G	150	120
	453S13_5_TP_1SS_5G	5	4
	453S13_9_TP_2SS_5G	170	136
	453S13_10_TP_2SS_5G	150	120
	453S18_3_TP_1SS_5G	110	88
	453S18_4_TP_1SS_5G	150	120
	453S18_5_TP_1SS_5G	5	4
	453S18_9_TP_2SS_5G	170	136
	453S18_10_TP_2SS_5G	150	120
4.7.1	471S4_2SS_24G	50	40
	471S5_2SS_5G	60	48
	471S6_2SS_5G	150	120
	471S6_2SS_24G	75	60

Test case	Threshold name	Value(AP)	Value(Mobile AP)
	471S4_1SS_24G		25
	471S5_1SS_5G		30
	471S6_1SS_5G		75
	471S6_1SS_24G	NA	37.5
4.12.1	4121S6_TP_24G	27	21.6
	4121S11_TP_24G	27	21.6
	4121S13_6_TP_5G	110	88
	4121S13_11_TP_5G	110	88
4.13.1	4131S4_TP_24G	13	10.4
	4131S8_TP_5G	30	24
4.14.1	4141S4_DL1_TP_24G	4	3.2
	4141S4_DL2_TP_24G	3	2.4
4.14.2	4142S4_DL1_TP_5G	4	3.2
	4142S4_DL2_TP_5G	3	2.4
4.16.1	4161S5_TP_24G	37	29.6
	4161S7_TP_5G	150	120
4.29.1	4291S6_STAID_24G	80	80
	4291S6_ATP_24G	20	16
	4291S6_STA_TP_24G	5	4
	4291S11_STAID_5G	80	80
	4291S11_ATP_5G	108	86.4
	4291S11_STA_TP_5G	27	21.6
4.30.1	4301S7_STAID_24G	80	80
	4301S7_MU_24G	80	80
	4301S7_ATP_24G	20	16
	4301S7_STA_TP_24G	5	4
	4301S9_STAID_24G	80	80

Test case	Threshold name	Value(AP)	Value(Mobile AP)
	4301S9_MU_24G	80	80
	4301S9_ATP_24G	20	16
	4301S9_STA_TP_24G	5	4
	4301S11_STAID_24G	80	80
	4301S11_MU_24G	80	80
	4301S11_ATP_24G	29	23.2
	4301S11_STA_TP_24G	5	4
	4301S11_STA_TP_2SS_24G	8	6.4
	4301S17_STAID_5G	80	80
	4301S17_MU_5G	80	80
	4301S17_ATP_5G	108	86.4
	4301S17_STA_TP_5G	27	21.6
	4301S19_STAID_5G	80	80
	4301S19_MU_5G	80	80
	4301S19_ATP_5G	108	86.4
	4301S19_STA_TP_5G	27	21.6
	4301S21_STAID_5G	80	80
	4301S21_MU_5G	80	80
	4301S21_ATP_5G	150	120
	4301S21_STA_TP_5G	27	21.6
	4301S21_STA_TP_2SS_5G	41	32.8
4.36.1	4361S6_TP_1SS_24G	5	4
	4361S6_MU_1SS_24G	80	80
	4361S6_ATP_1SS_24G	20	16
	4361S10_TP_2SS_24G	8	6.4
	4361S10_MU_2SS_24G	80	80
	4361S10_ATP_2SS_24G	32	25.6

Test case	Threshold name	Value(AP)	Value(Mobile AP)
	4361S15_TP_1SS_5G	27	21.6
	4361S15_MU_1SS_5G	80	80
	4361S15_ATP_1SS_5G	108	86.4
	4361S20_TP_2SS_5G	41	32.8
	4361S20_MU_2SS_5G	80	80
	4361S20_ATP_2SS_5G	164	131.2
4.37.1	4371S6_1SS_TP_5G	27	21.6
	4371S6_1SS_MU_5G	80	80
	4371S6_1SS_ATP_5G	108	86.4
	4371S10_2SS_TP_5G	41	32.8
	4371S10_2SS_MU_5G	80	80
	4371S10_2SS_ATP_5G	164	131.2
4.40.1	4401S7_ATP_24G	12	9.6
	4401S7_STA_TP_24G	24	19.2
	4401S7_DELTA_24G	0.5	0.5
4.40.2	4402S6_STA_TP_24G	24	19.2
	4402S6_DELTA_24G	0.5	0.5
	4402S13_ATP_24G	12	9.6
4.40.3	4403S3_ATP_24G	12	9.6
	4403S3_STA_TP_24G	24	19.2
	4403S3_DELTA_24G	0.5	0.5
4.40.4	4404S6_ATP_5G	110	88
	4404S6_STA_TP_5G	216	172.8
	4404S6_DELTA_5G	0.5	0.5
4.40.5	4405S6_STA_TP_5G	216	172.8
	4405S6_DELTA_5G	0.5	0.5
	4405S13_ATP_5G	110	88

