Baseband (BB)

***Bluetooth*® Test Suite**

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Contents

1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and Test Cases (TC) to test the Bluetooth Baseband layer. The objective of this Test Suite is to provide a basis for interoperability for Bluetooth devices giving a high probability of air interface interoperability between different manufacturers' Bluetooth devices. The general concepts and conformance testing principles as defined in ISO/IEC 9646-1 and OSI Conformance Testing Methodology and Framework (CTMF) are used as a basis for the testing of Bluetooth protocol and profile implementation.

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 given in [1] and [8] apply.

[1] Specification of the Bluetooth System, Core System Package, Volume 2, Part B, Baseband (BB)

[2] ISO/IEC 9646-1: “Conformance testing methodology and framework / General Concepts”

[3] ISO/IEC 9646-2: "Conformance testing methodology and framework / Abstract Test Suite specification"

[4] ETSI ETR 266: "Methods for Testing and Specification (MTS); Test Purpose style guide", http://www.etsi.org

[5] Specification of the Bluetooth System, Core System Package, Volume 2, Part A, Radio Frequency (RF)

[6] ICS Proforma for Baseband (BB)

[7] Specification of the Bluetooth System, Core System Package, Volume 3, Part D, Test Support

[8] Bluetooth Test Strategy and Terminology Overview

[9] Core Specification Addendum 4 (CSA4), Vol. 2 Part B

[10] Specification of the Bluetooth System, Core System Package, Volume 2, Part C Link Manager Protocol (LMP)

[11] Specification of the Bluetooth System, Core System Package, Volume 2, Part E (versions 1.2 to 5.1) or Volume 4, Part E (version 5.2 and higher) Host Controller Interface (HCI)

[12] Specification of the Bluetooth System, Core System Package, Volume 2, Part H Security

[13] Specification of the Bluetooth System, Core System Package, Volume 2, Part B, Baseband (BB) Version 4.1 or later

[14] Profile Implementation eXtra Information for Test (IXIT) for the Core Specification

[15] Specification of the Bluetooth System, Core System Package, Volume 3, Part A, Logical Link Control and Adaptation Protocol Specification

3 Test Suite Structure (TSS)

3.1 Test Strategy

The Baseband is layer 2 of the Bluetooth BR/EDR protocol stack.

Figure 3.1 shows the basic layers of the Bluetooth BR/EDR stack.

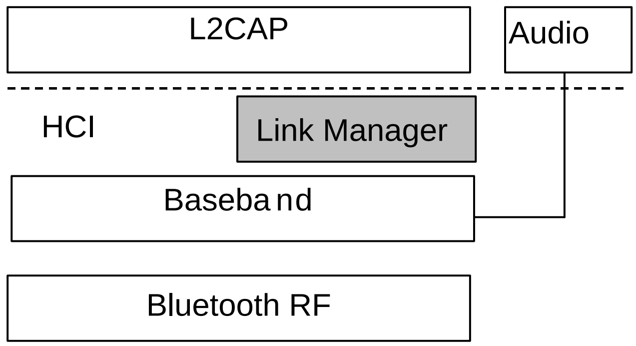

Figure 3.1: Bluetooth BR/EDR protocol stack, Basic Layers

The test suite structure is structured as a tree with the first level defined as BB representing the protocol group “BB for Master and Slave.”

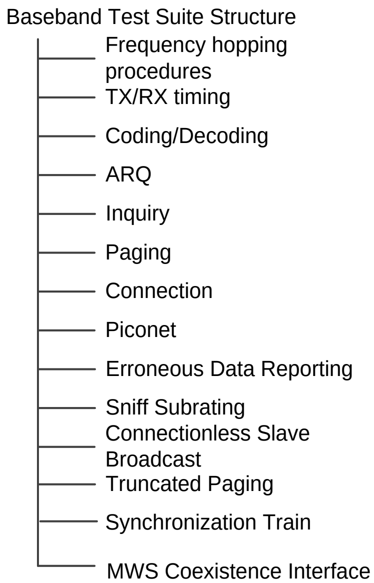

Figure 3.2: Test suite structure for the Baseband part

3.2 Test Groups

The test groups are organized in 3 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 BV.

3.2.1 Protocol Groups

The protocol groups identify the Bluetooth Baseband services: Frequency Hopping, TX/RX Timing, Coding/Decoding, Automatic Repeat Request, Inquiry, Paging, Connection, Erroneous Data Reporting, Sniff Subrating, Piconet, and Coarse Clock Adjustment defined in [5].

3.2.1.1 Frequency Hopping/Signaling

With the functional module:

- Frequency Hopping

3.2.1.2 TX/RX Timing

With the functional module:

- TX Timing
- RX Timing

3.2.1.3 Coding/Decoding

With the functional modules:

- Packet Types
- FEC (R=1/3)
- FEC (R=2/3)

3.2.1.4 Automatic Repeat Request

With the functional modules:

- ARQ Procedures - Master
- ARQ Procedures - Slave
- ARQ Procedures - Flush

3.2.1.5 Inquiry

With the functional modules:

- Inquiry Procedures - Master
- Inquiry Procedures - Slave

3.2.1.6 Paging

With the functional modules:

- Paging Procedures - Master
- Paging Procedures - Slave

3.2.1.7 Connection

With the functional modules:

- Connection - Master
- Connection - Slave

3.2.1.8 Piconet

With the functional modules:

- Piconet - Master
- Piconet - Slave

3.2.1.9 Erroneous Data Reporting

With the functional modules:

- Erroneous Data Reporting – SCO
- Erroneous Data Reporting – eSCO

3.2.1.10 Sniff Subrating

The Sniff Subrating module verifies that the IUT correctly handles Sniff subrating both as Master and as Slave.

3.2.1.11 Connectionless Slave Broadcast

With the functional modules:

- Connectionless Slave Broadcast – Transmitter
- Connectionless Slave Broadcast – Receiver

3.2.1.12 Truncated Paging

With the functional modules:

- Truncated Paging – Master
- Truncated Paging – Slave

3.2.1.13 Synchronization Train

With the functional modules:

- Synchronization Train – Transmitter
- Synchronization Train – Receiver

3.2.1.14 Piconet Clock Adjust

With the functional modules:

- Coarse Clock Adjustment – Master
- Coarse Clock Adjustment – Slave

3.2.2 Behavior Testing Groups

The main test groups are valid behavior group and the invalid behavior group.

3.2.2.1 Valid Behavior (BV) Tests

This sub group provides testing to verify that the IUT reacts in conformity with the dynamic conformance requirements of the Bluetooth standard, after receipt or exchange of a valid Protocol Data Units (PDUs). Valid PDUs means 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 dynamic conformance requirements of the Bluetooth standard, after receipt of a syntactically or semantically invalid PDU.

4 Test Cases

4.1 Test Case Identification Conventions

Test cases shall be assigned unique identifiers per the conventions in [8]. 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.

Identifier Abbreviation	**Spec Identifier <spec abbreviation>**
BB	Baseband
Identifier Abbreviation	**Class Identifier <class>**
PHYS	Physical Test for formal testing
PROT	Protocol test for formal testing
Identifier Abbreviation	**Feature Identifier <feat>**
FRE	Frequency Hopping
TRX	TX/RX Timing
COD	Coding/Decoding
ARQ	Automatic Repeat Request
INQ	Inquiry
PAG	Paging
CON	Connection
PIC	Piconet
ED	Erroneous Data Reporting
SSR	Sniff Subrating
CSB	Connectionless Slave Broadcast
TP	Truncated Paging
ST	Synchronization Train
XCB	Coexistence Piconet Clock Adjustment

Table 4.1: TC Naming Conventions for BB

4.2 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.

4.3 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.

4.4 General Test Conditions

For the purpose of the test procedures defined in this Bluetooth document it is assumed that propagation delay on the air interface and runtime of the Lower Tester and of the IUT can be neglected.

