802.11 PAL (80211PAL)

Bluetooth® Test Suite

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1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and Test Cases (TC) to test the 802.11 PAL. The objective of this Test Suite is to provide a basis for conformance tests for a device or subsystem giving a high probability of air interface interoperability between different manufacturer's implementations. The following revisions are applicable to this document.
2 References, Definitions, and Abbreviations

2.1 References

This Bluetooth document incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For the purpose of this Bluetooth document, the definitions and abbreviations in [1], [2] and [5] apply.

[1] Bluetooth Test Strategy and Terminology Overview


[3] ICS Proforma for 802.11 PAL


3 Test Suite Structure (TSS)

The test suite structure is a tree which tests the following functionality.

Physical Link
  - Create Physical Link
  - Disconnect Physical Link
  - Link Loss

Logical Link
  - Create Logical Link (LLC)
  - Disconnect Logical Link (LLD)

Data Transfer
  - Transmit (TX)
  - Receive (RX)

Buffer Management (BU)

Other
  - Activity Reports
  - Short Range Mode (SRM)

Figure 3.1: TSS for 802.11 PAL

3.1 Test Strategy

The test objectives are to verify functionality within an 802.11 PAL and enable interoperability between 802.11 PALs on different devices. The testing approach is to cover mandatory and optional requirements in the protocol specification and to match these to the support of the IUT as described in the ICS proforma.

Conformance testing is the appropriate test method to meet these intents. The basis for the test approach is the general concepts and conformance testing principles defined in ISO/IEC 9646-1 and ISO/IEC 9646-2; both are part of the OSI Conformance Testing Methodology and Framework (CTMF).

The conformance test equipment shall provide an implementation of the Radio, MAC Controller, and PAL conforming to the relevant specifications to perform the test cases defined in this Test Suite. For some test cases, it is necessary to stimulate the IUT using HCI primitives. In practice, these primitives could be supported using a Physical HCI or another interface supported by the IUT together with test code.
Messages going into or out of this interface must be viewable to the test system as HCI commands and events.

Verification that the MAC complies with [5] is outside of the scope of this specification except where a specific behavior is specified in [2]. For this reason the test inputs are specified in terms of HCI commands and events at the top of the PAL in the tester and the IUT. In addition behavior in the 802.11 media is observed to verify compliance with [2].

The PAL test suite contains Valid Behavior (BV) tests complemented with Invalid Behavior (BI) tests where required. The test coverage mirrored in the test suite structure is the result of a process that started with catalogued specification requirements that were logically grouped and assessed for testability enabling coverage in defined test cases.

![Test system architecture for 802.11 PAL](image)

**Figure 3.2:** Test system architecture for 802.11 PAL

### 3.2 Test Groups

The test groups are organized in three levels. The first level defines the protocol groups representing the protocol services. The second level separates the protocol services in functional modules. The last level in each branch contains the standard ISO subgroups Valid Behavior (BV) and Invalid Behavior (BI).

#### 3.2.1 Protocol Groups

The protocol group identifies the kind of test for 802.11 Protocol Adaptation Layer test cases:

- **3.2.1.1 Discovery/Status (DI)**
  - AMP Information (AI)
  - AMP ASSOC (AA)
  - AMP Status (ST)
3.2.1.2 Physical Link (PL)
Physical link Creation (PLC)
Physical Link Disconnect (PLD)
Physical Link Supervision (PLS)

3.2.1.3 Logical Link (LL)
Logical Link Creation (LLC)
Logical Link Disconnect (LLD)

3.2.1.4 Data Transfer (DA)
Best effort data transfer (BE)
Guaranteed Data Transfer (GU)
Buffer Management (BU)

3.2.1.5 Other
Activity Reports (AR)
Short Range Mode (SRM)

3.2.2 Test Subgroups

3.2.2.1 Valid Behavior (BV) Tests
This sub group provides testing to verify that the IUT reacts in conformity with the Bluetooth Core Specification, after receipt or exchange of valid Protocol Data Units (PDUs). Valid PDUs and HCI events and commands mean that the exchange of messages and the content of the exchanged messages are considered as valid.

3.2.2.2 Invalid Behavior (BI) Tests
This sub group provides testing to verify that the IUT reacts in conformity with the Bluetooth Core Specification, after receipt of a syntactically or semantically invalid PDU and HCI events and commands.
4 Test Cases (TC)

4.1 Introduction

4.1.1 Test Case Identification Conventions

Test cases shall be assigned unique identifiers per the conventions in [1]. The convention used here is `<spec abbreviation>/<IUT role>/<class>/<feat>/<func>/<subfunc>/<cap>/<xx>-<nn>-<y>`.

Bolded ID parts shall appear in the order prescribed. Non-bolded ID parts (if applicable) shall appear between the bolded parts. The order of the non-bolded parts may vary from test suite to test suite, but shall be consistent within each individual test suite.

<table>
<thead>
<tr>
<th>Identifier Abbreviation</th>
<th>Spec Identifier &lt;spec abbreviation&gt;</th>
</tr>
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<tbody>
<tr>
<td>80211PAL</td>
<td>802.11 PAL Spec</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Identifier Abbreviation</th>
<th>Feature Identifier &lt;feat&gt;</th>
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<td>Exceptions</td>
</tr>
<tr>
<td>DI</td>
<td>Discovery</td>
</tr>
</tbody>
</table>

Table 4.1: TC Feature Naming Conventions for 802.11 PAL

4.1.2 Conformance

When conformance is claimed, all capabilities indicated as mandatory for this Specification shall be supported in the specified manner (process-mandatory). This also applies for all optional and conditional capabilities for which support is indicated. All mandatory capabilities, and optional and conditional capabilities for which support is indicated, are subject to verification as part of the Bluetooth Qualification Program.

The Bluetooth Qualification Program may employ tests to verify implementation robustness. The level of implementation robustness that is verified varies from one Specification to another and may be revised for cause based on interoperability issues found in the market.

Such tests may verify:

- That claimed capabilities may be used in any order and any number of repetitions that is not excluded by the Specification, OR
- That capabilities enabled by the implementations are sustained over durations expected by the use case, OR
• That the implementation gracefully handles any quantity of data expected by the use case, OR

• That in cases where more than one valid interpretation of the Specification exist, the implementation complies with at least one interpretation and gracefully handles other interpretations, OR

• That the implementation is immune to attempted security exploits.

A single execution of each of the required tests is required in order to constitute a Pass Verdict. However, it is noted that in order to provide a foundation for interoperability, it is necessary that a qualified implementation consistently and repeatedly pass any of the applicable tests.

In any case, where a member finds an issue with the Test Plan Generator, the Test Case as described in the Test Suite, or with the Test System utilized, the Member is required to notify the responsible party via an errata request such that the issue may be addressed.

4.1.3 Pass/Fail Verdict Conventions

Each test case has an Expected Outcome section, which outlines all the detailed pass criteria conditions that shall be met by the IUT to merit a Pass Verdict.

The convention in this test suite is that, unless there is a specific set of fail conditions outlined in the test case, the IUT fails the test case as soon one of the pass criteria conditions cannot be met. If this occurs the outcome of the test shall be the Fail Verdict.

4.1.4 Lower Layer Assumptions

For conformance testing of the 802.11 PAL layer it is necessary to utilize a MAC and PHY in conformance with [5].

In the MSCs in this document, certain 802.11 frames may occur outside the scope of any particular test. These include, but are not limited to, probe requests, probe responses, data frame retransmissions, and action frames. The presence of these frames shall not be used to affect the Pass or Fail Verdict of any test.

The 802.11 AMP device may support the simultaneous use of multiple protocols. However, this document assumes the IUT is not actively participating in any operations other than those described herein.

4.1.5 Initialization

The following sequence is executed prior to all tests and before any applicable preamble.
4.1.6 Preambles

4.1.6.1 Physical Link Initiated by IUT Preamble
Write remote AMP ASSOC on IUT

Network Started by IUT

Read Local AMP ASSOC on IUT

Loop until AMP ASSOC remaining == AMP ASSOC fragment size

Write remote AMP ASSOC on IUT (PLH, LengthSoFar=0, AMP ASSOC Remaining Length, AMP ASSOC fragment)

HCI Command Complete event (Num HCI Comm, Opcode=0x140B, Status=0x00, PLH)

HCI Accept Physical Link (PLH, Link Key Length, Link Key Type, Link Key)

Beacon (ssid=AMP-xx-xx-xx-xx-xx-xx), type=ESS)

HCI Channel Selected event (PLH)

HCI Accept Physical Link (PLH, Link Key Length, Link Key Type, Link Key)

Beacon (ssid=AMP-xx-xx-xx-xx-xx-xx), type=ESS)

HCI Channel Selected event (PLH)

HCI Create Physical Link (PLH, Link Key Length=32, Link Key Type=Authenticated Combination Key, Link Key)

HCI Command Status event (status=0x00, Num HCI Comm, Opcode=0x0435)
Start Network Activity

Write remote AMP ASSOC on Tester

Probe Request
(a1=MA_iut, a2=MA_tester, a3=MA_iut, SSID=AMP<MA_IUT>, IEEE IEs)

Probe Response
(a1=MA_tester, a2=MA_iut, a3=MA_IUT, IEEE IEs)

Authentication Message 1
(a1=MA_IUT, a2=MA_tester, a3=MA_iut, alg=open system(0))

Authentication Message 2
(a1=MA_tester, a2=MA_iut, a3=MA_IUT, status=successful(0))

Association Request
(a1=MA_IUT, a2=MA_tester, a3=MA_IUT, SSID=AMP<MA_IUT>, IEEE IEs)

Association Response
(a1=MA_tester, a2=MA_iut, a3=MA_IUT, IEEE IEs)

RSNA Authentication 1
(HADDR_hdr, AMP LLC, EAPOL frame 1)

RSNA Authentication 2
(HADDR_hdr, AMP LLC, EAPOL frame 2)

RSNA Authentication 3
(HADDR_hdr, AMP LLC, EAPOL frame 3)

RSNA Authentication 4
(HADDR_hdr, AMP LLC, EAPOL frame 4)

HCI Physical Link Complete event
(status=0x00, PLH)
4.1.6.2 Preamble for establishment of Logical Link initiated by IUT

IUT is in DISCONNECTED state

```
HCI_Read_Local_AMP_Info

HCI Command Complete event
(Num_HCI_Comm, Opcode=0x1409, status=0x00, AMP_Status,
Total_Bandwidth,
Max_Guaranteed_Bandwidth,
Min_Latency, Max_PDU_Siz,
Controller_Type, PAL_Capabilities,
AMP_ASSOC_Length,
Max_Flush_Timeout,
Best_Effort_Flush_Timeout)

HCI_Create_Physical_Link
(PLH, Link_Key_Length=32,
Link_Key_Type=Authenticated
Combination Key, Link_Key)

HCI Command Status event
(status=0x00, Num_HCI_Comm,
Opcode=0x0435)
```
Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

- **Lower Tester**
  - Write remote AMP_ASSOC on IUT

- **IUT**
  - **Upper Tester**
  - **Network Started by IUT**
    - **Beacon** (ssid=AMP-xx-xx-xx-xx-xx-xx, type=ESS)

- **Read Local AMP_ASSOC on IUT**

  Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size
  - **Lower Tester**
    - **HCI Channel Selected event (PLH)**
  - **IUT**
    - **Upper Tester**
    - **Networks started**
      - **Beacon** (ssid=AMP-xx-xx-xx-xx-xx-xx, type=ESS)

**HCI Command Complete event**
- Num_HCI_Comm, Opcode=0x140
- Status=0x00
- PLH

**Networks started**
Probe Request
(a1=MA_iut, a2=MA_tester,
A3=MA_iut, 
SSID=AMP<MA_IUT>,IEEE_IEs)

Probe Response
(a1=MA_tester,
a2=MA_IUT,a3=MA_IUT, IEEE_IEs)

Authentication Message 1
(a1=MA_IUT,
a2=MA_tester,a3=MA_IUT,alg=open system(0))

Authentication Message 2
(a1=MA_tester,a2=MA_IUT ,
a3=MA_IUT, status=successful(0))

Association Request
(a1=MA_IUT,s2=MA_tester,a3=MA_IUT,
SSID=AMP<MA_IUT>, IEEE_IEs)

Association Response
(a1=MA_tester,a2=MA_IUT,
a3=MA_IUT,)

RSNA Authentication 1
(4ADDR_hdr, AMP LLC, 
EAPOL frame 1)

RSNA Authentication 2
(4ADDR_hdr, AMP LLC, 
EAPOL frame 2)

RSNA Authentication 3
(4ADDR_hdr, AMP LLC, 
EAPOL frame 3)

RSNA Authentication 4
(4ADDR_hdr, AMP LLC, 
EAPOL frame 4)

HCI Physical Link Complete event 
(status=0x00, PLH)

Physical Link Connected
4.1.6.3   Preamble for Reading Local AMP Info and Local AMP ASSOC

Device in Tester

IUT

Upper Tester

IUT is in DISCONNECTED state

HCI_Command_Complete_event
(Num_HCI_Comm, Opcode=0x1409, status=0x00, AMP_Status, Total_Bandwidth, Max_Guaranteed_Bandwidth, Min_Latency, Max_PDU_Siz, Controller_Type, PAL_Capabilities, AMP_ASSOC_Length, Max_Flush_Timeout, Best_Effort_Flush_Timeout)

Loop until AMP_ASSOC_remaining == AMP_ASSOC_fragment_size

HCI_Command_Complete_event
(Num_HCI_Comm, Opcode=0x140A, status=0x00, PLH, AMP_ASSOC_Remaining_Length=0, AMP_ASSOC_fragment)

4.1.6.4   Preamble for Establishing 2 Physical Links with a best effort logical link on each

Run 4.1.6.2 using the BE logical link option before this procedure.