Test case	Threshold name	Value(AP)	Value(Mobile AP)
4.41.1	4411S6_STA_ATP_24G	12	9.6
	4411S6_STA_TP_24G	3	2.4
4.41.2	4412S6_STA_ATP_5G	110	88
	4412S6_STA_TP_5G	27	21.6
4.44.1	4441S7_STAID_5G	80	80
	4441S7_MU_5G	80	80
	4441S7_ATP_5G	108	86.4
	4441S7_STA_TP_5G	27	21.6
	4441S9_STAID_5G	80	80
	4441S9_MU_5G	80	80
	4441S9_ATP_5G	108	86.4
	4441S9_STA_TP_5G	27	21.6
	4441S11_STAID_5G	80	80
	4441S11_MU_5G	80	80
	4441S11_ATP_5G	108	86.4
	4441S11_STA_TP_5G	27	21.6
4.45.1	4451S6_MUBAR_24G	80	80
	4451S6_DLTP_24G	22	17.6
	4451S6_STA_DLTP_24G	5.5	4.4
	4451S12_MUBAR_5G	80	80
	4451S12_DLTP_5G	140	112
	4451S12_STA_DLTP_5G	33	26.4
4.46.1	4461S6_MBA_24G	10	10
	4461S8_MBA_24G	10	10
	4461S14_MBA_5G	10	10
	4461S16_MBA_5G	10	10
4.50.1	4501S5_PPDU_24G	40	40

Test case	Threshold name	Value(AP)	Value(Mobile AP)
	4501S5_BA_24G	50	50
	4501S10_PPDU_5G	40	40
	4501S10_BA_5G	50	50
4.51.1	4511S5_256_24G	40	40
	4511S5_256_5G	40	40
4.52.1	4521S5_TP_5G	165	132
	4521S6_TXOP_5G	5	5
	4521S6_TP_5G	165	132
	4521S7_TXOP_5G	5	5
	4521S7_TP_5G	165	132
	4521S8_TXOP_5G	5	5
	4521S8_TP_5G	165	132
	4521S13_TP_24G	36	28.8
	4521S14_TXOP_24G	5	5
	4521S14_TP_24G	36	28.8
	4521S15_TXOP_24G	5	5
	4521S15_TP_24G	36	28.8
4.56.1	4561S9_STA1_DLTP_24G	27	NA
	4561S9_STA2_DLTP_24G	27	
	4561S10_STA1_DLTP_24G	27	
	4561S10_STA2_DLTP_24G	27	
	4561_alpha	0.5	
	4561_Tolereance_SP_Start	-100	
	4561_Tolereance_SP_End	+100	
	4561S11_STA1_ULTP_24G	27	
	4561S11_STA2_ULTP_24G	27	
	4561S20_STA1_DLTP_5G	110	

Test case	Threshold name	Value(AP)	Value(Mobile AP)
	4561S20_STA2_DLTP_5G	110	
	4561S21_STA1_DLTP_5G	110	
	4561S21_STA2_DLTP_5G	110	
	4561S22_STA1_ULTP_5G	110	
	4561S22_STA2_ULTP_5G	110	NA
4.56.2	4562S7_STA1_DLTP_24G		21.6
	4562_tolerance_SP_start		21.6
	4562_tolerance_SP_end		21.6
	4561S8_STA1_DLTP_24G		21.6
	4561S9_STA1_DLTP_24G		21.6
	4562_alpha		0.5
	4562S14_STA1_DLTP_24G		-100
	4562S15_STA1_DLTP_24G		100
	4562S22_STA1_DLTP_5G		88
	4562S23_STA1_DLTP_5G		88
	4562S24_STA1_DLTP_5G		88
	4562S29_STA1_ULTP_5G		88
	4562S30_STA1_ULTP_5G	NA	88
4.58.1	4581S7_S_MU_OMI_5G	90	90
	4581S8_TF_5G	5	5
	4581S8_TIME_5G	5	5
	4581S8_MU_OMI_5G	90	90
	4581S9_TF_5G	5	5
	4581S9_TIME_5G	5	5
	4581S9_MU_OMI_5G	90	90
	4581S10_TF_5G	5	5
	4581S10_TIME_5G	5	5