The test purposes defined in this Test Suite represent only the behavior that is important to create the final verdict. Additional behavior that provides BB and LM is not presented. For example, the Master polls the Slave in order to synchronize the Slave to the channel. Further LM has 30s of time to response to LMP requests, between this 30s a possible behavior is not stated in the test procedure of the test purposes.

For the definition of Nominal Test Conditions and Extreme Test Conditions, see Sections 5.1 and 5.2 of [5]. Unless otherwise specified, tests shall be performed under normal conditions.

4.4.1 Lower Layer Assumptions

For conformance testing of the Baseband layer it is necessary to have working lower layers in conformance with the lower layer Test Suite.

4.4.2 Upper Layer Assumptions

For conformance testing of the Baseband layer it is necessary to have a Test Control Interface as described in [5]. HCI commands can be sent and HCI events can be received via this TCI to stimulate the IUT respectively to get information from the IUT. This interface builds the UT.

4.4.3 Implicit Testing

For some subjects to be validated, conformance is not verified explicitly. This does not imply that correct functioning of these subjects is not essential, but that these are implicitly tested to a sufficient degree in other tests.

For example tests relating to Data Whitening are implicitly covered by other test cases.

4.4.4 Advertisement of Features for Test Cases

It is favorable to avoid LMP traffic that could create situations in which a test case is not designed to be executed or which may add complexity to the test system implementation. This can be achieved by proper selection of which features are advertised by the Lower Tester. In some test cases this is exactly specified in the test suite but in most cases it is not. As a general rule, for each test case the Lower Tester should not advertise more features than necessary to facilitate execution of the test purpose. Specifically, with the introduction of Enhanced Data Rate, this feature shall only be advertised by the Lower Tester in those test cases where it is necessary for the test purpose.

4.4.5 Default External Frame Configuration

The following MSC is used by test equipment in achieving initial conditions or test procedures in certain tests.

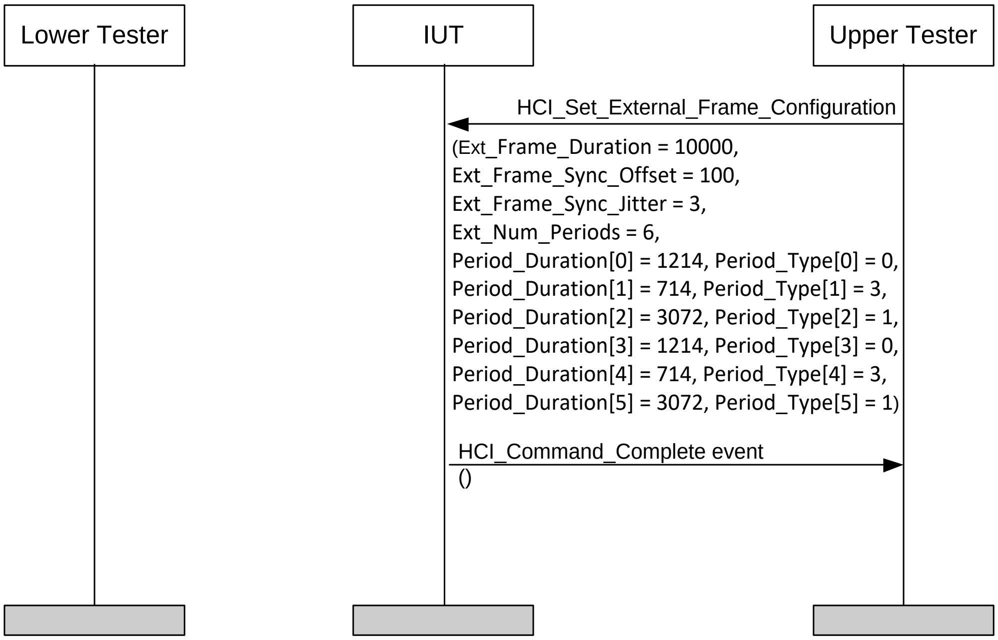

Figure 4.1: Default External Frame Configuration

4.5 Frequency Hopping

Test subgroup objectives:

Verify the frequency hopping procedure.

4.5.1 BB/PHYS/FRE/BV-01-C [79 Channel Hop Seq]

- Test Purpose

  Verify that the hopping sequences in connection state are correct for the 79 channel hopping scheme.

- Reference

  [1] 2.2.2

- Initial Condition

  The Lower Tester pages the IUT to become the Master.

  The Lower Tester and IUT are in normal connection state. The Bluetooth clock of the Lower Tester is chosen to include clock wrap-around (2^{27}-1 to 0) during the Test Procedure.

- Test Procedure

  a) The Lower Tester transmits POLL packets in all Master-to-Slave slots. To verify the sequence for every 32-hop-segment, 2600 packets are checked.
  b) The Lower Tester records the clock values for which a response from the IUT is received. It is not necessary to check the content of the ACK packets sent by the IUT. Every signal sent back in the correct slot is taken as a criterion that the correct hop frequency was used.
  c) The Bluetooth clock of the Lower Tester is reinitialized to the value used in the Initial Conditions. The IUT is paged again and test steps a)–b) are repeated.
  d) Step c) is repeated so that the same clock values are tested three times in total.

e) The Bluetooth clock of the Lower Tester is initialized to a value randomly chosen such that the new clock value range used does not overlap with the previous range in the Initial Conditions.
f) A new page procedure is performed and steps a)–d) are repeated.

- Expected Outcome

  Pass Verdict

  For each of the 5200 clock values the Lower Tester has recorded at least one response.

- Notes

  A standardized cable interface can be used for the Baseband connection.

  If the IUT responds with an LMP command the Lower Tester uses its own LMP response as a trigger packet.

  In steps c) and d) of the Test Procedure, the test is repeated with the same Bluetooth clock to detect any systematical errors.

4.5.2 BB/PHYS/FRE/BV-02-C [AFH Hop Seq]

- Test Purpose

  Verify that the Slave correctly implements the AFH hopping sequence for the following cases: 79 channel AFH, even channels bad, odd channels bad, and three “random” cases where one tests the minimum number of channels (20). IUT is Slave and Lower Tester is Master.

- Reference

  [1] 2.3

- Initial Condition

  The Lower Tester pages the IUT to become the Master.

  The Lower Tester and IUT are in normal connection state.

  Adaptive frequency hopping is enabled by the Lower Tester using all channels: AHS(79).

  The Bluetooth clock of the Master is chosen to include clock wrap-around (2^{27} – 1 to 0) during the Test Procedure.

- Test Procedure

  a) The Lower Tester transmits POLL packets in all Master-to-Slave slots. To verify the sequence for every 32-hop-segment, 2600 packets are checked.
  b) The Lower Tester records the clock values for which a response from the IUT is received. It is not necessary to check the content of the ACK packets sent by the IUT. Every signal sent back in the correct slot is taken as a criterion that the correct hop frequency was used.
  c) The Bluetooth clock of the Lower Tester is reinitialized to the value used in the Initial Conditions. The IUT is paged again and test steps a) and b) are repeated again.
  d) Step c) is repeated so that the same clock values are used three times in total.
  e) The Bluetooth clock of the Lower Tester is initialized to a value randomly chosen such that the new clock range used does not overlap with the previous range in the Initial Conditions.

f) A new page procedure is performed and steps a)–d) are repeated.
g) The Bluetooth clock of the Master is re-initialized to include clock wrap-around (2^{27} – 1 to 0) during the Test Procedure.
h) The Lower Tester changes the set of used channels to all odd channels and repeats steps a)–f).
i) The Bluetooth clock of the Master is re-initialized to include clock wrap-around (2^{27} – 1 to 0) during the Test Procedure.
j) The Lower Tester changes the set of used channels to all even channels and repeats steps a)–f).
k) The Bluetooth clock of the Master is re-initialized to include clock wrap-around (2^{27} – 1 to 0) during the Test Procedure.
l) The Lower Tester changes the set of used channels to a random set of channels with at least 20 used and repeats steps a)–f).
m) The Bluetooth clock of the Master is re-initialized to include clock wrap-around (2^{27} – 1 to 0) during the Test Procedure.
n) The Lower Tester changes the set of used channels to a second random set of channels with at least 20 used and repeats steps a)–f).
o) The Bluetooth clock of the Master is re-initialized to include clock wrap-around (2^{27} – 1 to 0) during the Test Procedure.
p) The Lower Tester changes the set of used channels to a third random set of channels with at least 20 used and repeats steps a)–f).