When executing the following procedure, the tester uses a different MAC address in the AMP_ASSOC and in the address fields of 802.11 headers to that used in preamble 4.1.6.2.
4.1.6.5 Preamble for establishing a physical link with a best effort and guaranteed logical link

Run 4.1.6.2 using the BE logical link option before this procedure.
4.1.6.6  Preamble for Starting an HT Physical and Logical Link

**IUT is in DISCONNECTED state**

Flowchart:

- **Upper Tester**
  - **IUT**
  - **Lower Tester**

**HCI_Enable_Device_Under_Test_Mode**

**HCI_Command_Complete**

**HCI_Read_Local_AURA**

**LCM**

**Opt**/*40 MHz*/

**Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size**

**HCI_Read_local_AURA**

(PLH, LengthSoFar)

**HCI_Command_Complete** event

(Num_HCI_Comm, Opcode=0x1409, ...)

**Network Started by LT**

**Beacon**

(ssid=AMP-xx-xx-xx-xx-xx-xx, type=ESS, HT_Capabilities, HT_Operation, Supported Rates, Extended Supported Rates (note 1))

**HCI_Command_Status** event

(status=0x00, Num_HCI_Comm, Opcode=0x0436)

**HCI_Write_Remote_AURA**

(PLH, LengthSoFar=0, AMP_ASSOC_Remaining_Length=0, AMP_ASSOC_fragment)

**HCI_Command_Complete** event

(Num_HCI_Comm, Opcode=0x140B, Status=0x00, PLH)

**HCI_Accept_Physical_Link**

(PLH, Link_Key_Length=32, Link_Key_Type=Authenticated, Combination Key, Link_Key)

**HCI_Command_Status** event

(status=0x00, Num_HCI_Comm, Opcode=0x0436)

**Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size**
Note 1: Include 11n rate in BSSBasicRateSet.
4.2 Discovery Tests (DI)
Test group objectives are described here.

4.2.1 AMP Information

4.2.1.1 80211PAL/DI/AI/BV-01-C [Read local AMP info]

- **Test Purpose**
  Verify IUT returns valid local AMP info when requested.

- **Reference**
  [2] Section 2.2

- **Initial Condition**
  The IUT is initialized (see Section 4.1.5) and in the DISCONNECTED state.

- **Test Procedure**

  ![Diagram of test procedure]

- **Expected Outcome**
  **Pass Verdict**
  
  - UT receives HCI command complete event from the IUT.
  - Verify that the Controller_Type return parameter is of type 802.11 (0x01).
  - Validate individual parameters returned in the command complete event. The parameters returned shall contain the following:
    - Status: 0x00 (success)
    - Total Bandwidth: Shall not exceed the technology maximum application throughput. For this document this is deemed to be 30000 kbps.
- Max Guaranteed Bandwidth: A value less than or equal to Total Bandwidth
- Min Latency: A value >= DIFS + $CW_{min}$ $CW_{min}$ values are defined in [5].
- Max PDU Size: Shall be Max80211PALPDUSize as defined in [2].
- Controller type: 802.11 (0x01)
- PAL Capabilities: If ICS Item 7 (Guaranteed Logical Links) is declared then bit 0 =1 else bit 0 = 0. All other bits shall be 0.
- AMP Assoc Length: Max80211AMPASSOCLen as defined in [2]
- Max Flush Timeout: Any value 0 to 4294967295
- Best Effort Flush Timeout: Any value 0 to 4294967295

4.2.1.2 80211PAL/DI/AI/BV-02-C [Read Local AMP Info on HT device, guaranteed logical links not supported]

• Test Purpose
Verify IUT returns valid local AMP info when requested.

• Reference
[2] Section 2.2

• Initial Condition
The IUT is initialized (see Section 4.1.5) and in the DISCONNECTED state.

• Test Procedure

```
<table>
<thead>
<tr>
<th>Lower Tester</th>
<th>IUT</th>
<th>Upper Tester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IUT is in DISCONNECTED state</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HCI_Read_Local_AMP_Info</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HCI Command Complete event (Num_HCI_Comm, Opcode=0x1409, status=0x00, AMP_Status, Total_Bandwidth, Max_Guaranteed_Bandwidth, Min_Latency, Max_PDU_Siz, Controller_Type, PAL_Capabilities, AMP_ASSOC_Length, Max_Flush_Timeout, Best_Effort_Flush_Timeout)</td>
<td></td>
</tr>
</tbody>
</table>
```
• Expected Outcome

Pass Verdict

- UT receives HCI command complete event from the IUT.
- Verify that the Controller_Type return parameter is of type 802.11 (0x01).
- Validate individual parameters returned in the command complete event. The parameters returned shall contain the following:
  - Status: 0x00 (success)
  - Total Bandwidth: Shall not exceed the technology maximum application throughput. For the HT PHY this is 50000 kbps.
  - Max Guaranteed Bandwidth: A value less than or equal to Total Bandwidth
  - Min Latency: A value >= AIFS[n] + CWmin
  - AIFS[n] and CWmin values are defined in [5].
  - Max PDU Size: Shall be Max80211PALPDUSize as defined in [2]
  - Controller type: 802.11 (0x01)
  - PAL Capabilities: All bits shall be 0.
  - AMP Assoc Length: Max80211AMPASSOCLen as defined in [2]
  - Max Flush Timeout: Any value 0 to 4294967295
  - Best Effort Flush Timeout: Any value 0 to 4294967295

4.2.1.3 80211PAL/DI/AI/BV-03-C [Read Local AMP Info on HT device, guaranteed logical links supported]

• Test Purpose

Verify IUT returns valid local AMP info when requested.

• Reference

[2] Section 2.2

• Initial Condition

The IUT is initialized (see Section 4.1.5) and in the DISCONNECTED state.
• Test Procedure

IUT is in DISCONNECTED state

Lower Tester  IUT  Upper Tester

HCI_Read_Local_AMP_Info

HCI Command Complete event
(Num_HCI_Comm, Opcode=0x1409,
status=0x00, AMP_Status,
Total_Bandwidth,
Max_Guaranteed_Bandwidth,
Min_Latency, Max_PDU_Siz,
Controller_Type, PAL_Capabilities,
AMP_ASSOC_Length,
Max_Flush_Timeout,
Best_Effort_Flush_Timeout)

• Expected Outcome

Pass Verdict

- UT receives HCI command complete event from the IUT.
- Verify that the Controller_Type return parameter is of type 802.11 (0x01).
- Validate individual parameters returned in the command complete event. The parameters returned shall contain the following:
  - Status: 0x00 (success)
  - Total Bandwidth: Shall not exceed the technology maximum application throughput. For the HT PHY this is 50000 kbps.
  - Max Guaranteed Bandwidth: A value less than or equal to Total Bandwidth
  - Min Latency: A value >= AIFS[n] + CW_min
  - AIFS[n] and CW_min values are defined in [5].
  - Max PDU Size: Shall be Max80211PALPDUSize as defined in [2]
  - Controller type: 802.11 (0x01)
  - PAL Capabilities: Bit 0 shall be 1. All other bits shall be 0.
  - AMP Assoc Length: Max80211AMPASSOCLen as defined in [2]
  - Max Flush Timeout: Any value 0 to 4294967295
  - Best Effort Flush Timeout: Any value 0 to 4294967295
4.2.2 AMP ASSOC

4.2.2.1 80211PAL/DI/AA/BV-01-C Read local AMP ASSOC, no Physical Link

- **Test Purpose**
  Verify valid results are returned in response to the IUT issuing an HCI Read Local AMP ASSOC command.

- **Reference**
  [2] Section 2.14.1
  [4] Section 7.5.9

- **Initial Condition**
  The IUT is initialized (see Section 4.1.5) and in the DISCONNECTED state.

- **Test Procedure**

  ![Diagram](Diagram.png)

  Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

- **Test Condition**
  The LengthSoFar parameter shall start at 0 and shall increment by the previous ASSOC fragment size on each iteration.

- **Expected Outcomes**
  **Pass Verdict**
  Command complete event(s) contain the complete AMP_ASSOC.

  Acceptable data fields in the AMP_ASSOC are those defined in 2.10 of [2].
The AMP_ASSOC shall contain the mandatory parameters:

- MAC Address: Shall match the MAC address of the IUT.
- Preferred channel list: shall contain at least one channel from 1 to 13 according to the format specified in [2], section 3.2.3. May contain multiple channels.
- The PAL version TLV shall contain a PAL version value of 0x01.

AMP_ASSOC may also contain the following optional fields:

- Connected channel list: may contain at least one channel from 1 to 13 according to the format specified in [2], section 3.2.3. May contain multiple channels.
- 802.11 PAL Capabilities: Support of activity reporting and scheduling shall match declaration in ICS.

If ICS Item 6 (Activity Reports) is declared, bit 0 shall be 1 else bit 0 shall be 0.

If ICS Item 7 (Activity Report Scheduling) is declared, bit 1 must be 1 else bit 1 must be 0.

4.2.2.2 80211PAL/DI/AA/BV-02-C [Write Remote AMP ASSOC]

- Test Purpose
  Write Remote AMP ASSOC command is properly accepted by IUT.

- References
  [1] Section 2.10.1
  [4] Section 7.5.10

- Initial Condition
  The IUT is initialized and in the DISCONNECTED state. The local AMP Info and local AMP_ASSOC have been read using the preamble in Section 4.1.6.3.
• Test Procedure

The AMP_ASSOC_fragment parameter in the HCI Write Remote AMP ASSOC command shall contain only the mandatory TLVs specified below. The AMP_ASSOC shall contain the mandatory parameters:

- MAC Address: Shall match the MAC address of the Lower Tester.
- Preferred channel list: shall contain channel from 1 to 11 according to the format specified in [2], section 3.2.3.
- PAL Version with a version of 0x01.

• Expected Outcome

Pass Verdict

Command complete event in response to HCI Write Remote AMP ASSOC shall have status of 0x00.

HCI Channel Selected event shall contain the Physical Link Handle value from the HCI Create Physical Link command.
Beacons shall be received with:

- SSID set to 'AMP-xx-xx-xx-xx-xx-xx' (with no null termination and no quotes) where the “x“ characters are replaced by the lowercase hexadecimal characters of the MAC address of the IUT.
- EDCA parameter set presence shall be consistent with QoS support option. RSNA information element shall be present.
- Capability Information field with ESS subfield set to 1 and IBSS subfield set to 0.

### 4.2.2.3 80211PAL/DI/AA/BI-01-C [Write remote AMP ASSOC, unsupported IE token]

- **Test Purpose**
  
  Verify that the IUT ignores an unsupported IE from a remote device in an AMP ASSOC.