Test case	Threshold name	Value(AP)	Value(Mobile AP)
	4581S10_MU_OMI_5G	90	90
	4581S11_TF_5G	5	5
	4581S11_TIME_5G	5	5
	4581S11_MU_OMI_5G	90	90
	4581S13_TXOP_5G	5	5
	4581S20_MU_OMI_24G	10	10
	4581S21_TF_24G	5	5
	4581S21_TIME_24G	5	5
	4581S21_MU_OMI_24G	10	10
	4581S22_TF_24G	5	5
	4581S22_MU_OMI_24G	10	10
	4581S22_TIME_24G	5	5
	4581S23_TF_24G	5	5
	4581S24_TXOP_24G	5	5
4.58.2	4582S7_S_MU_OMI_5G	NA	45
	4581S8_TF_5G		5
	4582S8_TIME_5G TXOP		5
	4582S8_MU_OMI_5G		45
	4582S9_TF_5G		5
	4582S9_MU_OMI_5G		5
	4581S11_TXOP_5G *TXOP		45
4.63.1	4631S7_ATP_24G	12	9.6
	4631S7_DELTA_24G	0.5	0.5
	4631S13_ATP_5G	108	86.4
	4631S13_DELTA_5G	0.5	0.5
4.64.1	4641S7_ATP_5G	108	86.4
	4641S7_DELTA_5G	0.5	0.5

Test case	Threshold name	Value(AP)	Value(Mobile AP)
4.67.1	4671S10_TP_24G	12	9.6
	4671S14_TP_5G	50	40
4.69.1	4691S7_MU_5G	80	80
	4691S7_20M_STA_5G	5	5

Table 321 lists the threshold values that are used in the STAUT tests in this test plan.

The rubric for decoding the first segment of the threshold names is as follows:

The numbers before the letter "S" are the test case section number without the periods.

The letter "S" stands for the word step. The number following the letter "S" is the step number.

For example, "453S4" represents test case 4.5.3 step 4.

Table 321. STAUT test case threshold values

Test case	Threshold name	Value(STAUT)	Value (20 MHz-only STAUT)
5.5.1	551S3_TP_24G	27	16.2
	551S4_TP_24G	37	22.2
	551S8_TP_24G	37	22.2
	551S9_TP_24G	50	30
	551S11_TP_5G	110	16.2
	551S12_TP_5G	150	22.2
	551S13_8_TP_5G	150	22.2
	551S13_9_TP_5G	200	30
5.5.2	552S4_TP_24G	27	16.2
	552S7_TP_5G	110	22.2
5.6.1	561S4_TP1_24G	27	16.2
	561S5_TP2_24G	37	22.2
	561S6_TP3_24G	5	3
	561S8_TP1_5G	110	16.2
	561S8_TP2_5G	150	22.2

Test case	Threshold name	Value(STAUT)	Value (20 MHz-only STAUT)
	561S8_TP3_5G	5	3
5.15.1	5151S5_DLTP_24G	27	16.2
	5151S10_DLTP_24G	27	16.2
	5151S15_DLTP_5G	110	16.2
	5151S20_DLTP_5G	110	16.2
5.16.1	5161S4_TP_24G	27	16.2
	5161S8_TP_5G	50	16.2
5.17.1	5171S4_DUT_AP1_TP_24G	4	2.4
	5171S4_STA1_AP2_TP_24G	3	1.8
5.18.1	5181S4_DUT_AP1_TP_5G	60	2.4
	5181S4_STA1_AP2_TP_5G	60	1.8
5.19.1	5191S5_TP_24G	37	22.2
	5191S7_TP_5G	150	22.2
5.34.1	5341S6_TP_24G	2	1.2
	5341S8_TP_24G	4	2.4
	5341S10_TP_24G	15	9
	5341S12_TP_24G	15	9
	5341S18_TP_5G	2	1.2
	5341S24_TP_5G		4
	5341S30_TP_5G	NA	15
5.34.2	5342S6_TP_5G	4	NA
5.34.3	5343S6_TP_5G	15	NA
	5343S8_TP_5G	34	
	5343S13_TP_5G	69	
	5343S16_TP_5G	69	
5.34.4	5344S8_TP_5G	NA	17
5.40.1	5401S7_1SS_RU26_TP_24G	2	1.2