- Expected Outcome

  Pass Verdict

  For each hop set, the Lower Tester has recorded at least one response on each of the 5200 clock values.

- Notes

  A standardized cable interface can be used for the Baseband connection.

  If the IUT responds with an LMP command the Lower Tester uses its own LMP response as a trigger packet.

  In steps c) and d) of the Test Procedure, the test is repeated with the same Bluetooth clock to detect systematic errors.

4.5.3 BB/PHYS/FRE/BV-03-C [AFH Hop Seq after Master Slave Switch]

- Test Purpose

  Verify that the IUT correctly disables AFH after a successful Master Slave switch. IUT is Master and Lower Tester is Slave.

- Reference

  [1] 8.6.5

- Initial Condition

  a) The IUT pages the Lower Tester to become the Master.
  b) The Lower Tester and IUT are in normal connection state.
  c) Adaptive frequency hopping is enabled by the IUT using any channel map.

- Test Procedure

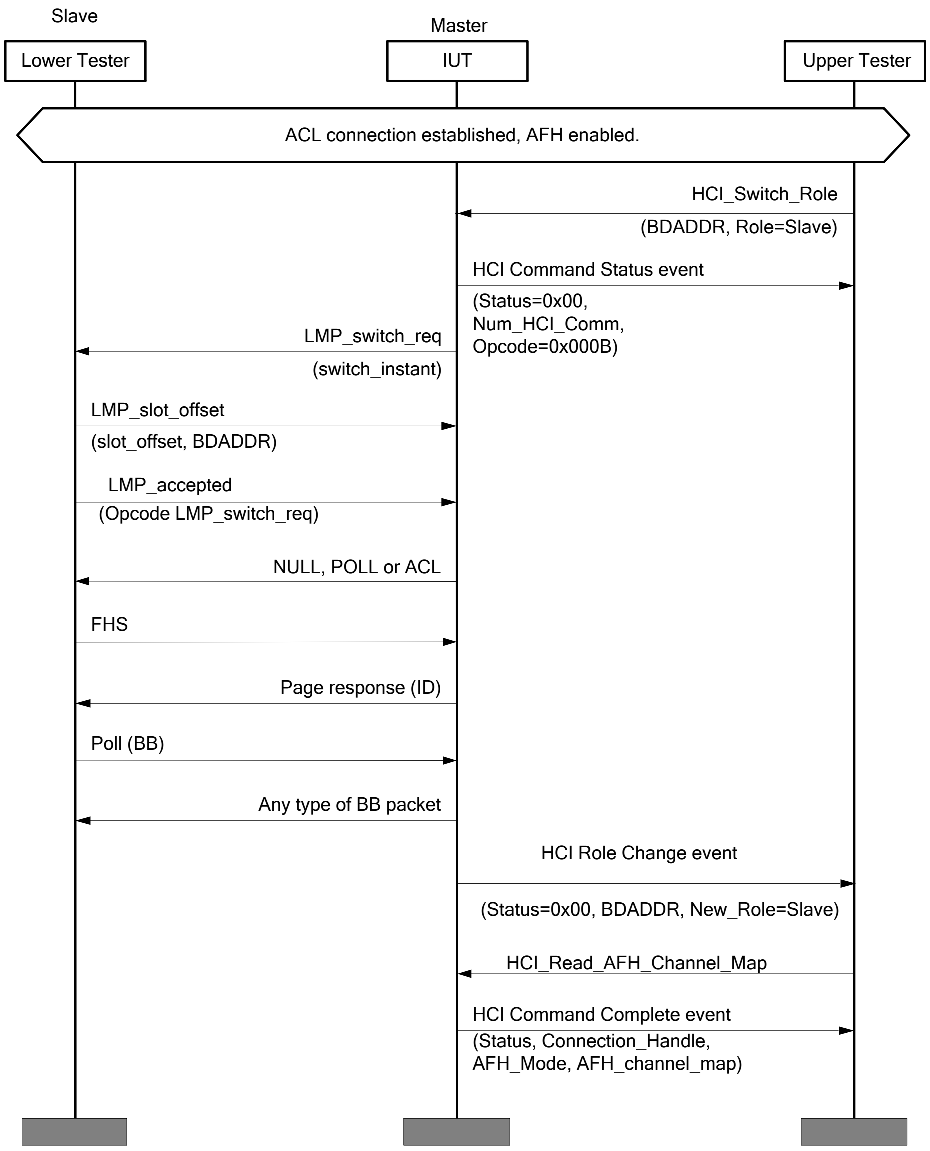

Figure 4.2: BB/PHYS/FRE/BV-03-C (AFH Hop Seq after Master Slave Switch)

a) The Upper Tester initiates a role switch.
b) Upon successful completion of the role switch the Upper Tester reads the channel map of the IUT using HCI.
c) The Lower Tester sends 10 POLL packets and checks that the IUT replies each packet correctly. In this way is tested that AFH mode is disabled.

- Expected Outcome

<u>Pass Verdict</u>

The AFH Mode parameter in the HCI Command Complete Event is set to 0x00 (AFH disabled).

- Notes

A standardized cable interface can be used for the Baseband connection.

4.6 TX/RX Timing

Test group objectives:

Verify the TX and RX timing.

4.6.1 TX Timing

Test subgroup objectives:

Verify the TX timing.

4.6.1.1 BB/PHYS/TRX/BV-01-C [Master TX Timing]

- Test Purpose

  Verify that the IUT as Master keeps an exact timing interval of M x 1250 µs during the existence of a piconet.

- Reference

  [1] 2.2.5

- Initial Condition

  a) The IUT pages the Lower Tester to become the Master of the piconet.
  b) IUT and Lower Tester are in connection state.
  c) Lower Tester uses *LMP_quality_of_service_req* to negotiate the maximum poll interval accepted by the Master.

- Test Procedure

  a) The Lower Tester identifies the Position of Bit p0 in the Access Code of a Poll packet sent by the Master and sets a timestamp. As clock reference the Lower Tester reference is used instead of the Bluetooth clock.
  b) Timing drift is measured by setting a timestamp upon reception of a Poll packet, counting 5000 Master slots and setting a second timestamp upon reception of the next Poll packet sent by the Master.
  c) Steps a) and b) are repeated 4 times. The overall drift is calculated as the average of the 5 measurement values.

- Expected Outcome

  Pass Verdict

  The measured timing drift t_{drift} of the IUT over 5000 slots is ≤ 125 µs.

- Notes

  In step c) of the Initial Conditions, the maximum accepted POLL interval is negotiated to allow the IUT to use a low power mode.

4.6.2 RX Timing

Test subgroup objectives:

Verify the RX timing.

Verify the timing and correctness of the guard time, synchronization sequence, and trailer symbols that are transmitted in Enhanced Data Rate packets.

4.6.2.1 BB/PHYS/TRX/BV-03-C [Master RX/TX Timing]

- Test Purpose

  Verify that the Master's RX timing is based on its TX timing with a shift of 625 µs. Verify that the Master uses a ±10 µs uncertainty window in the RX slot to allow for Slave misalignments.

- Reference

  [1] 2.2.5

- Initial Condition

  a) The IUT pages the Lower Tester to become the Master of the piconet.
  b) IUT and Lower Tester are in connection state.
  c) The Lower Tester uses *LMP_quality_of_service_req* to negotiate the minimum poll interval accepted by the Master.