- **References**
  
  [1] Section 2.10.1

  [4] Section 7.5.10

- **Initial Condition**
  
  The IUT is initialized and in the DISCONNECTED state. The local AMP Info and local AMP ASSOC have been read using the preamble in Section 4.1.6.3.
**Test Procedure**

Lower Tester  
IUT  
Upper Tester

IUT is in DISCONNECTED state

**Loop until AMP_ASSOC_remaining == AMP_ASSOC_fragment size**

HCI Create Physical Link
(PLH, Link_Key_Length, Link_Key_Type, Link_Key)

HCI Command Status event
(status=0x00, Num_HCI_Comm, Opcode=0x0435)

**Start network**

Beacon
(ssid=AMP-xx-xx-xx-xx-xx, type=ESS)

**HCI Channel Selected event**
(PLH)

The AMP_ASSOC_fragment parameter in the HCI Write Remote AMP ASSOC command shall contain an invalid TLV formatted as given below. This TLV shall be the first TLV in the list of otherwise valid TLVs in the AMP_ASSOC.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Length</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any reserved value for the PAL version under test</td>
<td>0x10</td>
<td>000102030405060708090A0B0C0D0E0F</td>
</tr>
</tbody>
</table>

**Expected Outcome**

**Pass Verdict**

- Command complete event in response to the HCI Write Remote AMP ASSOC command shall have status of 0x00
- HCI Channel Selected event shall contain the Physical Link Handle value from the HCI Create Physical Link command
Beacons shall be received with:

- SSID set to 'AMP-xx-xx-xx-xx-xx' (with no null termination and no quotes) where the "x" characters are replaced by the lowercase hexadecimal characters of the MAC address of the IUT.
- EDCA parameter set presence shall be consistent with QoS support option. RSNA information element shall be present.
- Capability Information field with ESS subfield set to 1 and IBSS subfield set to 0.

4.2.2.4 80211PAL/DI/AA/BI-02-C [Read local AMP ASSOC, invalid physical link]

- **Test Purpose**
  Verify that the IUT rejects a valid HCI Read Local AMP ASSOC issued by the IUT for an invalid Physical_Link_Handle.

- **Reference**
  [4] Section 7.5.9

- **Initial Condition**
  The IUT shall be initialized and in the DISCONNECTED state. The local AMP Info and local AMP_ASSOC shall have been read using the preamble in Section 4.1.6.3.

- **Test Procedure**

- **Test Condition**
  PLH2 shall be distinct from PLH and shall not be zero.
• Expected Outcome

Pass Verdict

Status field in HCI Command Complete event contains error code 0x02 for Unknown Connection Identifier.

4.2.2.5 80211PAL/DI/AA/BI-03-C [Write remote AMP ASSOC, invalid length of TLV]

• Test Purpose

Verify IUT rejects Write_Remote_amp_Assoc with invalid length of one its TLVs.

• Reference

[2], Section 2.14.1

[4] Section 7.5.9

• Initial Condition

The IUT is in the DISCONNECTED state. The local AMP Info and local AMP_Assoc have been read using the preamble in Section 4.1.6.3.

• Test Procedure

![Test Procedure Diagram]

IUT is in DISCONNECTED state, test system has started a network

Loop until AMP_Assoc remaining == AMP_Assoc fragment size

HCI Create Physical Link
(PLH, Link_Key_Length, Link_Key_Type, Link_Key)

HCI Command Status event
(status=0x00, Num_HCI_Comm, Opcode=0x0435)

HCI Write Remote Amp_Assoc
(PLH, LengthSoFar=0, AMP_Assoc_Length, AMP_Assoc_fragment)

HCI Command Complete event
(Num_HCI_Comm, OpCode=0x140B, status=0x12, PLH, AMP_Assoc_Remaining_Length, AMP_Assoc_Fragment)
The UT shall create a TLV with the following format:

<table>
<thead>
<tr>
<th>Tag</th>
<th>Length</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x01 (MAC address)</td>
<td>7</td>
<td>00010203040506</td>
</tr>
</tbody>
</table>

This TLV shall be used as the MAC address TLV in the AMP_ASSOC parameter in the HCI Write Remote AMP ASSOC command.

- **Expected Outcome**
  - **Pass Verdict**

  Status field contains Error Code 0x12 (Invalid HCI Command Parameters).

4.2.2.6 80211PAL/DI/AA/BV-03-C [Read Local AMP ASSOC, Activity Reports declared]

- **Test Purpose**
  
  Verify valid results are returned in response to the IUT issuing an HCI Read Local AMP ASSOC command.

- **Reference**
  
  [2] Section 2.14.1
  [4] Section 7.5.9

- **Initial Condition**
  
  The IUT is initialized and in the DISCONNECTED state.

- **Test Procedure**
• Test Condition
  The LengthSoFar parameter shall start at 0 and shall increment by the previous ASSOC fragment size on each iteration.

• Expected Outcomes
  **Pass Verdict**

  Command complete event(s) contain the complete AMP_ASSOC.

  Acceptable data fields in the AMP_ASSOC are those defined in 2.10 of [2].

  The AMP_ASSOC shall contain the mandatory parameters:

  - MAC Address: Shall match the MAC address of the IUT.
  - Preferred channel list TLV: shall contain at least one channel according to the format specified in [2], section 3.2.3. May contain multiple channels.
  - The PAL version TLV shall contain a PAL version value of 0x01.
  - 802.11 PAL Capabilities: Bit 0 shall be 1.

  AMP_ASSOC may also contain the following optional fields:

  - Connected channel list: may contain at least one channel according to the format specified in [2], section 3.2.3. May contain multiple channels.

4.2.2.7  80211PAL/DI/AA/BV-04-C [Read Local AMP ASSOC, Activity Report Scheduling supported]

• Test Purpose
  Verify valid results are returned in response to the IUT issuing an HCI Read Local AMP ASSOC command.

• Reference
  [2] Section 2.14.1
  [4] Section 7.5.9

• Initial Condition
  The IUT is initialized and in the DISCONNECTED state (see Section 4.1.5).
• **Test Procedure**

![Diagram](image)

- **Test Condition**
  The LengthSoFar parameter shall start at 0 and shall increment by the previous ASSOC fragment size on each iteration.

- **Expected Outcomes**
  **Pass Verdict**

  Command complete event(s) contain the complete AMP ASSOC.

  Acceptable data fields in the AMP ASSOC are those defined in 2.10 of [2].

  The AMP ASSOC shall contain the mandatory parameters:
  - MAC Address: Shall match the MAC address of the IUT.
  - Preferred channel list TLV: shall contain at least one channel according to the format specified in [2], section 3.2.3. May contain multiple channels.
  - The PAL version TLV shall contain a PAL version value of 0x01.
  - 802.11 PAL Capabilities: Bit 1 shall be 1.

  AMP ASSOC may also contain the following optional fields:
  - Connected channel list: may contain at least one channel according to the format specified in [2], section 3.2.3. May contain multiple channels.
4.2.2.8 80211PAL/DI/AA/BV-05-C [Read Local AMP ASSOC on HT, 40 MHz channel generation]

- **Test Purpose**
  Verify valid results are returned in response to the IUT issuing an HCI Read Local AMP ASSOC command.

- **Reference**
  [2] Section 2.14.1
  [4] Section 7.5.9

- **Initial Condition**
  The IUT is initialized and in the DISCONNECTED state (see Section 4.1.5)

- **Test Procedure**

  ![Diagram]

- **Test Condition**
  The LengthSoFar parameter shall start at 0 and shall increment by the previous ASSOC fragment size on each iteration.

- **Expected Outcomes**
  **Pass Verdict**
  Command complete event(s) contain the complete AMP_ASSOC.
  Acceptable data fields in the AMP_ASSOC are those defined in 2.10 of [2].
The AMP_ASSOC shall contain the mandatory parameters:

- **MAC Address:** Shall match the MAC address of the IUT.
- **Preferred channel list v2 TLV:** shall contain at least one 40 MHz channel in 5 GHz according to the format specified in [2], section 3.2.3. May contain multiple channels.
- **802.11 PAL Capabilities:** bit 2 must be set to 1.
- **The PAL version TLV shall contain a PAL version value of 0x01.**

AMP_ASSOC may also contain the following optional fields:

- **Connected channel list:** may contain at least one channel according to the format specified in [2], section 3.2.3. May contain multiple channels.

### 4.2.2.9 80211PAL/DI/AA/BV-06-C [Write Remote AMP ASSOC, 40 MHz channel parsing]

- **Test Purpose**
  
  When configured with the Enable Device Under Test Mode, and presented with a PCLv2 with at least one 40 MHz channel, verify IUT initiator selects a 40 MHz channel.

- **References**

  [1] Section 2.10.1

  [4] Section 7.5.10

- **Initial Condition**

  The IUT is initialized and in the DISCONNECTED state. The local AMP Info and local AMP_ASSOC have been read using the preamble in Section 4.1.6.3.
• Test Procedure

IUT is in DISCONNECTED state

HCI_Command_Complete_event

HCI_Create_Physical_Link_(PLH, Link_Key_Length, Link_Key_Type, Link_Key)

HCI_Command_Status_event

 HCI_Write_Remote_ACK_ASSOC(PLH, LengthSoFar=0, AMP_ASSOC_Remaining_Length, AMP_ASSOC_fragment)

HCI_Command_Complete_event

HCI_Enable_Device_Under_Test_Mode

IUT is in DISCONNECTED state

• Test Condition

The AMP_ASSOC parameter in the HCI Write Remote AMP ASSOC command shall contain the TLVs specified below.

MAC Address: Shall match the MAC address of the IUT.

Preferred channel list v2 in the Write Remote AMP ASSOC from the UT shall contain at least one 40 MHz channel. The Operating Class shall be 116.

PAL Version with a version of 0x01

• Expected Outcome

Pass Verdict

Command complete event in response to HCI Write Remote AMP ASSOC shall have status of 0x00.

HCI Channel Selected event shall contain the Physical Link Handle value from the HCI Create Physical Link command.
Beacons shall be received with:

- SSID set to ‘AMP-xx-xx-xx-xx-xx-xx’ (with no null termination and no quotes) where the “x” characters are replaced by the lowercase hexadecimal characters of the MAC address of the IUT.
- EDCA parameter set and RSNA information element shall be included in beacons and probe responses.
- Capability Information field with ESS subfield set to 1 and IBSS subfield set to 0.
- Beacon shall appear on one of the channels, 36 or 44, in Operating Class 116.
- HT Capability and HT Operation elements shall be included in beacons and Supported Channel Width subfield shall be set to 1.

4.2.3 AMP Status

4.2.3.1 80211PAL/DI/ST/BV-01-C Read Link Quality

- **Test Purpose**
  Verify IUT returns a valid link quality in response to the UT issuing an HCI Read Link Quality command.

- **Reference**
  [2] Section: 2.5
  [4] Section: 7.5.3

- **Initial Condition**
  Physical Link and logical link established by IUT preamble (see Section 4.1.6.2).

- **Test Procedure**

  ![Diagram](image)

  **LT sends data packets to IUT.**
• Expected Outcomes

Pass Verdict

In the HCI Command Complete event, Status = 0x00, the Handle shall be the same as the HCI Read Link Quality command and the Link_Quality return parameter contains any value from 0x00 – 0xFF.

4.3 Physical Link Tests (PL)

This section tests the creation and deletion of physical links.

4.3.1 Create Physical Links

4.3.1.1 80211PAL/PL/PLC/BV-01-C [Initiate Physical Link]

• Test Purpose

Verify that the IUT can establish a physical link.

• Reference

[2] Section 3.1, 3.3.1, 3.3.2

[4] Section 7.1.37

• Initial Condition

The IUT shall be in the DISCONNECTED state. The local AMP Info and local AMP_ASSOC have been read using the preamble in Section 4.1.6.3.
• Test Procedure

Lower Tester

IUT

Upper Tester

 HCI_Create_Physical_Link
(PLH, Link_Key_Length=32, Link_Key_Type=Authenticated Combination Key, Link_Key)

 HCI_Command_Status_event
(status=0x00, Num_HCI_Comm, Opcode=0x0435)

Write remote AMP ASSOC on IUT

 Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

 HCI_Write_Remote_AMP_ASSOC
(PLH, LengthSoFar=0, AMP_ASSOC_Remaining_Length, AMP_ASSOC_fragment)

 HCI_Command_Complete_event
(Num_HCI_Comm, Opcode=0x140B, Status=0x00, PLH)

Network Started by IUT

 Beacon
(ssid=AMP-xx-xx-xx-xx-xx-xx-
(type=ESS))

 Read Local AMP_ASSOC on IUT

 Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

 HCI_Read_Local_AMP_Assoc
(PLH, LengthSoFar)

 HCI_Command_Complete_event
(Num_HCI_Comm, Opcode=0x140A, status=0x00, PLH, AMP_ASSOC_Remaining_Length, AMP_ASSOC_fragment)
Other 802.11 MAC frames such as data retransmissions, RTS/CTS control frames, Probe Request, and Probe Response may be sent during the connection process. 802.11 Acknowledgements and NULL data frames are not shown in the MSC above.

- **Expected Outcomes**
  
  **Pass Verdict**
  
  - IUT reports the same Physical Link Handle in the HCI Channel Selected event and HCI Physical Link Complete event as was given in the HCI Create Physical Link command.
- After sending the HCI Channel Selected event, the IUT correctly reports the selected channel in the HCI Command Complete Event following the HCI Read Local AMP ASSOC command.
- A physical link shall be successfully created, indicated by an HCI Physical Link Complete event with status code of 0x00 being sent to the UT from the IUT.