Test case	Threshold name	Value(STAUT)	Value (20 MHz-only STAUT)
	5401S10_1SS_RU52_TP_24G	4	2.4
	5401S13_1SS_RU106_TP_24G	15	9
	5401S23_1SS_RU26_TP_5G	2	1.2
	5401S26_1SS_RU52_TP_5G	4	2.4
	5401S29_1SS_RU106_TP_5G	15	9
	5401S31_1SS_RU242_TP_5G	34	20.4
	5401S33_1SS_RU484_TP_5G	69	41.4
	5401S16_2SS_RU26_TP_24G	2	1.2
	5401S16_2SS_RU52_TP_24G	4	2.4
	5401S16_2SS_RU106_TP_24G	15	9
	5401S36_2SS_RU26_TP_5G	2	1.2
	5401S36_2SS_RU52_TP_5G	4	2.4
	5401S36_2SS_RU106_TP_5G	15	9
	5401S36_2SS_RU242_TP_5G	34	20.4
	5401S36_2SS_RU484_TP_5G	69	41.4
5.41.1	5411S7_1SS_TP_5G	34	NA
	5411S9_1SS_TP_5G	69	
	5411S12_7_2SS_TP_5G	34	
	5411S12_9_2SS_TP_5G	69	
5.44.1	5441S6_TP_24G	2	1.2
5.44.2	5442S6_1SS_TP_24G	15	9
	5442S6_2SS_TP_24G	22	13.2
	5442S12_1SS_TP_24G	4	2.4
	5442S12_2SS_TP_24G	6	3.6
5.44.3	5443S6_1SS_TP_24G	4	2.4
	5443S6_2SS_TP_24G	6	3.6
	5443S12_1SS_TP_24G	4	2.4

Test case	Threshold name	Value(STAUT)	Value (20 MHz-only STAUT)
	5443S12_2SS_TP_24G	6	3.6
5.44.4	5444S6_1SS_TP_5G	34	NA
5.44.5	5445S5_1SS_TP_5G	15	NA
	5445S5_2SS_TP_5G	22	
	5445S11_1SS_TP_5G	69	
	5445S11_2SS_TP_5G	103	
5.44.6	5446S6_1SS_TP_5G	34	NA
	5446S6_2SS_TP_5G	51	
	5446S12_1SS_TP_5G	34	
	5446S12_2SS_TP_5G	51	
5.44.7	5447S6_1SS_TP_5G	4	NA
5.44.8	5448S6_1SS_TP_5G	15	NA
	5448S6_2SS_TP_5G	22	
	5448S12_1SS_TP_5G	2	
	5448S12_2SS_TP_5G	3	
5.44.9	5449S6_1SS_TP_5G	4	NA
	5449S6_2SS_TP_5G	6	
	5449S12_1SS_TP_5G	15	
	5449S12_2SS_TP_5G	22	
5.44.10	54410S6_1SS_TP_5G for 1 SS		1.2
	54410S6_2SS_TP_5G for 2SS		1.2
	54410S6_RU52_1SS_TP_5G for 1 SS		2.4
	54410S6_ RU52_2SS_TP_5G for 2SS		2.4
	54410S6_RU106_1SS_TP_5G for 1 SS		9
	54410S6_ RU106_2SS_TP_5G for 2SS	NA	9
5.44.11	54411S6_1SS_TP_5G for 1 SS		1.2
	54411S6_2SS_TP_5G for 2SS	NA	1.2

Test case	Threshold name	Value(STAUT)	Value (20 MHz-only STAUT)
	54411S6_RU52_1SS_TP_5G for 1 SS,		2.4
	54411S6_ RU52_2SS_TP_5G for 2SS		2.4
	54411S6_RU106_1SS_TP_5G for 1 SS		9
	54411S6_ RU106_2SS_TP_5G for 2SS		9
5.45.1	5451S6_1SS_TP_24G	4.6	2.76
	5451S6_2SS_TP_24G	7	4.2
	5451S6_ATP_24G	7	4.2
5.45.2	5452S6_1SS_TP_5G	22.6	9
	5452S6_2SS_TP_5G	34	13.2
	5452S6_ATP_5G	34	28.8
5.49.1	5491S6_TP_5G	69	NA
	5491S8_TP_5G	34	
	5491S13_TP_5G	100	
5.50.1	5501S6_TP_24G	4	2.4
	5501S12_TP_5G	34	9
5.51.1	5511S6_TP_24G	10	6
	5511S6_PPDU_24G	80	80
	5511S12_TP_5G	40	24
	5511S12_PPDU_5G	80	80
5.53.1	5531S7_PPDU_24G	10	10
	5531S9_PPDU_24G	10	10
	5531S10_PPDU_24G	10	10
	5531S13_PPDU_5G	10	10
	5531S14_PPDU_5G	10	10
	5531S15_PPDU_5G	10	10
5.54.1	554S5_256_24G	40	40
	554S10_256_5G	40	40