- Test Procedure

  a) The Lower Tester transmits a DM1 packet with a payload header indicating zero length L2CAP continuation fragment in every Slave TX slot following a Master to Slave transmission.
  b) The Lower Tester's TX timing is varied from the nominal 625 µs Slave RX/TX timing. Variation values are 0 and ±9.5 µs with equal probability.
  c) The start of the IUT's TX burst is identified in the tester by setting a timestamp at bit position p0. The Lower Tester uses the burst received from the IUT as reference to calculate the variation for the next test TX burst.
  d) The number of ACKs returned by the IUT for at least 1000 transmitted test burst is counted.

- Expected Outcome

  <u>Pass Verdict</u>

  The measured ratio of returned ACKs to transmitted test packets is ≤ 0.95.

- Notes

  The test requirement of 95 percent returned ACKs is to take into account the imperfect radio path but not to allow any errors due to the size of the IUT’s RX detection window width. It also requires the Lower Tester’s TX jitter to be less than ±0.5 µs.

4.6.2.2 BB/PHYS/TRX/BV-04-C [Slave RX/TX Timing]

- Test Purpose

  Verify that the Slave's transmission starts N x 625 µs after receiving a burst.

  Verify the Slave’s RX detection window width and turn around timing jitter.

- Reference

  [1] 2.2.5

- Initial Condition

  a) The Lower Tester pages the IUT to become the Master of the piconet.
  b) IUT and Lower Tester are in connection state.

- Test Procedure

  a) The Lower Tester transmits DM1 packets with a payload header indicating zero length L2CAP continuation fragments in all Master TX slots.
  b) The IUT's estimate of the Lower Tester's timing is varied by adding a variation to the nominal 1250 µs test TX timing. Variation values are 0 ±4 and ±8 µs in the following repeating sequence (referenced to the nominal Master transmit timing): 0, 0, +4, 0, +8, 0, +4, 0, 0, 0, 0, –4, 0, -8, 0, –4, 0, 0.
  c) The start of the Slave's TX burst is identified in the tester by setting a timestamp at bit position p0.
  d) The Slave's RX / TX timing is calculated by comparing the start of the Slave's TX burst to the start of the test TX burst.
  e) The number of bursts returned by the Slave for at least 1000 transmitted Master bursts is counted.

- Expected Outcome

  Pass Verdict

  The measured ratio of returned IUT TX bursts to transmitted test bursts is ≥ 0.95.

  The measured time between the test TX bursts and IUT's TX bursts is 625 ±3 µs for all bursts received by the Lower Tester.

- Notes

  The test requirement of 95 percent returned burst is to take into account the imperfect radio path but not to allow any errors due to the size of the IUT's RX detection window width. The ±3 µs allowance is to cope with jitter and measurement uncertainties in both test equipment and IUT.

4.7 Coding/Decoding

Test group objectives:

Verify that correct coding and decoding is used.

4.7.1 Packet Types

Test subgroup objectives:

Verify that the different packet types are correctly coded and decoded.

Because it can be assumed that coding and decoding is independent of the role of the IUT this test subgroup are only specified for IUT configured as Slave in Test Mode (Loopback). Besides, tests relating to coding and decoding of packets in case of IUT configured as Master is implicitly covered by other test cases.

4.7.1.1 BB/PROT/COD/BV-01-C [HV1 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a HV1 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.2.1

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, Synchronous packets) active.

- Test Procedure

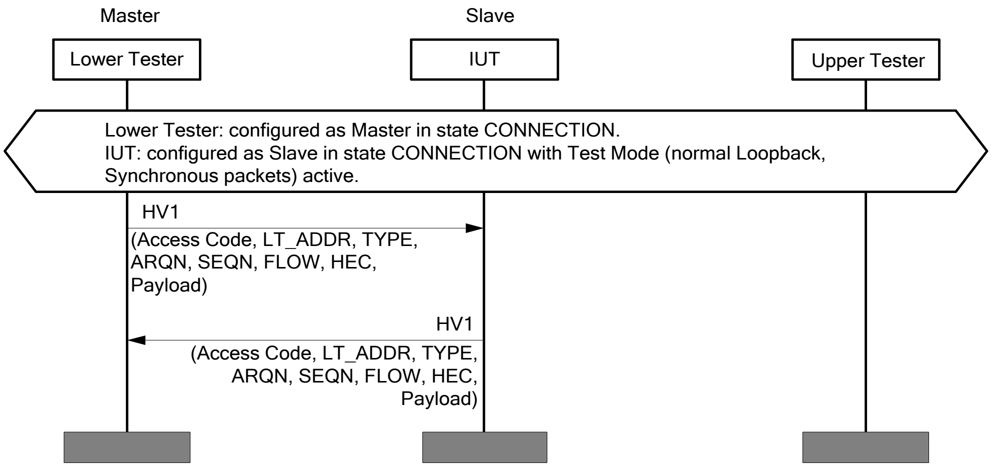

Figure 4.3: BB/PROT/COD/BV-01-C (HV1 packet type)

The Lower Tester transmits a HV1 packet.

<u>HV1</u>

Access Code:

> Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.
>
> Sync word: derived from the 24 bit address (LAP) of the Master (CAC).
>
> Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

> *LT_ADDR*: Logical Transport Address of the Slave.
>
> TYPE: '0101'B.
>
> FLOW: Any value.
>
> ARQN: Any value.

SEQN: Any value.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload: 10 Bytes PRBS.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is protected by FEC 1/3 but is not CRC coded.

4.7.1.2 BB/PROT/COD/BV-02-C [HV2 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a HV2 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.2.2

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, Synchronous packets) active.

- Test Procedure

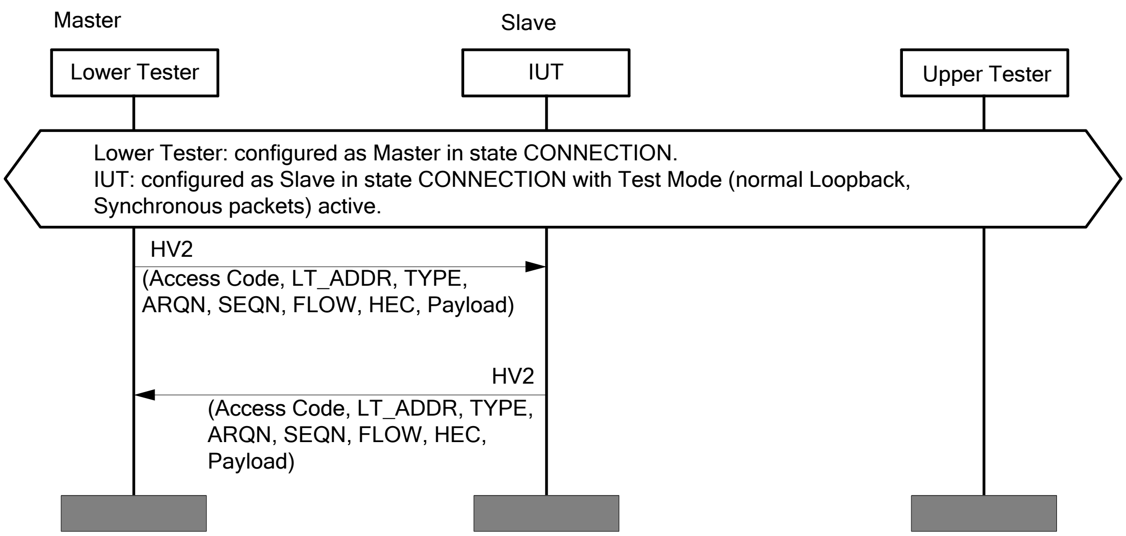

Figure 4.4: BB/PROT/COD/BV-02-C (HV2 packet type)

The Lower Tester transmits a HV2 packet.

HV2

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0110'B.

FLOW: Any value.

ARQN: Any value.

SEQN: Any value.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload: 20 Bytes PRBS.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is protected by FEC 2/3 but is not CRC coded.

4.7.1.3 BB/PROT/COD/BV-03-C [HV3 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a HV3 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.2.3

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, Synchronous packets) active.