4.3.1.2 80211PAL/PL/PLC/BV-02-C [Accept Physical Link]

• Test Purpose
  Verify that the IUT can accept a physical link initiated from a peer and fully establish the physical link.

• Reference
  [2] Section 3.1, 3.3.1, 3.3.2
  [4] Section 7.1.38

• Initial Condition
  The IUT is initialized (see Section 4.1.5) and in the DISCONNECTED state.
Test Procedure

IUT is in DISCONNECTED state

- **Lower Tester**
- **IUT**
- **Upper Tester**

**Network Started**

Beacon

(ssid=AMP-xx-xx-xx-xx-xx-xx
(note 1), type=ESS)

Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

- **HCI Read Local AMP Info**
  - HCI Command Complete event
    - (Num_HCI_Comm, Opcode=0x1409,
      status=0x00, AMP_Status,
      Total_Bandwidth,
      Max_Guaranteed_Bandwidth,
      Min_Delay, Max_PDU_Siz,
      Controller_Type, PAL_Capabilities,
      AMP_ASSOC_Length,
      Max_Flush_Timeout,
      Best_Effort_Flush_Timeout)

- **HCI Read Local AMP Assoc**
  - (PLH, LengthSoFar)
  - HCI Command Complete event
    - (Num_HCI_Comm, Opcode=0x140A,
      status=0x00, PLH,
      AMP_ASSOC_Remaining_Length=0,
      AMP_ASSOC_fragment)

- **HCI Accept Physical Link**
  - (PLH, Link_Key_Length=32,
    Link_Key_Type=Authenticated
    Combination Key, Link_Key)
  - HCI Command Status event
    - (status=0x00, Num_HCI_Comm,
      Opcode=0x0436)

- **Write remote AMP ASSOC on IUT**

- **Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size**

**Lower Tester**

**IUT**

**Upper Tester**

- **HCI Write Remote AMP ASSOC**
  - (PLH, LengthSoFar=0,
    AMP_ASSOC_Remaining_Length,
    AMP_ASSOC_fragment)
  - HCI Command Complete event
    - (Num_HCI_Comm, Opcode=0x140B,
      Status=0x00, PLH)
Other 802.11 MAC frames such as data retransmissions, RTS/CTS control frames, Probe Request, and Probe Response may be sent during the connection process. 802.11 Acknowledgements and NULL data frames are not shown in the MSC above.
• Expected Outcomes

Pass Verdict

- The IUT shall report the same Physical Link Handle as the one used in the Accept Physical Link command in all generated events containing a Physical Link Handle return parameter.
- An HCI Physical Link Complete event with status of 0x00 shall be sent to the UT from the IUT.
- 802.11 messages are generated by the IUT as shown in the test procedures.

4.3.1.3 80211PAL/PL/PLC/BV-03-C Initiate physical link, connection accept timeout

• Test Purpose

Verify that the IUT returns an HCI Create Physical Link complete with failure event.

• Reference

[2] Section 3.1, 3.3.1, 3.3.2

• Initial Condition

The IUT is in the DISCONNECTED state as defined in Section 3.1 Physical Link State Machine of [2].
• **Test Procedure**

```
  Upper Tester                  IUT                  Lower Tester
  
  Disconnected

  HCI_Create_Physical_Link
  (PLH, Link_Key_Length=32,
   Link_Key_Type=Authenticated
   Combination Key, Link_Key)

  HCI Command Status event
  (status=0x00, Num_HCI_Comm,
   Opcode=0x0435)

  Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

  HCI_Write_Remote_AMP_ASSOC
  (PLH, LengthSoFar,
   AMP_ASSOC_Rest_In_Length,
   AMP_ASSOC_fragment)

  HCI Command Complete event
  (Num_HCI_Comm, Opcode=0x140A,
   Status=0x00, PLH)

  HCI_Channel_Selected event
  (PLH)

  starting

  Beacon
  (ssid=AMP-xx-xx-xx-xx-xx-xx (note 1),
   type=ESS)

  Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

  HCI_Read_Local_AMP_Assoc
  (PLH, LengthSoFar)

  HCI Command Complete event
  (Num_HCI_Comm, Opcode=0x140A,
   status=0x00, PLH,
   AMP_ASSOC_Remaining_Length,
   AMP_ASSOC_fragment)

  HCI_Physical_Link_Complete event
  (status=0x00, PLH)

  connected
```

• **Expected Outcomes**

**Pass Verdict**

IUT shall report the same Physical Link Handle used in the HCI Create Physical Link Command in all generated events containing a physical link handle return parameter.
After sending the HCI Channel Selected event, IUT shall correctly format the selected channel in the AMP_ASSOC in the HCI Command Complete event following the HCI Read Local AMP ASSOC command.

The physical link creation shall fail due to no connection attempt from the LT. After the connection accept timeout period expires an HCI Physical Link Complete event with status=0x10 (Connection Accept Timeout) shall be sent from the IUT to the UT.

4.3.1.4 80211PAL/PL/PLC/BV-04-C [Initiate physical link, no compatible channels]

- Test Purpose
  Verify that the IUT returns an HCI Create Physical Link Complete event with failure when there are no common usable channels between the peers.

- Reference
  [2] Section 3.1, 3.3.1, 3.3.2

- Initial Condition
  The IUT is in the DISCONNECTED state. The local AMP Info and local AMP_ASSOC have been read using the preamble in Section 4.1.6.3.
The Write Remote AMP ASSOC shall have a channel which is NOT in the local AMP ASSOC. The UT should have an inverse channel from local AMP ASSOC.
Pass Verdict

- IUT reports the same Physical Link Handle in the HCI Physical Link Complete event which was used in the HCI Create Physical Link command.

- After the HCI Write_Remote_AMP_ASSOC command, IUT rejects the physical link as there are no compatible channels with an HCI Physical Link Complete event with status=0x39 (Connection Rejected Due to No Suitable Channel Found) or 0x0D (DISCONNECTED State).

4.3.1.5 80211PAL/PL/PLC/BV-05-C [Create Physical Link, second physical link]

• Test Purpose
  Verify that the IUT can create a second physical link on the same 802.11 channel.

• Reference
  [2] Section 3.1, 3.3.1, and 3.3.2

• Initial Condition
  The IUT has completed the procedure outlined in Section 4.1.5.
Note 1: The AMP ASSOC given to the IUT in the HCI Write Remote AMP ASSOC command contains a preferred channel list containing only the channel of the first physical link. It contains a MAC address different from that of the first physical link.
• Expected Outcome

Pass Verdict

- IUT uses the same Physical Link Handle used in the second HCI Create Physical Link command in the HCI Channel Selected event and HCI Physical Link Complete event.
- The IUT sends the HCI Command Status event in response to the HCI Create Physical Link command prior to the connection accept timeout.
- After sending the HCI Channel Selected event, IUT reports the selected channel in the HCI Command Complete Event following the HCI Read Local AMP ASSOC.
- The IUT returns HCI Physical Link Complete event with a status parameter of success prior to the expiration of the connection accept timeout.

4.3.1.6 80211PAL/PL/PLC/BI-01-C [Reject physical link from other AMP devices]

• Test Purpose

Verify that the IUT does not accept a physical link from an AMP device that was not specified in the remote AMP ASSOC exchange.

• Reference

[2] Section 3.3.4

• Initial Condition

- The IUT shall be in the DISCONNECTED state. The local AMP Info and local AMP_ASSOC have been read using the preamble in section 4.1.6.3.
- The following TLVs shall be used in the AMP_ASSOC parameter to the HCI Write Remote AMP ASSOC command.

<table>
<thead>
<tr>
<th>Type</th>
<th>Length</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x01 – MAC address</td>
<td>6</td>
<td>Any address not matching the address of LT</td>
</tr>
<tr>
<td>0x02 – Preferred channel list</td>
<td>6</td>
<td>{'XXX', 201, 254, 0}</td>
</tr>
</tbody>
</table>
**Test Procedure**

- **IUT and test system in DISCONNECTED state**
  - HCI Create Physical Link
    (PLH, Link_Key_Length, Link_Key_Type, Link_Key)
  - HCI Command Status event
    (status=0x00, Num_HCI_Comm, Opcode=0x0435)

- **Waiting for Write remote AMP ASSOC on IUT (note 1)**
  - Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size
    - HCI Write Remote AMP ASSOC
      (PLH, LengthSoFar=0,
       AMP_ASSOC_Remaining_Length,
       AMP_ASSOC_fragment)
    - HCI Command Complete event
      (Num_HCI_Comm, Opcode=0x140B,
       Status=0x00, PLH)

- **Network Started**
  - HCI Channel Selected event
    (PLH)

- **Waiting for Read Local AMP Assoc on IUT**
  - Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size
    - HCI Read Local AMP Assoc
      (PLH, length so far =0)
    - HCI Command Complete event
      (Num_HCI_Comm, Opcode=0x140A,
       status=0x02, PLH,
       AMP_Assoc_Remaining_Length, AMP_Assoc_Fragment)

- **Wait for Physical Link Handshake (note 2) - Tester uses MAC_ADDR different than in the AMP_ASSOC**
  - Probe Request
    (a1=MA_IUT, a2=MA_tester, a3=MA_IUT, SSID=AMP<MA_IUT>, IEEE_IEs)
  - Authentication Message 1
    (a1=MA_IUT, a2=MA_tester, a3=MA_IUT, alg=open system(0))
  - Authentication Message 2
    (a1=MA_IUT, a2=MA_tester, a3=MA_IUT, alg=open system(0), status=0)
  - Association Request
    (a1=MA_IUT, a2=MA_tester, a3=MA_IUT, SSID=AMP<MA_IUT>, IEEE_IEs)
  - Deauthentication
    (a1=MA_tester, a2=MA_IUT, a3=MA_IUT, reason=0)
  - HCI Physical Link Complete event
    (status=0x08, PLH)
Note 1: The peer MAC address in the AMP ASSOC is different from that of the LT MAC.

Note 2: This is the 802.11 message sequence as defined in 80211PAL/PL/PLC/BV-01-C but with the Rx address in the messages from the tester different to that in the write remote AMP ASSOC to the IUT.

• Expected Outcome
  
  Pass Verdict
  
  IUT reports the same Physical Link Handle in the HCI Physical Link Complete event which was used in the HCI Create Physical Link command.

  After sending the HCI Channel Selected event, IUT reports a selected channel that is common to the Preferred Channel list of the local and remote AMP ASSOCs.

  The IUT sends an HCI Physical Link Complete event with status of 0x10 (Connection Accept Timeout).

• Notes
  
  The IUT may not generate responses to 802.11 authentication frame.

4.3.1.7  80211PAL/PL/PLC/BV-06-C [Initiate Physical link on HT device]

• Test Purpose
  
  Verify that the initiating IUT can establish a physical link when it is an HT capable device and the responding device is an HT capable device.

• Reference
  
  [2] Section 3.1, 3.3.1, 3.3.2

  [4] Section 7.1.37

• Initial Condition
  
  The IUT shall be in the DISCONNECTED state. The local AMP Info and local AMP_ASSOC have been read using the preamble in Section 4.1.6.3.
• Test Procedure

Preamble in 5.1.5.3 is completed

Upper Tester

IUT

Lower Tester

Write remote AMP ASSOC on IUT

Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

Network Started by IUT

Beacon (ssid=AMP-xx-xx-xx-xx-xx-xx, type=ESS)

Read Local AMP_ASSOC on IUT

Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

HCI_Create_Physical_Link (PLH, Link_Key_Length=32, Link_Key_Type=Authenticated Combination Key, Link_Key)

HCI_Command_Status_event (status=0x00, Num_HCI_Comm, Opcode=0x0435)

HCI_Write_Remote_AMP_ASSOC (PLH, LengthSoFar=0, AMP_ASSOC_Remaining_Length, AMP_ASSOC_fragment)

HCI_Command_Complete_event (Num_HCI_Comm, Opcode=0x140A, Status=0x00, PLH)

HCI_Read_Local_AMP_Assoc (PLH, LengthSoFar)

HCI_Command_Complete_event (Num_HCI_Comm, Opcode=0x140A, status=0x00, PLH, AMP_ASSOC_Remaining_Length, AMP_ASSOC_fragment)
Other 802.11 MAC frames such as data retransmissions, RTS/CTS control frames, Probe Request and Probe Response may be sent during the connection process. 802.11 Acknowledgements and NULL data frames are not shown in the MSC above.

- **Test Condition**
  LT shall respond as an HT capable device.
• Expected Outcomes

Pass Verdict

IUT shall report the same Physical Link Handle in all generated HCI events as the handle parameter contained in the HCI Create Physical Link command.