Test case	Threshold name	Value(STAUT)	Value (20 MHz-only STAUT)
5.55.1	5551S5_BA_24G	50	40
	5551S5_PPDU_24G	40	40
	5551S10_BA_5G	50	40
	5551S10_PPDU_5G	40	40
5.56.1	5561S7_TXOP_5G	5	5
	5561S7_TP_5G	165	21.6
	5561S8_TXOP_5G	5	5
	5561S8_TP_5G	165	21.6
	5561S9_TXOP_5G	5	5
	5561S9_TP_5G	165	21.6
	5561S11_TXOP_5G	5	5
	5561S11_TP_5G	165	21.6
	5561S12_TXOP_5G	5	5
	5561S12_TP_5G	165	21.6
	5561S19_TXOP_24G	5	5
	5561S19_TP_24G	36	21.6
	5561S20_TXOP_24G	5	5
	5561S20_TP_24G	36	21.6
5.59.1	5591S4_CTT_24G	1600	1600
	5591S5_CFO_24G	1395	1395
	5591S5_ERR_24G	-370~370	-370~370
	5591S5_GAP_24G	1586	1586
	5591S9_CTT_5G	1600	1600
	5591S10_CFO_5G	1395	1395
	5591S10_ERR_5G	-370~370	-370~370
	5591S10_GAP_5G	1586	1586
5.59.2	5592S8_RSSI_A_24G	4	4

Test case	Threshold name	Value(STAUT)	Value (20 MHz-only STAUT)
	5592S8_RSSI_B_24G	6	6
	5592S12_RSSI_A_5G	4	4
	5592S12_RSSI_B_5G	6	6
5.60.1	5601S7_DLTP_24G	27	16.2
	5601S8_ULTP_24G	27	16.2
	5601S12_DLTP_24G	27	16.2
	5601S13_ULTP_24G	27	16.2
	5601_alpha	0.5	0.5
	5601_Tolereance_SP_Start	-100	-100
	5601_Tolereance_SP_End	+100	100
	5601S16_DLTP_24G	27	16.2
	5601S17_ULTP_24G	27	16.2
	5601S24_DLTP_5G	110	66
	5601S25_ULTP_5G	110	66
	5601S29_DLTP_5G	110	66
	5601S30_ULTP_5G	110	66
	5601S33_DLTP_5G	110	66
	5601S34_ULTP_5G	110	66
5.61.1	5611S10_TP_24G	3	1
	HETBT_pctLow %	15 %	15%
	HETBT_pctHigh %	85 %	85%
	5611S19_TP_5G	13	1
5.63.1	5631S9_1SS_TP_5G	4	2.4
	5631S9_AP1_ATP_5G	16	9.6
5.68.1	5681S6_PPDU_24G	80	80
	5681S6_PKTS_24G	80	80
	5681S12_PPDU_5G	80	80

Test case	Threshold name	Value(STAUT)	Value (20 MHz-only STAUT)
	5681S12_PKTS_5G	80	80
5.69.1	5691S7_1SS_TP_24G	15	9
	5691S7_1SS_HETB_PPDU_24G	80	80
	5691S7_1SS_TF_24G	50	50
	5692S14_1SS_TP_5G	69	9
	5692S14_1SS_HETB_PPDU_5G	80	80
	5692S14_1SS_TF_5G	50	50
5.70.1	5702S7_1SS_TP_5G	69	NA
	5702S7_1SS_HETB_PPDU_5G	80	
	5702S7_1SS_TF_5G	50	
5.72.1	5721S7_TP_24G	11	6.6
	5721S13_TP_24G	11	6.6
	5721S17_TP_5G	45	27
	5721S20_TP_5G	45	27
5.74.1	5741S7_1SS_80M_5G	45	3
	5741S8_TF_5G	5	3
	5741S8_TF_TIME_5G	5	3
	5741S8_TP_1SS_5G	45	3
	5741S9_TF_5G	5	3
	5741S9_TF_TIME_5G	5	3
	5741S9_TP_1SS_80M_5G	45	3
	5741S11_TF_5G	5	3
	5741S11_TF_TIME_5G	5	3
	5741S11_TP_1SS_80M_5G	45	3
	5741S12_TF_5G	5	3
	5741S12_TF_TIME_5G	5	3
	5741S12_TP_1SS_80M_5G	45	3