- Test Procedure

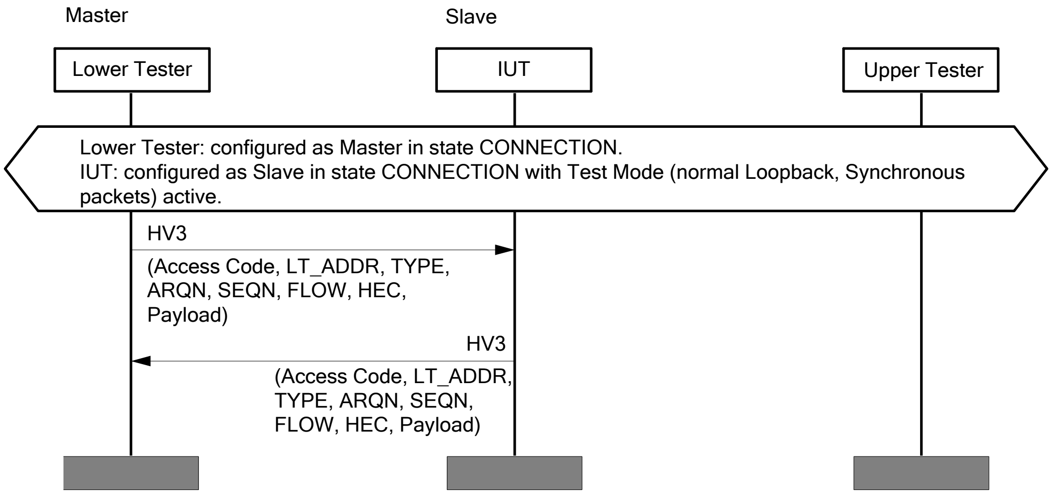

Figure 4.5: BB/PROT/COD/BV-03-C (HV3 packet type)

The Lower Tester transmits a HV3 packet.

<u>HV3</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave

TYPE: '0111'B.

FLOW: Any value.

ARQN: Any value.

SEQN: Any value.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload: 30 Bytes PRBS.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC and is not CRC coded.

4.7.1.4 BB/PROT/COD/BV-04-C [DV Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a DV packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.2.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, Synchronous packets) active.

- Test Procedure

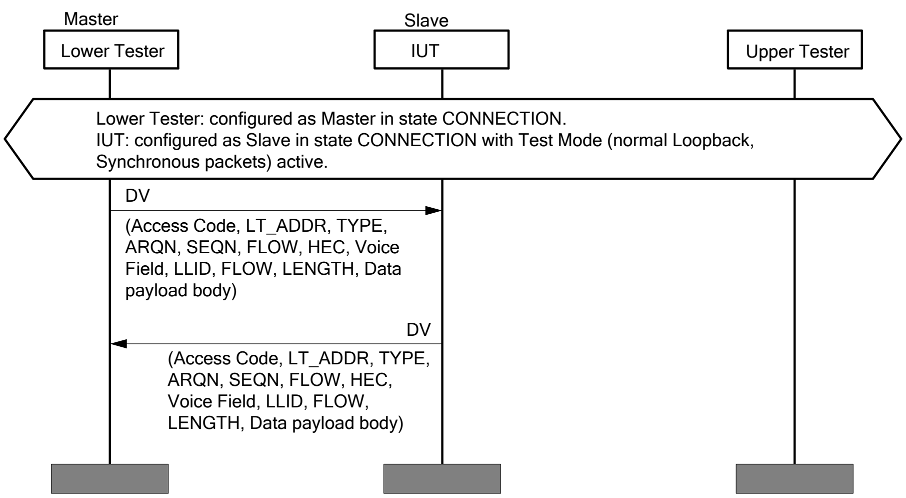

Figure 4.6: BB/PROT/COD/BV-04-C (DV packet type)

The Lower Tester transmits a DV packet.

DV

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave

TYPE: '1000'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Voice Field: 10 Bytes PRBS.

Data payload header:

LLID: '10'B.

FLOW: '1'B.

LENGTH: '01001'B = '9'D.

Data payload body: 9 Bytes PRBS plus 16 bit CRC.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The voice payload is not protected by FEC. The data payload is protected with FEC 2/3 and is CRC coded.

4.7.1.5 BB/PROT/COD/BV-05-C [DH1 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a DH1 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.2

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, ACL packets) active.

- Test Procedure

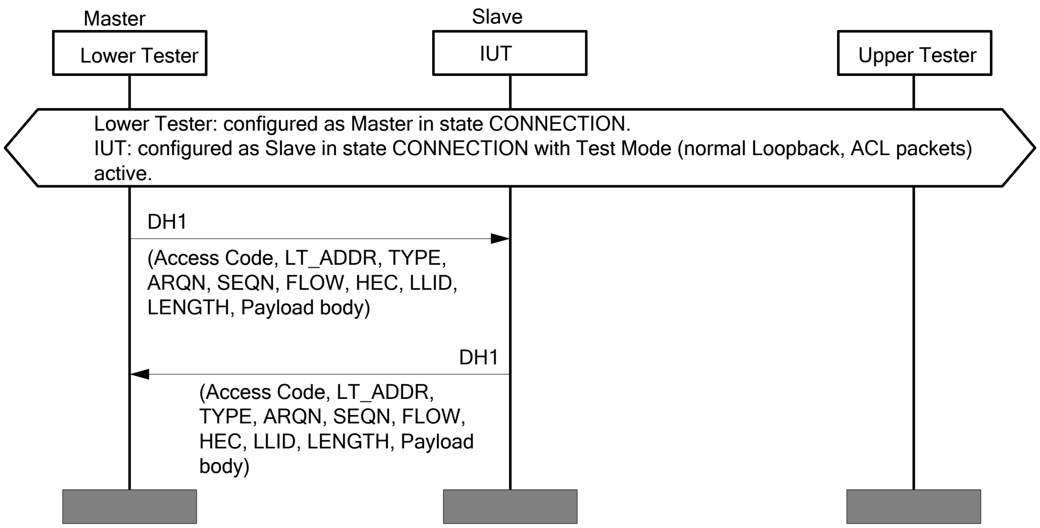

Figure 4.7: BB/PROT/COD/BV-05-C (DH1 packet type)

The Lower Tester transmits a DH1 packet.

<u>DH1</u>

Access Code:

> Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.
>
> Sync word: derived from the 24 bit address (LAP) of the Master (CAC).
>
> Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

> *LT_ADDR*: Logical Transport Address of the Slave
>
> TYPE: '0100'B.
>
> FLOW: '1'B.
>
> ARQN: '1'B.
>
> SEQN: depends on the former transmission of the Lower Tester.
>
> HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload Header:

LLID: '10'B.

FLOW: '1'B.

LENGTH: '11011'B = '27'D.

Payload body: 27 Bytes PRBS plus 16 bit CRC.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

4.7.1.6 BB/PROT/COD/BV-06-C [DM3 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a DM3 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.3

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, ACL packets) active.