A physical link shall be successfully created, indicated by an HCI Physical Link Complete event with status code of 0x00 being sent to the UT from the IUT.

The HT Capabilities and HT Operation elements are included in the IUT’s beacon and association response frames.

Both the HT-Greenfield subfield and the PCO subfield within the HT Capabilities element are set to 0, and RIFS Mode subfield within the HT Operation element is set to 0.

4.3.1.8 80211PAL/PL/PLC/BV-07-C [Initiate Physical link on HT device with 40 MHz channels]

• Test Purpose

Verify that the Initiating IUT can establish a physical link when it is a 40 MHz HT capable device and the responding device is a 40 MHz HT capable device.

• Reference

[2] Section 2.16, 3.1, 3.3.1, 3.3.2

[4] Section 7.1.37

• Initial Condition

The IUT shall be in the DISCONNECTED state. The local AMP Info and local AMP_ASSOC have been read using the preamble in Section 4.1.6.3.
Test Procedure

- **Lower Tester**
- **IUT**
- **Upper Tester**

Preamble in 5.1.5.3 is completed

**HCI_Enable_Device_Under_Test_Mode**

**HCI_Create_Physical_Link**
(PLH, Link_Key_Length=32, Link_Key_Type=Authenticated Combination Key, Link_Key)

**HCI_Command_Complete event**
(status=0x00, Num_HCI_Comp, Opcode=0x0435)

**Write remote AMP ASSOC on IUT**

Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

**HCI_Write_Remote AMP_ASSOC**
(PLH, LengthSoFar=0, AMP_ASSOC_Remaining_Length, AMP_ASSOC_fragment)

**HCI_Command_Complete event**
(Num_HCI_Comp, Opcode=0x140A, Status=0x00, PLH)

Network Started by IUT

**Beacon**
(ssid=AMP-xx-xx-xx-xx-xx-xx, type=ESS)

Read local AMP ASSOC on IUT

Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

**HCI_Read_Local AMP_Assoc**
(PLH, LengthSoFar)

**HCI_Command_Complete event**
(Num_HCI_Comp, Opcode=0x140A, status=0x00, PLH, AMP_ASSOC_Remaining_Length, AMP_ASSOC_fragment)
Other 802.11 MAC frames such as data retransmissions, RTS/CTS control frames, Probe Request and Probe Response may be sent during the connection process. 802.11 Acknowledgements and NULL data frames are not shown in the MSC above.

- Test Condition
  Remote AMP ASSOC from LT shall contain only 40 MHz channels in its PCLv2 TLV.
• Expected Outcomes

  Pass Verdict

IUT reports the same Physical Link Handle in the HCI Channel Selected event and HCI Physical Link Complete event as was given in the HCI Create Physical Link command.

The HT Capabilities and the HT Operation elements are included in the IUT’s beacon, probe response, and association response frames. Within the HT Capabilities element, the Supported Channel Width subfield shall be set to 1.

Selected primary channel as given in the HCI Read Local AMP ASSOC shall be a channel which is adjacent to a channel suitable for use as an extension channel in 40 MHz transmissions.

A physical link shall be successfully created, indicated by an HCI Physical Link Complete event with status code of 0x00 being sent to the UT from the IUT.

4.3.1.9 80211PAL/PL/PLC/BV-08-C [Accept Physical link on HT device]

• Test Purpose

  Verify that the Responder IUT can establish a physical link when it is an HT capable device and the Initiator is an HT capable device.

• Reference

  [2] Section 3.1, 3.3.1, 3.3.2

  [4] Section 7.1.38

• Initial Condition

  The IUT is initialized (see Section 4.1.5) and in the DISCONNECTED state.
• Test Procedure

**Network Started**

Beacon
(ssid=AMP-xx-xx-xx-xx-xx-xx-
type=ESS)

**Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size**

**Write remote AMP ASSOC on IUT**

**Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size**

**Write remote AMP ASSOC on IUT**

**Network Started**

Beacon
(ssid=AMP-xx-xx-xx-xx-xx-xx-
type=ESS)
Other 802.11 MAC frames such as data retransmissions, RTS/CTS control frames, Probe Request and Probe Response may be sent during the connection process. 802.11 Acknowledgements and NULL data frames are not shown in the MSC above.

* Expected Outcomes

**Pass Verdict**

IUT reports the same Physical Link Handle in the HCI Physical Link Complete event as was given in the HCI Create Physical Link command.
The HT Capability IE is included in the IUT responder’s beacons and association request.

Both the HT-Greenfield subfield and the PCO subfield in the HT Capabilities element are set to 0.

An HCI Physical Link Complete event with status of 0x00 shall be sent to the UT from the IUT.

4.3.1.10 80211PAL/PL/PLC/BV-09-C [Accept Physical link on HT device with 40 MHz channel]

- **Test Purpose**
  Verify that the Responder IUT can establish a physical link when it is a 40 MHz HT capable device and the Initiator is a 40 MHz HT capable device.

- **Reference**
  [2] Section 2.16, 3.1, 3.3.1, 3.3.2
  [4] Section 7.1.38

- **Initial Condition**
  The IUT is initialized (see Section 4.1.5) and in the DISCONNECTED state.
- Test Procedure

Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

Network Started
Other 802.11 MAC frames such as data retransmissions, RTS/CTS control frames, Probe Request, and Probe Response may be sent during the connection process. 802.11 Acknowledgements and NULL data frames are not shown in the MSC above.

- **Test Condition**
  The LT shall include a 40 MHz channel in the remote AMP_ASSOC written to the responding IUT after the HCI_Accept_Physical_Link command.

- **Expected Outcomes**
  **Pass Verdict**
  IUT reports the same Physical Link Handle in the HCI Physical Link Complete event as was given in the HCI Accept Physical Link command.
The HT Capability IE is included in the IUT responder’s beacons and association request. The Supported Channel Width subfield of the HT Capability IE shall be set to 1.

An HCI Physical Link Complete event with status of 0x00 shall be sent to the UT from the IUT.

4.3.1.11 80211PAL/PL/PLC/BV-10-C [Initiate Physical link on HT device with non-HT responder]

• Test Purpose
Verify that a non-HT link is successfully created when an HT initiator IUT and non-HT responder attempt to establish a connection.

• Reference
[2] Section 3.1, 3.3.1, 3.3.2
[4] Section 7.1.37

• Initial Condition
The IUT shall be in the DISCONNECTED state. The local AMP Info and local AMP_ASSOC have been read using the preamble in Section 4.1.6.3.
- **Test Procedure**

  ![Diagram]

  The preamble in section 5.1.5.3 is completed.

  - **Upper Tester**
    - **IUT**
    - **Lower Tester**

  **Write remote AMP ASSOC on IUT**

  Loop until AMP ASSOC remaining == AMP ASSOC fragment size

  - **Upper Tester**
    - **IUT**
    - **Lower Tester**

  **Network Started by IUT**

  - **Upper Tester**
    - **IUT**
    - **Lower Tester**

  **Beacon**

  - **Upper Tester**
    - **IUT**
    - **Lower Tester**

  **Read Local AMP ASSOC on IUT**

  Loop until AMP ASSOC remaining == AMP ASSOC fragment size

  - **Upper Tester**
    - **IUT**
    - **Lower Tester**

  The preamble in section 5.1.5.3 is completed.
Other 802.11 MAC frames such as data retransmissions, RTS/CTS control frames, Probe Request, and Probe Response may be sent during the connection process. 802.11 Acknowledgements and NULL data frames are not shown in the MSC above.

- **Test Condition**
  The LT shall not include HT elements in its association request.

- **Expected Outcomes**
  **Pass Verdict**

  IUT reports the same Physical Link Handle in the HCI Channel Selected event and HCI Physical Link Complete event as was given in the HCI Create Physical Link command.
When generating the HCI Command Complete event in response to the HCI Read Local AMP ASSOC command following the HCI Channel Selected event, the 802.11 PAL Capability TLV must have the HT Capability field (bit 2) set to 1.

A physical link shall be successfully created, indicated by an HCI Physical Link Complete event with status code of 0x00 being sent to the UT from the IUT.

4.3.1.12 80211PAL/PL/PLC/BV-11-C [Accept Physical link on HT device with non-HT initiator]

• Test Purpose
  Verify that a non-HT link is successfully created when a non-HT initiator and HT responder IUT attempt to establish a connection.

• Reference
  [2] Section 3.1, 3.3.1, 3.3.2
  [4] Section 7.1.38

• Initial Condition
  The IUT is initialized (see Section 4.1.5) and in the DISCONNECTED state.
• Test Procedure

IUT is in DISCONNECTED state

Loop until AMP_ASSOC remaining == AMP_ASSOC fragment size

Network Started

Beacon
(ssid=AMP-xx-xx-xx-xx-xx-xx, type=ESS)
Other 802.11 MAC frames such as data retransmissions, RTS/CTS control frames, Probe Request, and Probe Response may be sent during the connection process. 802.11 Acknowledgements and NULL data frames are not shown in the MSC above.
• Expected Outcome
  Pass Verdict

  In the HCI Command Complete event following the HCI Read Local AMP Info, the Total_Bandwidth parameter should be 50000.

  In the HCI Command Complete event following the HCI Read Local AMP ASSOC, in the 802.11_PAL_Capabilities TLV, the HT Capability field (bit 2) must be set to 1.

  An HCI Physical Link Complete event with status of 0x00 shall be sent to the UT from the IUT.

### 4.3.2 Disconnect Physical Link

#### 4.3.2.1 80211PAL/PL/PLD/BV-01-C [Disconnect physical link]

• Test Purpose
  Verify the IUT can disconnect an existing Physical Link. Verify that after disconnecting the IUT is not beaconing.

• Reference
  [2] Section 3.1.11
  [4] Section 7.1.39

• Initial Condition
  The IUT has established a physical link using the preamble in 4.1.6.1.

• Test Procedure

  ![Diagram](image-url)
• Expected Outcome

Pass Verdict

IUT sends HCI Disconnection Physical Link Complete event to the UT with status=0x00 and Reason=0x16 (Connection Terminated by Local Host).

IUT stops beaconing within 5 sec of receiving the HCI Disconnect Physical Link command.

4.3.2.2 80211PAL/PL/PLD/BI-01-C [Disconnect physical link, invalid link handle]

• Test Purpose

Verify the IUT rejects a HCI Disconnect Physical Link command containing an invalid Physical Link Handle. A physical link exists with a different Physical Link Handle.

• Reference

[2] Section 3.1.11

[4] Section 7.1.6

• Initial Condition

The IUT has established a physical link using the preamble in Section 4.1.5. The IUT has only one physical connection.

• Test Procedure

![Test Procedure Diagram]

• Expected Outcome

Pass Verdict

IUT continues beaconing.

IUT returns HCI Command Status event with error code 0x02 (Unknown Connection Identifier).
4.3.3 Physical Link Supervision

4.3.3.1 80211PAL/PL/PLS/BV-01-C [Respond to Link Supervision Request]

• Test Purpose
  Verify the IUT responds to a Link Supervision request from a link peer.

• Reference
  [2] Section 3.4

• Initial Condition
  A physical link exists between LT and IUT using the procedure specified in 4.1.6.1

• Test Procedure

  **Expected Outcome**
  **Pass Verdict**
  After receiving a Link Supervision timeout request from the LT, the IUT generates a Link Supervision within LSTO.

4.3.3.2 80211PAL/PL/PLS/BV-02-C Generate Link Supervision Request

• Test Purpose
  Verify IUT generates a Link Supervision request before timing out a Physical Link.

• Reference
  [2] Section 3.4

• Initial Condition
  The IUT has established a physical link and best effort logical link using the preamble in 4.1.6.
The Lower tester transmits beacons with a period less than LSTO.

The Lower tester shall respond to the first Link Supervision Request from the IUT.

The lower Tester shall ignore further Link Supervision Request from the IUT.

The IUT may transmit any number greater than 1 Link Supervision Requests.

• Expected Outcome

  Pass Verdict

  The IUT generates a Link Supervision request before LSTO expires.

  On receiving a Link Supervision response the IUT restarts its LSTO timer.

  Before the LSTO expires for the second time the IUT issues another Link Supervision request.

  After failing to receive a Link Supervision response before LSTO expires, the IUT sends HCI Disconnection Logical Link Complete event followed by HCI Disconnection Physical Link Complete event to the host.

4.4 Logical Link Tests (LL)

This section verifies the IUT logical link behavior conforms to the specification. Various flowspecs are used in this section; they are as follows.