Test case	Threshold name	Value(STAUT)	Value (20 MHz-only STAUT)
	5741S13_TF_5G	5	3
	5741S14_TF_5G	5	3
	5741S14_TP_1SS_80M_5G	45	3
	5741S22_1SS_20M_24G	5	3
	5741S24_TF_24G	5	3
	5741S24_TF_TIME_24G	5	3
	5741S24_TP_20M_24G	5	3
	5741S25_TF_24G	5	3
	5741S25_TF_TIME_24G	5	3
	5741S25_TP_1SS_20M_24G	5	3
	5741S26_TF_24G	5	3
	5741S27_TP_1SS_20M_24G	5	3
	5741S27_TF_24G	5	3

Appendix D Default WMM parameters

Table 322 and Table 323 give the default WMM parameters that are used for the STA and AP respectively in this test plan.

Note: Wi-Fi CERTIFIED 6 devices shall use the 802.11a/g WMM parameters as specified in the WMM Test Pan [5].

Table 322. STA default WMM parameters

AC	CWmin	CWmax	AIFSN	TXOP Limit(802.11b)	TXOP Limit(802.11a/g)
AC_BK	15 {4}	1023 {10}	7	0	0
AC_BE	15 {4}	1023 {10}	3	0	0
AC_VI	7 {3}	15 {4}	2	188(6.016ms)	94(3.008ms)
AC_VO	3 {2}	7 {3}	2	102(3.264ms)	47(1.504ms)

Table 323. AP default WMM parameters

AC	CWmin	CWmax	AIFSN	TXOP Limit(802.11b)	TXOP Limit(802.11a/g)
AC_BK	15 {4}	1023 {10}	7	0	0
AC_BE	15 {4}	1023 {10}	3	0	0
AC_VI	7 {3}	15 {4}	2	188(6.016ms)	94(3.008ms)
AC_VO	3 {2}	7 {3}	2	102(3.264ms)	47(1.504ms)

Appendix E Traffic streams

Table 324 provides additional information about the traffic stream script files that are used in this test plan.

Note that the script files assume that the test bed AP is configured for MCS 0-7.The throughput may need to be revised if the MCS configuration is different from that default.

When multiple scripts are run in the same step of a test case procedure, each script uses the same time reference. For example:

- If a step specifies running scripts UDP1 and UDP2 (even by different devices), the scripts will start at the same time.
- If a step specifies running UDP1 and UDP3 (even by different devices), the UDP3 script will start 30 seconds after the UDP1 script. The 30 second delay specified for UDP3 will be with respect to the same nominal start time as for UDP1.

Table 324. When two or more ping commands are run in the same step, they run simultaneously, unless specified otherwise. Traffic streams

Stream name	Frame size	Number of pairs	Throughput	Duration	Start delay
UDP1	16K bytes	1	Unlimited	60 seconds	0
UDP2	16K bytes	1	Unlimited	60 seconds	0
UDP3	16K bytes	1	Unlimited	30 seconds	30 seconds
UDP4	16K bytes	1	Unlimited	60 seconds	0
UDP1_BK	1000 bytes	1	85 Mbps	60 seconds	0
UDP1_BE	1000 bytes	1	85 Mbps	60 seconds	0
UDP2_BE	1000 bytes	1	76 Mbps	60 seconds	0
UDP3_BE	1000 bytes	1	76 Mbps	30 seconds	30 seconds
UDP3_BK	1000 bytes	1	76 Mbps	30 seconds	30 seconds
UDP3_VI	1000 bytes	1	76 Mbps	30 seconds	30 seconds
UDP1_VI	1000 bytes	1	85 Mbps	60 seconds	0
UDP2_VI	1000 bytes	1	76 Mbps	60 seconds	0
UDP2_VO	1000 bytes	1	76 Mbps	60 seconds	0
UDP4_BE	1000 bytes	1	85 Mbps	60 seconds	0

Appendix F (Informative) Document revision history

Table 325. Document revision history

Version	Date YYYY-MM_DD	Remarks
1.0	2019-08-29	Initial release.
1.1	2019-11-27	Addition of Mobile AP and 20 MHz-only STA profiles