- Test Procedure

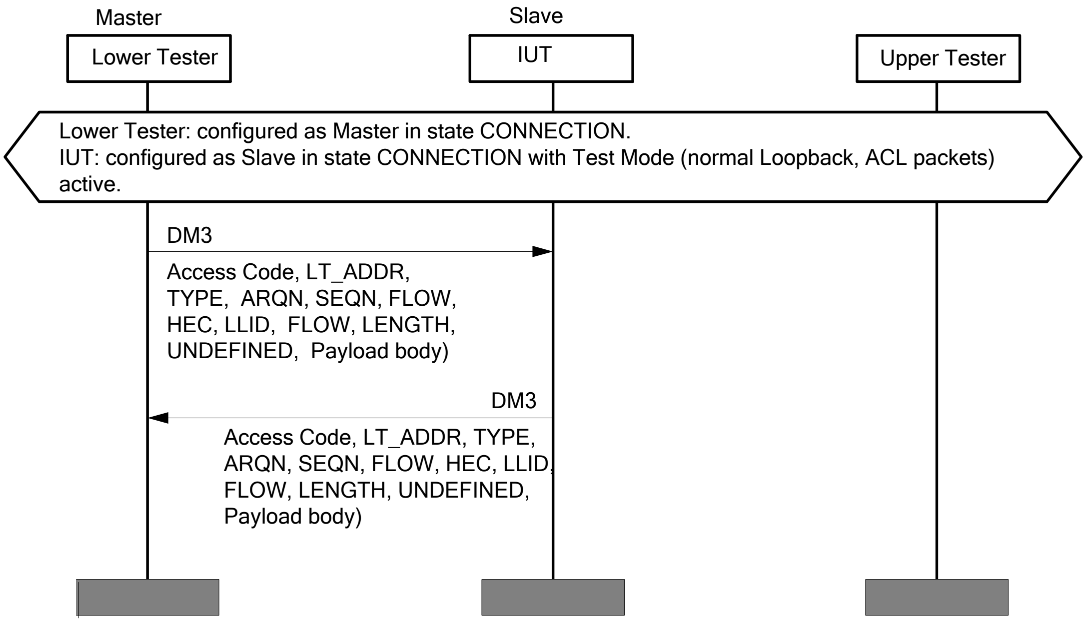

Figure 4.8: BB/PROT/COD/BV-06-C (DM3 packet type)

The Lower Tester transmits a DM3 packet.

<u>DM3</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the IUT.

TYPE: '1010'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload Header:

LLID: '10'B.

FLOW: '1'B.

LENGTH: '001111001'B = '121'D.

UNDEFINED: '0000'B.

Payload body: 121 Bytes PRBS plus 16 bit CRC.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is protected by FEC 2/3 and is CRC coded.

  This packet covers three time slots.

4.7.1.7 BB/PROT/COD/BV-07-C [DH3 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a DH3 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, ACL packets) active.

- Test Procedure

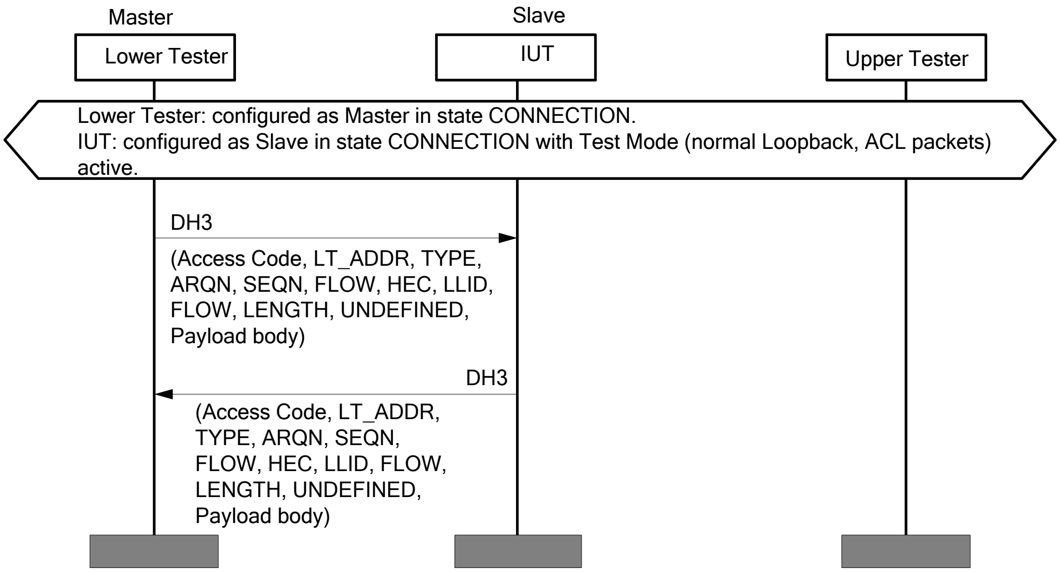

Figure 4.9: BB/PROT/COD/BV-07-C (DH3 Packet Type)

The Lower Tester transmits a DH3 packet.

DH3

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '1011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload Header:

LLID: '10'B.

FLOW: '1'B.

LENGTH: '010110111'B = '183'D.

UNDEFINED: '0000'B = any value.

Payload body: 183 Bytes PRBS plus 16 bit CRC.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

  This packet covers three timeslots.

4.7.1.8 BB/PROT/COD/BV-08-C [DM5 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a DM5 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.5

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, ACL packets) active.

- Test Procedure

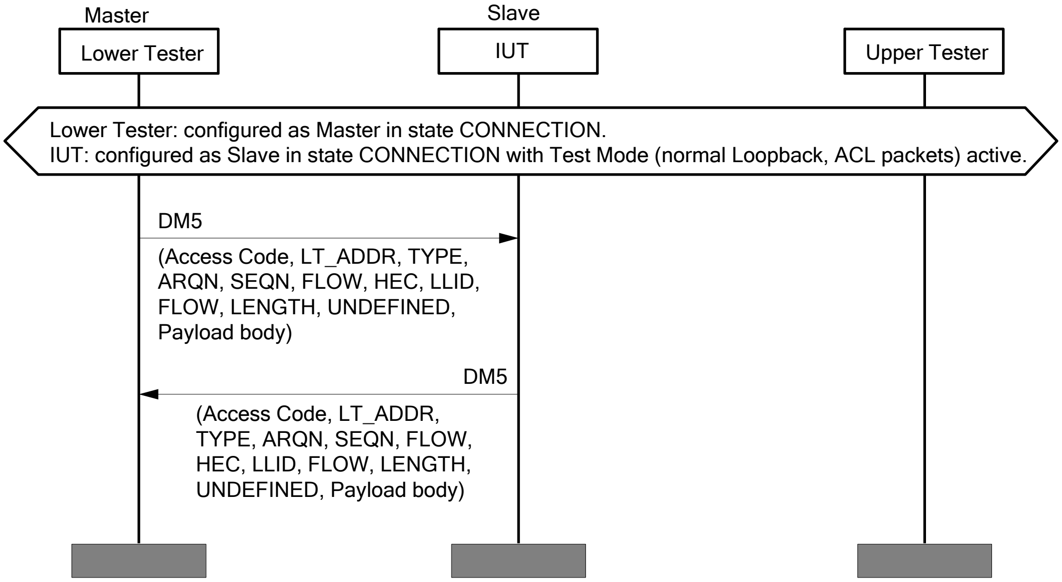

Figure 4.10: BB/PROT/COD/BV-08-C (DM5 packet type)

The Lower Tester transmits a DM5 packet.

<u>DM5</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '1110'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload Header:

LLID: '10'B.

FLOW: '1'B.

LENGTH: '011100000'B = '224'D.

UNDEFINED: '0000'B.

Payload body: 224 Bytes PRBS plus 16 bit CRC.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is protected by FEC 2/3 and is CRC coded.

  The packet used in this Test Case covers five timeslots.

4.7.1.9 BB/PROT/COD/BV-09-C [DH5 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a DH5 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.6

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, ACL packets) active.