• TX_BE_FS TX best effort flowspec

  (id=1, service_type=BE(0x01), max_SDU=0xffffffff, SDU interarrival time=0xffffffff, Access latency=0xffffffff, flush timeout=0xffffffff)
• RX_BE_FS RX best effort flowspec
  (id=2, service_type=BE(0x01), max_SDU=0xffffffff, SDU interarrival time=0xffffffff, Access latency=0xffffffff, flush timeout=0xffffffff)

• TX_GU_FS TX guaranteed latency flowspec
  (id=3, service_type=Guaranteed(0x02), max_SDU=1492, SDU interarrival time=0xffffffff, Access latency=10000, flush timeout=10000)

• RX_GU_FS RX guaranteed latency flowspec
  (id=1, service_type=Guaranteed(0x02), max_SDU=0xffffffff, SDU interarrival time=0xffffffff, Access latency=10000, flush timeout=10000)

• TX_BE_AGG_FS TX aggregated best effort flowspec
  (id=4, service_type=BE(0x01), max_SDU=1492, SDU interarrival time=0xffffffff, Access latency=0xffffffff, flush timeout=0xffffffff)

• RX_BE_AGG_FS RX aggregated best effort flowspec
  (id=4, service_type=BE(0x01), max_SDU=1492, SDU interarrival time=0xffffffff, Access latency=0xffffffff, flush timeout=0xffffffff)

• TX_GU_BW_FS TX guaranteed bandwidth flowspec
  (id=4, service_type=Guaranteed(0x02), max_SDU=1492, SDU interarrival time=100, Access latency=0xffffffff, flush timeout=0xffffffff)

• RX_GU_BW_FS RX guaranteed bandwidth flowspec
  (id=4, service_type=Guaranteed(0x02), max_SDU=1492, SDU interarrival time=100, Access latency=0xffffffff, flush timeout=0xffffffff)

4.4.1 Create Logical Link

4.4.1.1 80211PAL/LL/LLC/BV-01-C [Initiate logical link setup of best effort logical link]

• Test Purpose
  Verify the IUT can establish a best effort logical link.

• Reference
  [2] Sections: 4.1.1 and 4.1.3

• Initial Condition
  The IUT is in the CONNECTED state. The IUT shall run the preamble in Section 4.1.6.1.
• **Test Procedure**

```
Device in Tester -> IUT -> Upper Tester

IUT selects Logical Link Handle and maps Logical Link to Upper Tester
```

- **HCI Logical Link Complete event**
  (status=0x00, PLH, LLH)

Device in Tester

- **HCI Command Status event**
  (status=0x00, Num_HCI_Comm, Opcode=0x0438)

```
HCI Create Logical Link
(PLH, TX_BE_FS, RX_BE_FS)
```

IUT selects Logical Link Handle and maps Logical Link to UP

```
HCI Logical Link Complete event
(status=0x00, PLH, LLH)
```

- **Expected Outcome**

  **Pass Verdict**

  IUT sends an HCI Command Status event with status = 0x00 (pending) to the UT after the HCI Create Logical Link command.

  The IUT sends an HCI Logical Link Complete event to the UT before Logical Link Accept Timeout occurs. The HCI Logical Link Complete event has the following parameters:

  - status = 0x00 (success),
  - PLH matching that specified in the HCI Create Logical Link command.
  - TX_FS_ID matching the flowspec ID in TX_BE_FS.

  **4.4.1.2 80211PAL/LL/LLC/BV-02-C [Accept logical link setup of best effort logical link]**

• **Test Purpose**

  Verify the IUT can accept a best effort logical link.

• **Reference**

  [2] Section 4.1.1, 4.1.3

  [4] Section 7.1.41
• **Initial Condition**

The IUT is in the CONNECTED state. The IUT shall run the preamble in Section 4.1.6.1.

• **Test Procedure**

![Diagram showing the test procedure]

- **Expected Outcome**

  **Pass Verdict**

  IUT sends an HCI Command Status event with status = 0x00 (pending) to the UT after the HCI Accept Logical Link command.

  The IUT sends an HCI Logical Link Complete event to the UT before Logical Link Accept Timeout occurs. The HCI Logical Link Complete event has the following parameters:

  - status = 0x00 (success),
  - PLH matching that specified in the HCI Create Logical Link command.
  - TX_FS_ID matching the flowspec ID in TX_BE_FS.

4.4.1.3 80211PAL/LL/LLC/BV-03-C Initiate guaranteed logical link

• **Test Purpose**

  Verify IUT can establish a guaranteed logical link for a QoS enabled physical link.

• **Reference**

  [2] Sections 4.1.1, 4.1.4
[4] Section 7.1.40

• Initial Condition

The IUT is in the CONNECTED state with a Best Effort logical link. No other Logical Links have been set up.

• Test Procedure

UT starts a timer when the HCI Create Logical Link command is sent to the IUT. Timeout value shall be larger than the Logical Link Accept Timeout period.

![Diagram of test procedure]

• Expected Outcome

Pass Verdict

IUT sends an HCI Command Status event with status = 0x00 (pending) to the UT after the HCI Create Logical Link command.

The IUT sends an HCI Logical Link Complete event to the UT before expiration of the Logical Link Accept Timeout. The HCI Logical Link Complete event has the following parameters:

- status = 0x00 (success),
- PLH matching that specified in the HCI Create Logical Link command.
- TX_FS_ID matching the flowspec ID in TX_GU_FS.

4.4.1.4 80211PAL/LL/LLC/BV-04-C [Create logical link, accept guaranteed logical link]

• Test Purpose

Verify the IUT can accept a guaranteed logical link for a QoS enabled physical link.
• Reference
  [2] Section 4.1.1, 4.1.4, 6

  [4] Sections: 7.1.41

• Initial Condition
  The IUT is in the CONNECTED state. The physical link was established with QoS.
  No other Logical Links have been set up.

• Test Procedure
  IUT executes preamble described in 4.1.6.1.

  UT starts a timer when the HCI Create Logical Link command is sent to the IUT. Timeout value shall be larger than the Logical Link Accept Timeout period.

  IUT selects Logical Link Handle and maps Logical Link to UP
  IUT and test system have an active Physical Link

  HCI Command Status event (status=0x00, Num_HCI_Comm, Opcode=0x0439)

• Expected Outcome
  Pass Verdict

  IUT sends an HCI Command Status event with status = 0x00 (pending) to the UT after the HCI Create Logical Link command.
The IUT sends an HCI Logical Link Complete event with (success) to the UT before expiration of the Logical Link Accept Timeout. The HCI Logical Link Complete event has the following parameters:

- status = 0x00 (success),
- PLH matching that specified in the HCI Create Logical Link command.
- TX_FS_ID matching the flowspec ID in TX_BE_FS.

4.4.1.5 80211PAL/LL/LLC/BV-05-C [Create Logical Link, Cancel Logical link]

• Test Purpose
  Verify cancel logical link command is accepted or rejected, and the logical link is in a state consistent with the result.

• Reference
  [2] Section 4.1.1, 4.1.3, 6
  [4] Section 7.1.43

• Initial Condition
  Physical Link Initiated by IUT preamble (see Section 4.1.6.1).

  No other Logical Links shall have been set up.

• Test Procedure
  The tester shall attempt to cancel a logical link during its creation.

  There are 2 possible options for the test procedure to complete depending on whether the IUT receives the Cancel Logical Link command before or after it sends the Logical Link Complete event for the preceding Create Logical Link command.
The preamble in section 5.1.5.1 is completed

- **Expected Outcome**
  
  **Pass Verdict**

  IUT sends an HCI Command Status event with status = 0x00 (pending) to the UT after the HCI Create Logical Link command.

  Option 1: IUT Sends an HCI Command Complete event for the Logical Link Cancel command with status = 0x00 (success) followed by an HCI Logical Link Completion event with status = 0x02 ("Unknown Connection Identifier").

  The IUT returns an HCI Logical Link Complete event with status = 0x02 (Unknown Connection Identifier).
Option 2: On completion of the Logical Link creation process, the IUT sends an HCI Logical Link Complete event with status = 0x00 (success) to the UT.

Following this the IUT sends a Command Complete event for the Logical Link Cancel command with status indicating "ACL Connection Already Exists"

IUT sends at least one 802.11 AMP data frame according to the format indicated above.

### 4.4.1.6 80211PAL/LL/LLC/BV-06-C [Logical link, modify flow spec]

- **Test Purpose**
  Verify IUT accepts HCI modify flow spec modify command.

- **Reference**
  [2] Section 4.2
  [4] Section 7.1.44

- **Initial Condition**
  IUT is configured according to preamble in Section 4.1.6.2.

- **Test Procedure**

  ![Test Procedure Diagram]

  The preamble in section 5.1.5.2 is completed

  -HCI Flow Spec Modify event
    (LLH, BE_Aggragated_Counter=2, TX_BE_AGG_FS, RX_BE_AGG_FS)
  -HCI Command Status event
    (status=0x00, Num_HCI_Comm, Opcode=0x043C)

- **Test Condition**
  The required bandwidth specified in the updated flowspecs is less than the Total_Bandwidth parameter of the local AMP info.
• Expected Outcomes

Pass Verdict

The logical link is successfully updated with the new flowspec. An HCI Command Status event with status = 0x00 (success) shall be returned in response to the HCI Flow Spec Modify command.

An HCI Flow Spec Modify Complete event with status = 0x00 (success) is returned.

4.4.1.7 80211PAL/LL/LLC/BV-07-C [Create Logical link, multiple logical link]

• Test Purpose

Verify a guaranteed logical link can be created on IUT when a BE link already exists.

• Reference

[2] Section 4.1
[4] Section 7.1.40

• Initial Condition

IUT is configured according to preamble in Section 4.1.6.

• Test Procedure

```
<table>
<thead>
<tr>
<th>Lower Tester</th>
<th>IUT</th>
<th>Upper Tester</th>
</tr>
</thead>
</table>

The preamble in section 5.1.5.2 is completed

HCI_Create_Logical_Link
(PLH, TX_GU_FS, RX_GU_FS)

HCI Command Status event
(status=0x00, Num_HCI_Comm, Opcode=0x0438)

Select Logical Link Handle and map Logical Link to UP

HCI Logical Link Complete event
(status=0x00, PLH, LLH2)

QOS Data
(4 Addr header incl UP=0 or 3, AMP LLC, data)

QOS Data
(4 Addr header incl UP>3, AMP LLC, data)

ACL_DATA
(LL1, data)

ACL_DATA
(LL2, data)
```
- Test Condition
  The required bandwidth specified in the second flowspec is less than the Total_Bandwidth parameter of the local AMP info.

- Expected Outcome
  Pass Verdict
  An HCI Command Status event with status = 0x00 (pending) shall be sent by the IUT in response to the HCI Create Logical Link command from the UT.

  An HCI Logical Link Complete event with status = 0x00 (success) and a logical_link_handle different from that of the existing best effort link is received by the UT. Two data packets are transmitted on the 802.11 media, on using a best effort UP and the other using a higher UP.

4.4.1.8  80211PAL/LL/ LLC/BI-01-C [Create Logical Link, Nonexistent physical link]

- Test Purpose
  Verify attempt to create logical link on nonexistent physical link is rejected.

- References
  [2] Section 4.1
  [4] Section 7.1.40

- Initial Condition
  The IUT is initialized (see section 5.1.4) and in the DISCONNECTED state.

- Test Procedure

  Lower Tester  IUT  Upper Tester
  
  IUT and test system are in the DISCONNECTED state
  
  HCI_Create_Logical_Link
  (PLH, TX_BE_FS, RX_BE_FS)
  
  HCI Command Status event
  (status=0x02, Num_HCI_Comm, Opcode=0x0438)
• Expected Outcome
  Pass Verdict

  The IUT sends an HCI Command Status event with status = 0x02 (Unknown Connection Identifier) in response to the HCI Create Logical Link command.

4.4.1.9 80211PAL/LL/LLC/BI-02-C [Create logical link, Physical link connection in progress]

• Test Purpose
  Verify attempt to create logical link on a physical link which has not yet connected is rejected.

• References
  [2] Section 7.1.40
  [4] Section 4.1

• Initial Condition
  The IUT is in the DISCONNECTED state. The local AMP Info and local AMP_ASSOC have been read using the preamble in Section 4.1.6.3.
• Test Procedure

Lower Tester

IUT

Upper Tester

Write remote AMP ASSOC on IUT (note 1)

HCI Command Status event
(status=0x00, Num_HCI_Comm, Opcode=0x0435)

Network Started

HCI Channel Selected event
(PLH)

Try to create a logical link before the physical link setup has completed

HCI Command Status event
(status=0x0C, Num_HCI_Comm, Opcode=0x0438)

Read Local AMP Assoc on IUT

HCI Command Complete event
(Num_HCI_Comm, Opcode=0x140B, Status=0x00, PLH)

HCI Command Complete event
(Num_HCI_Comm, Opcode=0x140A, Status=0x02, PLH, AMP_Assoc_Remaining_Length, AMP_Assoc_Fragment)

HCI Command Complete event
(status=0x00, PLH)
• Expected Outcome
  Pass Verdict

An HCI Command Status with status = 0x0c (Command disallowed) is received by the UT in response to the HCI Create Logical Link command.

An HCI Physical Link Complete event shall be returned with a status of 0x00 (success).

4.4.1.10 80211PAL/LL/LLC/BI-03-C Create logical link, max bandwidth exceeded

• Test Purpose
  Verify attempt to create logical link on a physical link which exceeds maximum bandwidth is rejected.

• Reference
  [2] Section 4.1.4

• Initial Condition
  IUT is configured according to preamble in Section 4.1.6.1.

• Test Procedure

  Upper Tester
  IUT
  Lower Tester

  The preamble in section 5.1.5.1 is completed

  HCI_Create_Logical_Link
  (PLH, TX_GU_LARGE_FS, RX_GU_LARGE_FS)

  HCI Command Status event
  (status=0x2D, Num_HCI_Comm, Opcode=0x0438)

• Test Condition
  The requested bandwidth in the TX_GU_BW_FS shall be greater than the Maximum_Guaranteed_Bandwidth parameter from the HCI Read Local AMP Info command.

• Expected Outcome
  Pass Verdict

  IUT returns an HCI Command Status event with status = 0x2D (QoS Rejected) in response to the HCI Create Logical Link command.
4.4.2 Disconnect Logical Link

4.4.2.1 80211PAL/LL/LLD/BV-01-C [Disconnect logical link]

- **Test Purpose**
  Verify deletion of logical link.

- **Reference**
  [2] Section 4.3
  [4] Section 7.1.42

- **Initial Condition**
  IUT is configured according to preamble in Section 4.1.6.2.

- **Test Procedure**

  ![Diagram]

  - **Note 1:** This is the logical link handle of the preexisting logical link.

- **Expected Outcome**
  **Pass Verdict**

  IUT sends a Command Status event with status = 0x00 (pending) to the UT in response to the HCI Disconnect Logical Link command.

  IUT sends an HCI Disconnection Logical Link Complete event with status = 0x00 (success) and reason = 0x16 (Connection Terminated by Local Host) to the UT.
4.4.2.2 80211PAL/LL/LLD/BV-02-C [Disconnect logical link, multiple logical Links]

- Test Purpose
  Verify deletion of a guaranteed logical link while a BE logical link also exists does not interfere with the BE logical link.

- Reference
  [2] Section 4.3
  [4] Section 7.1.42

- Initial Condition
  IUT is configured according to preamble in Section 4.1.6.5.

- Test Procedure

  ![Diagram of test procedure]

  Note 1: The LLH is the handle of the pre-existing guaranteed logical link.

- Expected Outcome
  Pass Verdict
  The IUT sends an HCI Command Status event with status = 0x00 (pending) to the UT in response to the HCI Disconnect Logical Link command.
The IUT sends an HCI Disconnection Logical Link Complete event with status = 0x00 (success) and reason = 0x16 (Connection Terminated by Local Host) with the Guaranteed Logical Link Handle to the UT. The UT sends an ACL data frame using the logical link handle of the BE link and it is correctly received by the LT.

4.4.2.3 80211PAL/LL/LLD/BI-01-C [Disconnect logical link, invalid link handle]

- Test Purpose
  Verify IUT rejects a request to delete a nonexistent logical link.

- Reference
  [2] Section 3.1.11
  [4] Section 7.1.42

- Initial Condition
  IUT is in the CONNECTED state and configured according to preamble in Section 4.1.6.2.

- Test Procedure

  The preamble in section 5.1.5.2 is completed

  The UT sends an HCI Disconnect Logical Link command to the IUT with an invalid logical link handle such that the handle does not match the handle of the extant logical link.

- Expected Outcome

  Pass Verdict

  The IUT returns an HCI Command Status event with status = 0x02 (Unknown Connection Identifier) to the UT in response to the HCI Disconnect Logical Link command.
4.5 Data Transfer Tests (DAT)

4.5.1 Transmit Tests

For all data tests, a payload of 100 bytes shall be used, which has the following byte pattern: {00, 01, 02, 03… 99}

4.5.1.1 80211PAL/DA/TX/BV-01-C [Data Transfer – send predefined BE packet, Guaranteed Service not supported]

• Test Purpose

Data transmit test with one predefined data packet using BE flow spec and with no Guaranteed Service support on physical link.

• References

[2] Section 5.1
[4] Section 5.4.2

• Initial Condition

The IUT is in the CONNECTED state with a best effort logical link is established, as in Section 4.1.6.2.

• Test Procedure

![Test Diagram]

Note 1: The LLH is that returned when the best effort logical link was created.

The UT sends a HCL Data Packet to IUT with the handle set to the logical link handle of the best effort logical link with the pattern described in [2] 5.1.
Pass Verdict

The IUT initiates an 802.11 RTS/CTS handshake before transferring the data packet.

The data and length received at the LT match the description in [2] 5.1.

The IUT transmits the payload using a 4-addr frame with no QoS Control field.

The IUT transmits the 802.11 data frame prepended with an LLC-SNAP header as described in [2] Section 5.1.

The IUT protects the data frame with the key for the physical link.

4.5.1.2 80211PAL/DA/TX/BV-02-C Data transfer, transmit on guaranteed logical channel, QoS supported.

- Test Purpose
  Verify data transmitted on a guaranteed logical link is transmitted with a correct user priority while a BE link also exists.

- References
  [2] Section 5.1
  [4] Section 5.4.2

- Initial Condition
  A best effort logical link and a guaranteed logical link are created as in Section 4.1.6.2.

- Test Procedure

![Diagram of test procedure]
Note 1: The LLH is that returned when the guaranteed logical link was created.

The UT sends an ACL Data Packet to IUT with the handle set to the logical link handle of the guaranteed logical link.

**Pass Verdict**

The IUT initiates an 802.11 RTS/CTS handshake before transferring the data packet.

The data and length received by the LT matches the format described in [2] 5.5.1.

The IUT transmits the payload using a 4-addr frame containing a QoS Control field. The TID of the QoS Control Field shall be greater than 3, to denote higher quality of service.

The IUT transmits the data frame preceded with LLC-SNAP header as described in [2] Section 5.1.

The IUT protects the data frame with the key for the physical link.

4.5.1.3  80211PAL/DA/TX/BV-03-C [Data transfer, multiple physical link]

- **Test Purpose**
  Verify IUT transmits data to the correct peer when there are multiple physical links.

- **References**
  [2] Section 5.1
  [4] Section 5.4.2

- **Initial Condition**
  Execute preamble specified in 4.1.6.4.

  Best effort logical link shall be created on each of the physical links.
• **Test Procedure**

![Diagram of Test Procedure]

IUT and Lower Tester have two physical links between them. Each physical link has a best effort logical link.

802.11 Data Packet
(4 address qos header, TID>3, 
a1=MA_tester_2  a2=MA_IUT  
a3=MA_tester_2 a4=MA_IUT, AMP_LLC, Data)

802.11 Ack

HCI ACL Data Packet
(LLH2 (note 1), PB=0b11, 
BC=0b00, Length, Data)

Note 1: The LLH_2 is that returned when the best effort logical link was created for the second physical link.

The UT sends a HCL Data Packet to IUT with the handle set to the logical link handle of the best effort logical link for the second physical connection.

• **Expected Outcome**

  **Pass Verdict**

  The data packets are transmitted with the correct destination MAC address.
  
The data and length received the LT match the predefined data frame content in [2] 4.5.1.
  
The IUT transmits the data frame preceded with LLC-SNAP header as described in [2] Section 5.1
  
The IUT protects the data frame with the key for the second physical link.

4.5.1.4  **80211PAL/DA/TX/BI-01-C Data transfer, invalid logical link**

• **Test Purpose**

  Verify IUT drops a packet sent with an invalid logical link handle.

• **References**

  [2] Section 5.1

  [4] Section 5.4.2
• **Initial Condition**

The IUT is in the CONNECTED state with a best effort logical link is established, as in [Section 4.1.6.2](#).

• **Test Procedure**

![Diagram of test procedure](image)

**Note 1:** The LLH is that returned when the best effort logical link was created.

• **Expected Outcome**

**Pass Verdict**

No part of the payload of the second HCI ACL Data packet containing the invalid logical link handle is transmitted over 802.11 AMP data frames to the LT. The following packet containing sent with the "CC⋯C" payload is received by the receiver correctly.

### 4.5.1.5 80211PAL/DA/TX/BV-04-C [Data Transfer, transmit from HT device]

• **Test Purpose**

Verify that an HT-capable IUT transmits data correctly when connected to another HT device.

• **References**

[2] Section 3.3, 3.6, 5.1
Section 5.4.2

• Initial Condition:
The Lower Tester starts an HT Logical Link, using the procedure defined in Section 4.1.6.6.

• Test Procedure

Once the LT and the IUT have successfully established a logical link, the UT sends an ACL Data Packet to IUT with the handle set to the logical link handle of the logical link. The packet should be sent to the LT.

Pass Verdict

All data are sent using IEEE802.11 QoS Data Frames with 4 address fields.

The data and length received by the LT matches the format described in [2], Section 5.5.1.

The IUT transmits the data frame preceded with LLC-SNAP header as described in [2] Section 5.1.

The IUT protects the data frame with the key for the physical link.

• Notes

Other 802.11 MAC frames are sent during the connection process such as RTS/CTS control frames, 802.11 Acknowledgements, and ADDBA Request/ ADDBA Response may be sent after association. These frames are not shown in the MSC above.

4.5.1.6 80211PAL/DA/TX/BV-05-C [Data Transfer transmit from HT device, with 40MHz Channel]

• Test Purpose

Verify that an HT-capable IUT transmits data correctly when associated to another HT device, using 40MHz channel width.

• References

[2] Section 2.16, 3.3, 3.6, 5.1

[4] Section 5.4.2
• Initial Condition

The Lower Tester starts an HT Logical Link, using the procedure defined in Section 4.1.6.6. The EDUTM command is used to cause the IUT to use 40 MHz channel width.

• Test Procedure

![Diagram](image)

Pass Verdict

The data and length received by the LT matches the format described in [2], 5.5.1.

The IUT transmits the payload using a 4-addr frame containing a QoS Control field. The frame is sent using 40 MHz channel width.

The IUT transmits the data frame preceded with LLC-SNAP header as described in [2] Section 5.1.

The IUT protects the data frame with the key for the physical link.

• Notes

Other 802.11 frames may be exchanged, such as ADDBA Request/ ADDBA Response frames

4.5.2 Data Receive Tests

4.5.2.1 80211PAL/DA/RX/BV-01-C [Data transfer, receive predefined best effort packet, Guaranteed Service not supported]

• Test Purpose

Verify IUT receives data and passes it to the HCI interface with the correct physical link handle.

• References

[2], Section 5.1

[4] Section 5.4.2

• Initial Condition

A best effort logical link is established using the preamble in Section 4.1.6.2.
• **Test Procedure**

![Diagram: Test Procedure](image)

- **Expected Outcome**
  
  **Pass Verdict**

  The data and the length received by the UT matches the data and the length transmitted from the LT minus the AMP_LLC plus the HCI header. The link handle in the indicated ACL data frame is the physical link handle created in the preamble.

  **4.5.2.2 80211PAL/DA/RX/BV-02-C [Data transfer, receive guaranteed data, Guaranteed Service supported]**

  - **Test Purpose**
    
    Verify data received on a guaranteed link is received correctly and sent to the HCI of the IUT.

  - **References**
    
    [2] Section 5.1
    
    [4] Section 5.4.2

  - **Initial Condition**

    A guaranteed logical link is established using the preamble in Section 4.1.6.2.
• **Test Procedure**

   The QoS enabled physical channel is in CONNECTED state. The guaranteed logical channel is established.

   802.11 Data Frame
   (4 address header
   a1=MA_IUT a2=MA_tester
   a3=MA_IUT a4=MA_tester , TID > 3
   AMP_LLC, Data)

   HCI ACL Data Packet
   (Handle=PLH, PB=0b11,
   BC=0b00, Length, Data)

• **Expected Outcome**

  **Pass Verdict**

  The data and the length received by the UT matches the data and the length transmitted from the LT. The link handle in the indicated ACL data frame is the physical link handle created in the preamble.

4.5.2.3  **80211PAL/DA/RX/BV-03-C [Data Transfer, best effort data reception, Guaranteed Service supported]**

• **Test Purpose**

  Verify data is received on a best effort logical link when Guaranteed Service Type is supported on link.