- Test Procedure

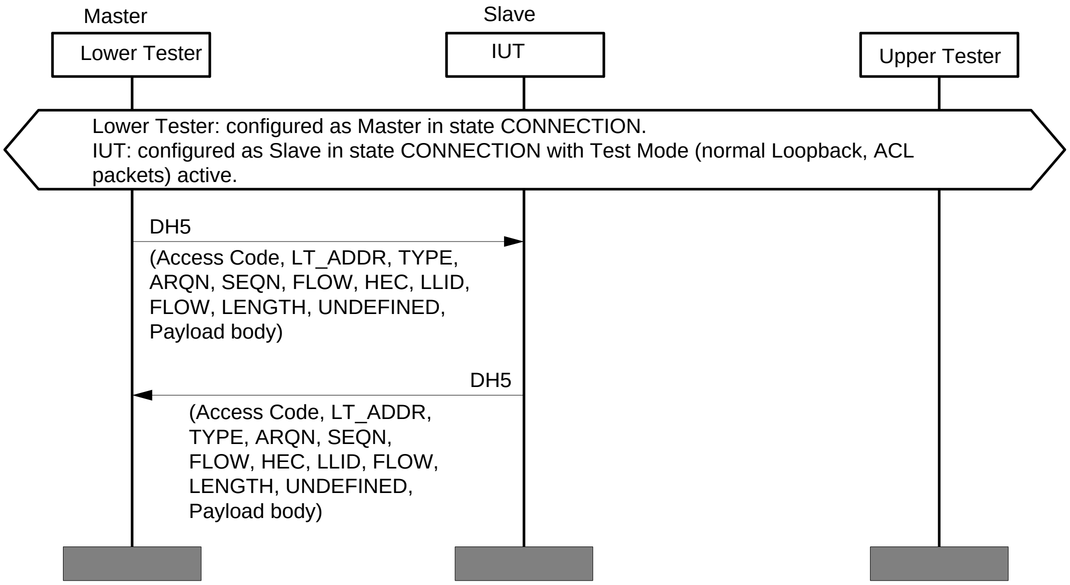

Figure 4.11: BB/PROT/COD/BV-09-C (DH5 packet type)

The Lower Tester transmits a DH5 packet.

<u>DH5</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '1111'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload Header:

LLID: '10'B.

FLOW: '1'B.

LENGTH: '101010011'B = '339'D.

UNDEFINED: '0000'B.

Payload body: 339 Bytes PRBS plus 16 bit CRC.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

  This packet in this Test Case covers five timeslots.

4.7.1.10 BB/PROT/COD/BV-10-C [AUX1 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of an AUX1 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.7

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, ACL packets) active.

- Test Procedure

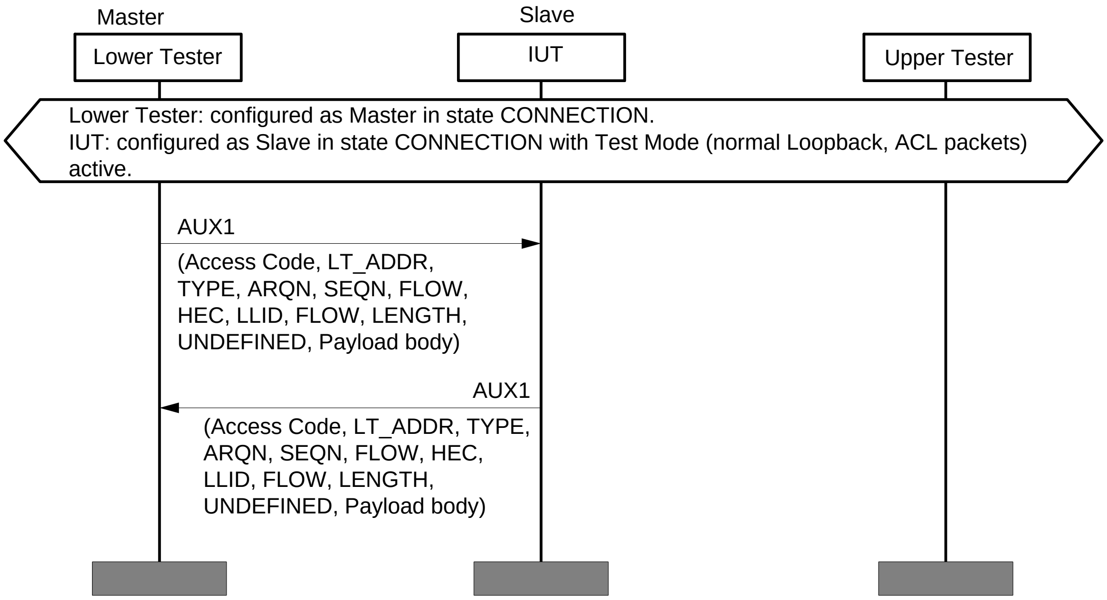

Figure 4.12: BB/PROT/COD/BV-10-C (AUX1 packet type)

The Lower Tester transmits an AUX1 packet.

<u>AUX1</u>

Access Code:

> Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.
>
> Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).
>
> Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

> LT_ADDR: Logical Transport Address of the Slave.
>
> TYPE: '1001'B.
>
> FLOW: '1'B.
>
> ARQN: '1'B.
>
> SEQN: Depends on the former transmission of the Lower Tester.
>
> HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload Header:

LLID: '00'B.

FLOW: '1'B.

LENGTH: '11101'B = '29'D.

Payload body: 29 Bytes PRBS.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

4.7.1.11 BB/PROT/COD/BV-11-C [Erroneous Slave Address]

- Test Purpose

  Verify that the IUT configured as Slave upon reception of a packet containing a logical transport address not belonging to the Slave does not transmit any packet.

- Reference

  [1] 4.2

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode ACL link).

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

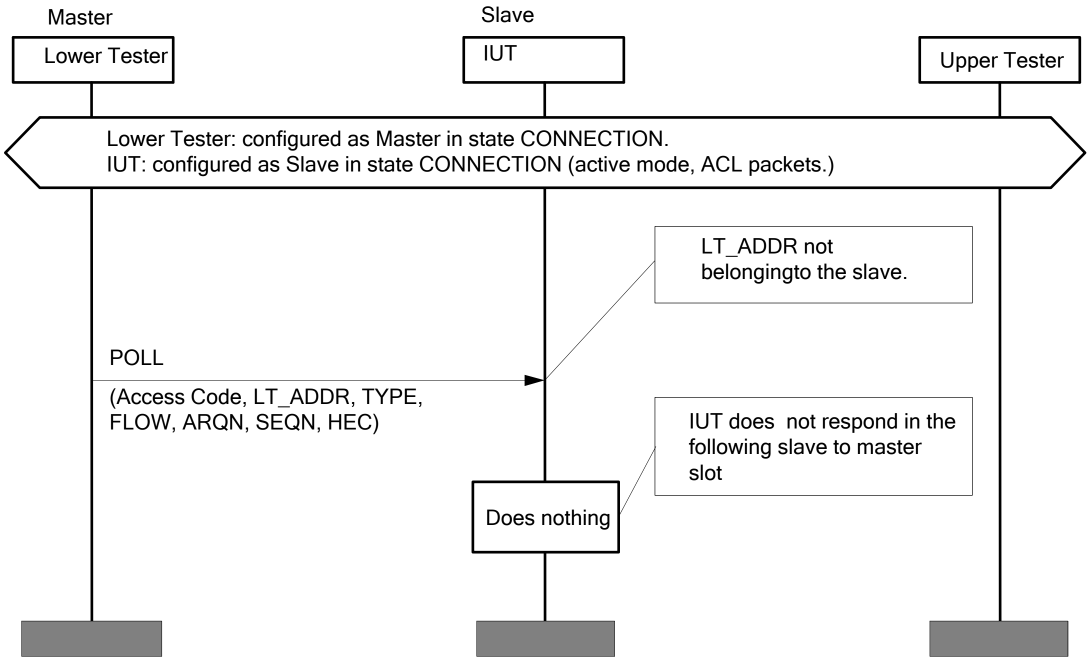

Figure 4.13: BB/PROT/COD/BV-11-C (Erroneous Slave address)

The Lower Tester transmits a POLL packet with a logical transport address not belonging to the Slave.

<u>POLL</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address not belonging to the Slave.

TYPE: '0001'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

The Lower Tester verifies that the IUT does not transmit any packet back to the Lower Tester.

The procedure is repeated to test all LT_ADDR not belonging to the IUT (six addresses). For each address one POLL packet is transmitted to make sure that the IUT does not respond to the POLL packet.

- Expected Outcome

  Pass Verdict

  The IUT does not transmit any packet in the Slave to Master slot.

4.7.1.12 BB/PROT/COD/BV-17-C [EV3 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of an EV3 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.3.1

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, Synchronous packets) active.