• **References**

  [2] Section 5.1

  [4] Section 5.4.2

• **Initial Condition**

  A best effort logical link and a guaranteed logical link are created as according to the preamble in Section 4.1.6.5.
The LT sends a data frame with TID subfield of the QoS Control field of the header to 0 or 3.

- **Expected Outcome**
  - **Pass Verdict**
  
  The data and the length received by the UT matches the data and the length transmitted from the LT.

4.5.2.4 80211PAL/DA/RX/BV-04-C [Date transfer, receive data, multiple physical links]

- **Test Purpose**
  Verify data received on a second physical link is received correctly and sent to the HCI of the IUT with the correct physical link handle.

- **References**
  - [2] Section 5.1
  - [4] Section 5.4.2

- **Initial Condition**
  Two physical links (A and B) are established with the LT with a BE logical link over each physical link, using preamble 4.1.6.4.
Test Procedure

Physical channels A and B are in CONNECTED state.
A single logical channel is established over each physical link.

The LT sends a data frame using its local MAC address for Physical Link 1 and another using its local MAC Address for Physical Link 2.

It is not necessary to monitor or verify 802.11 control frames in this test.

Expected Outcome

Pass Verdict

A data packet is received on with a handle set to PLH1, the data matches that sent by the Lower Tester using its Physical Link 1 MAC address.

A data packet is received on with a handle set to PLH2, the data matches that sent by the Lower Tester using its Physical Link 2 MAC address.

4.5.2.5 80211PAL/DA/RX/BV-05-C [Data Transfer, receive from HT device]

Test Purpose

Verify that an HT-capable IUT receives data and passes it to the HCI interface with the correct physical link handle when associated to another HT device.

References

[2] Section 3.3, 3.6, 5.1
[4] Section 5.4.2

Initial Condition

The LT starts a logical link, using the procedure defined in Section 4.1.6.6.
• **Test Procedure**

Once the Lower tester and the IUT have successfully established a logical link, the LT sends a QoS Data frame.

**Pass Verdict**

All data are sent using IEEE802.11 QoS Data Frames with 4 address fields.

The data and the length received by the UT matches the data and the length transmitted from the LT minus the AMP_LLc plus the HCI header. The link handle in the indicated ACL data frame is the physical link handle created in the preamble.

4.5.2.6 80211PAL/DA/RX/BV-06-C [Data Transfer, receive from HT device, using 40MHz Channel]

• **Test Purpose**

Verify that an HT-capable IUT receives data correctly and passes it to the HCI interface with the correct physical link handle when associated to another HT device, using 40MHz channel.

• **References**

[2] Section 2.16, Section 3.3, Section 3.6, Section 5.1

[4] Section 5.4.2

• **Initial Condition**

The LT starts a logical link, using the procedure defined in Section 4.1.6.6 with the 40 MHz option. The LT advertises its channel width capability (20/40 MHz) in the Supported Channel Width subfield of the HT Capabilities element, and its PCLv2 shall contain only 40 MHz channels.
• Test Procedure

Once the Lower tester and the IUT have successfully established a logical link, the LT sends a QoS Data frame, using a 40MHz Channel.

Pass Verdict

The data and the length received by the UT matches the data and the length transmitted from the LT minus the AMP_LL plus the HCI header. The link handle in the indicated ACL data frame is the physical link handle created in the preamble.

4.5.3 Data Buffer Management Tests

4.5.3.1 80211PAL/DA/BU/BV-01-C [Data Transfer, Data Flush]

• Test Purpose
  Verify flush command accepted.

• References
  [2] Section 5.3
  [4] Section 7.3.66

• Initial Condition
  A Physical and best effort logical link is created using the preamble specified in 4.1.6.2. The Lower tester is prevented from transmitting 802.11 ACKs.
The physical channel is in CONNECTED state.
A logical channel is established.

1s

Enable Acks

The UT sends two data packets.

The UT sends the HCI flush command immediately

After a delay of 1 second the LT enables MAC Acks.

**Expected Outcome**

**Pass Verdict**

The IUT may send an HCI Data Flush Event to the UT before it sends the command status.

The IUT generates a HCI Command status event with status of 0 (pending) followed by two minus the number of flush events received before the HCI Command Status HCI Flush Occurred Events to the UT or 802.11 data PDUs to the LT in any combination.

The IUT transmits an HCI Enhanced Flush Complete event to the UT.

No 802.11 data PDUs are transmitted on the media after the HCI Enhanced Flush Complete event is sent.
• Notes
Both ACL Data packets may get dropped before the HCI Enhanced Flush Command is received by the IUT. In this case, no Flush Occurred event is indicated.

4.5.3.2 80211PAL/DA/BU/BV-02-C [Flush Timeout]

• Test Purpose
Verify transmit packet discarded after flush timeout expiry.

• References
[2] Section 5.4
[4] Section 6.18

• Initial Condition
A guaranteed logical link is established using the preamble specified in 4.1.6.2.

• Test Procedure

The LT is configured to disable its ability to transmit 802.11 Ack control frames.

The UT sends a HCI ACL data packet to IUT.

• Expected Outcome
Pass Verdict

An HCI flush occurred event is received

The Data packet is not sent to LT

• Notes
The time before the HCI Flush Occurred event is indicated will vary according to the configuration of the 802.11 MAC.
4.5.3.3 80211PAL/DA/BU/BV-03-C [Read Data Block Size Command]

- **Test Purpose**
  Verify that the Read Data Block Size command returns the block size and that when data is transferred the 'number of completed packets' and 'number of completed blocks' fields of the HCI Number Of Completed Data Blocks Events account for each competed packet.

- **Reference**
  [4] Section 7.4.7

- **Initial Condition**
  Physical and best effort logical link have been set up using the preamble specified in Section 4.1.6.2.

- **Test Procedure**

  ![Diagram of test procedure]

- **Expected Outcome**

  **Pass Verdict**

  The sum of the values in `Num_Of_Completed_Packets` field of the HCI Number of Completed Data Blocks Events sent to the UT from the IUT is 2.

  The sum of the values in `Num_Of_Completed_Packets` field of the HCI Number of Completed Data Blocks Events sent to the UT from the IUT is 2.
4.5.4 Other

4.5.4.1 80211PAL/OT/AR/BV-01-C [Receive traffic report]

- Test Purpose
  Verify that the IUT accepts Activity Report with Schedule Known set to 0x0 and enables RTS/CTS.

- Reference
  [2] Section 5.2.3

- Initial Condition
  The IUT has completed the procedure in Section 4.1.6.2.

- Test Procedure

  **Pass Verdict**
  
  IUT receives activity report.
  
  UT sends ACL Data frame to IUT.
  
  IUT transmits 802.11 frames with RTS/CTS signaling.
4.5.4.2 80211PAL/OT/AR/BV-02-C [Schedule using Activity Report]

- **Test Purpose**
  Verify schedule of interference in Activity Report is used appropriately.

- **Reference**
  [2] Section 5.2.3

- **Initial Condition**
  The IUT has completed the procedure in Section 4.1.6.2 to create a BE logical link.

- **Test Procedure**

  ![Diagram of test procedure](#)
The AR used in this test contains 1 triplet with the following values:

Start_time = Current value of the TSF timer at the LT.

AR_DURATION = 20 ms

AR_PERIOD = 50 ms

HCI ACL Data Packets are sent to the IUT at a rate greater than AR_DURATION/2. The test shall be run for at least 10 times AR_PERIOD. The number of ACL data frames sent to the IUT in the test is not important. The same number of packets shall be received at the LT.

The 802.11 traffic shall be monitored by a sniffer with a good timing precision. The offset from the Lower Testers TSF timer and the sniffers timer shall be used to calculate the transmission time of the 802.11 data frames from the IUT in terms of the TSF in the LT. This offset may be calculated by the difference between the timestamp on captured beacons from the LT and the TSF value contained therein.

• Expected Outcome
  
  Pass Verdict

  No packets shall be transmitted by the IUT whilst the blackout timer is running on the LT.

4.5.4.3 80211PAL/OT/SRM/BV-01-C [Short Range Mode]

• Test Purpose
  
  Verify that the IUT accepts Short Range Mode command from the host.

• Reference
  
  None

• Initial Condition
  
  Physical Link Initiated by IUT preamble (see section 4.1.6.2).
• **Test Procedure**

![Diagram of test procedure]

- **Lower Tester**
- **IUT**
- **Upper Tester**

- IUT and Lower Tester are beaconing because of preexisting physical link. A BE logical link has been setup on the physical link, AR reports schedule unknown.

  - **HCI_Short_Range_Mode_Command**
    - (Physical Link Handle, Short Range Mode = 0x1)
  - **HCI_Command_Status_Event**
    - (Num HCI Comm, ComOpcode=0x0C6B, Status=0x00)
  - **PHY output power set to <=4dBm**
  - **HCl_Short_Range_Mode_Change_Complete_Event**
    - (PLH, Short Range State=1, Status=0x00)
  - **AMP HCI ACL Data Packet**
    - (Logical Link Handle, PB=0b11, BC=0x0, LEN = Len1 (Len1 <= MAX_PDU_SIZE), Data)
  - **RTS**
  - **CTS**
  - **Data**

• **Expected Outcome**

**Pass Verdict**

Verify if the UT receives both an HCI_Command_Status_Event and a Short_Range_Mode_Change_Complete_Event in response to the HCI Short Range Mode command.

The IUT transmits OFDM data packets with transmit power less than or equal to +4dBm.

• **Notes**

- It is possible that the IUT may transmit only frames with non OFDM modulation.
5 Test Case Mapping

The Test Case Mapping Table (TCMT) maps test cases to specific capabilities in the ICS. Profiles, protocols and services may define multiple roles, and it is possible that a product may implement more than one role. The product shall be tested in all roles for which support is declared in the ICS document. The columns for the TCMT are defined as follows:

**Item:** contains an y/x reference, where y corresponds to the table number and x corresponds to the feature number as defined in the ICS Proforma for 802.11 PAL [3]. If the item is defined with Protocol, Profile or Service abbreviation before y/x, the table and feature number referenced are defined in the abbreviated ICS proforma document.

**Feature:** recommended to be the primary feature defined in the ICS being tested or may be the test case name.

**Test Case(s):** the applicable test case identifiers required for Bluetooth Qualification if the corresponding y/x references defined in the Item column are supported.

For purpose and structure of the ICS/IXIT proforma and instructions for completing the ICS/IXIT proforma refer to the Bluetooth ICS and IXIT proforma document.

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*Table 5.1: Test Case Mapping*
## 6 Revision History and Contributors

### Revision History

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<td>TSE 3249: TP/PL/PLC/BV-02-C: MSC: change Probe Request from IUT to Tester. TSE 3254: Add note to TSE DA/TX/BI-01-C TSE 3255: TP/DA/TX/BV-01-C: Correct referenced document sections. TSE 4080: TCMT: correct duplicate TP/PL/PLC/BV-02-C</td>
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<td>2011-01-25-2011-12-15</td>
<td>Input reviewer comments: TSE 3348 TP/PI/Al/BV-01-C: Pass Verdict TSE 3349 TP/PL/PLC/BI-01-C: Pass Verdict Added support for HT tests. Added such tests to TCMT section. Corrected address fields in several MSCs. Added iteration loop to several MSCs for reading AMP ASSOCs. Removed Device in Tester from all MSCs. Corrected references to preambles. Used uniform language in the HT test descriptions. Split out a category of tests in TCMT according to if they use Guaranteed links or not. Removed HT Operation element from association request whether or not the responder uses HT. Added checks for prohibited features in TP/PL/PLC/BV-0{6,8}-C. Updated TCMT to match ICS.r06. Changed Pass Verdict in test cases using Accept Physical Link to remove requirement to use HCI Channel Selected event since it is in fact prohibited in that scenario. Discussed in TSE 2956. Removed TP/PL/PLC/BV-12-C since TP/PL/PLC/BV-11-C already results in the same Pass Criteria. Corrected reference to ICS in TP/DA/TX/BV-03-C per comment from BTI.</td>
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<td>p11r00</td>
<td>2019-11-27</td>
<td>Updated document naming convention and template items, moving Revision History and Contributors tables to the bottom of the document, updating Disclaimer text and Confidentiality markings to align with latest Documentation Marking Requirements, and making minor editorial fixes.</td>
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**Contributors**

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<tr>
<td>Chris Hansen</td>
<td>Broadcom</td>
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<tr>
<td>Raymond Hayes</td>
<td>Broadcom</td>
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<tr>
<td>Francoise Bannister</td>
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<td>Ana Donezar Ibanez</td>
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<td>Kevin Hayes (technical editor)</td>
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