- Test Procedure

  The Lower Tester transmits an EV3 packet.

  EV3

  Access Code:

  Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

  Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

  Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

  Packet Header:

  LT_ADDR: Logical Transport Address of the Slave.

  TYPE: ‘0111’B.

  FLOW: ‘1’B.

  ARQN: ‘1’B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial ‘647’O in respect to the UAP of the Master.

Payload Header:

N/A

Payload:

30 bytes PRBS plus 16 bit CRC.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

  There is no payload header.

4.7.1.13 BB/PROT/COD/BV18-C [EV4 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of an EV4 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.3.2

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, Synchronous packets) active.

- Test Procedure

  The Lower Tester transmits an EV4 packet.

  EV4

  Access Code:

  Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

  Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: ‘1100’B.

FLOW: ‘1’B.

ARQN: ‘1’B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial ‘647’O in respect to the UAP of the Master.

Payload Header:

N/A

Payload:

80 bytes PRBS plus 16 bit CRC.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is protected by FEC 2/3 and is CRC coded.

  There is no payload header.

  The packet covers three time slots.

4.7.1.14 BB/PROT/COD/BV19-C [EV5 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of an EV5 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.3.3

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, Synchronous packets) active.

- Test Procedure

  The Lower Tester transmits an EV5 packet.

  <u>EV5</u>

  Access Code:

  > Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.
  >
  > Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).
  >
  > Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

  Packet Header:

  > *LT_ADDR*: Logical Transport Address of the Slave.
  >
  > TYPE: ‘1101’B.
  >
  > FLOW: ‘1’B.
  >
  > ARQN: ‘1’B.
  >
  > SEQN: depends on the former transmission of the Lower Tester.
  >
  > HEC: Generated by the polynomial ‘647’O in respect to the UAP of the Master.

  Payload Header:

  > N/A

  Payload:

  > 80 bytes PRBS plus 16 bit CRC.

  The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  <u>Pass Verdict</u>

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC 2/3 but is CRC coded.

  There is no payload header.

The packet covers three time slots.

4.7.1.15 BB/PROT/COD/BV-20-C [2-EV3 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a 2-EV3 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.3.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION and with Test Mode (Loopback, eSCO packets) active.

  Whitening on

- Test Procedure

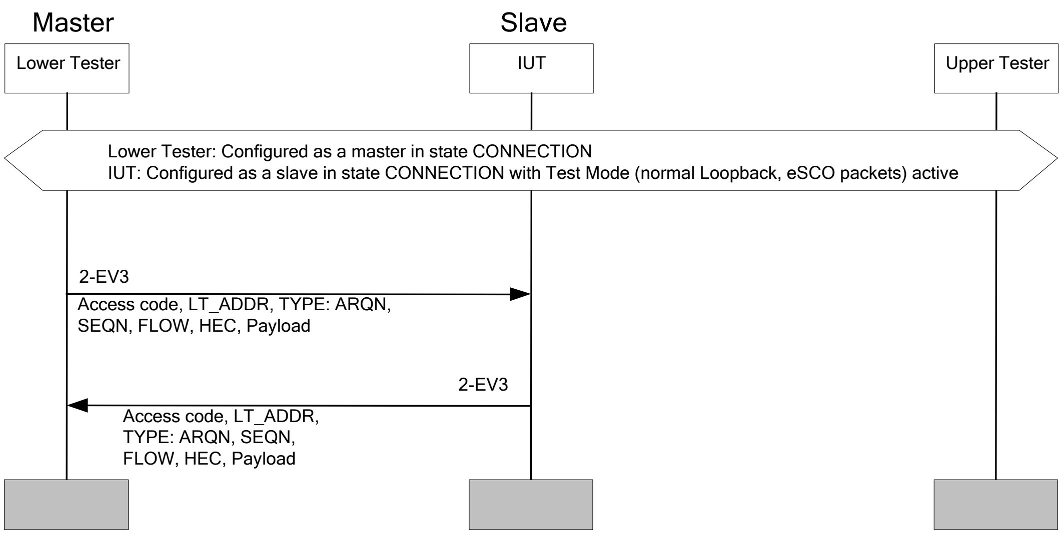

Figure 4.14: BB/PROT/COD/BV-20-C (2-EV3 packet type)

The Lower Tester transmits a 2-EV3 packet.

Access Code:

> Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.
>
> Sync word: derived from the 24 bit address (LAP) of the Master (CAC).
>
> Trailer: ‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR—Logical Transport Address.

TYPE—0110'B

FLOW—1'B

ARQN—'1'B

SEQN—depends on the former transmission of the Lower Tester

HEC—Generated by the polynomial '647'O in respect to the UAP of the Master.

Guard time—As defined in [1].

Sync sequence—As defined in [1].

Payload Header:—N/A

Payload body—60 Bytes PRBS9 plus 16 bit CRC.

Trailer—As defined in [1].

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the 2-EV3 packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

4.7.1.16 BB/PROT/COD/BV-21-C [2-EV5 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a 2-EV5 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.3.5

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION and with Test Mode (Loopback, eSCO packets) active.

  Whitening on

- Test Procedure

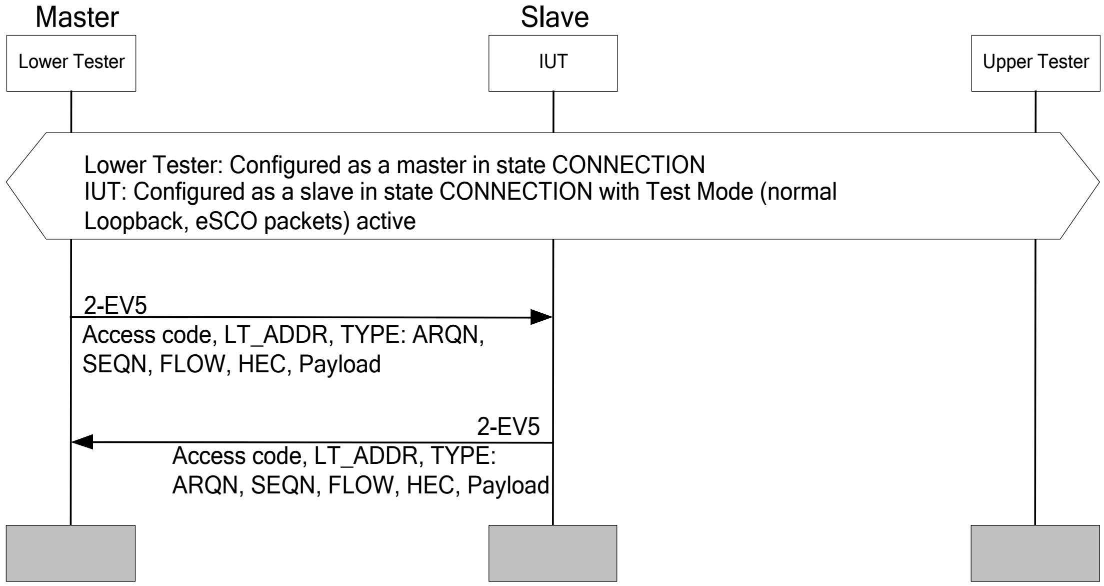

Figure 4.15: BB/PROT/COD/BV-21-C (2-EV5 packet type)

The Lower Tester transmits a 2-EV5 packet.

Access Code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer:‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address.

TYPE: '1100'B

FLOW: '1'B

ARQN: '1'B

SEQN: depends on the former transmission of the Lower Tester

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Guard time: As defined in [1]

Sync sequence: As defined in [1]

Payload Header: N/A

Payload body: 80 Bytes PRBS9 plus 16 bit CRC.

Trailer: As defined in [1]

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

4.7.1.17 BB/PROT/COD/BV-22-C [3-EV3 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a 3-EV3 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.3.6

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION and with Test Mode (Loopback, eSCO packets) active.

  Whitening on

- Test Procedure

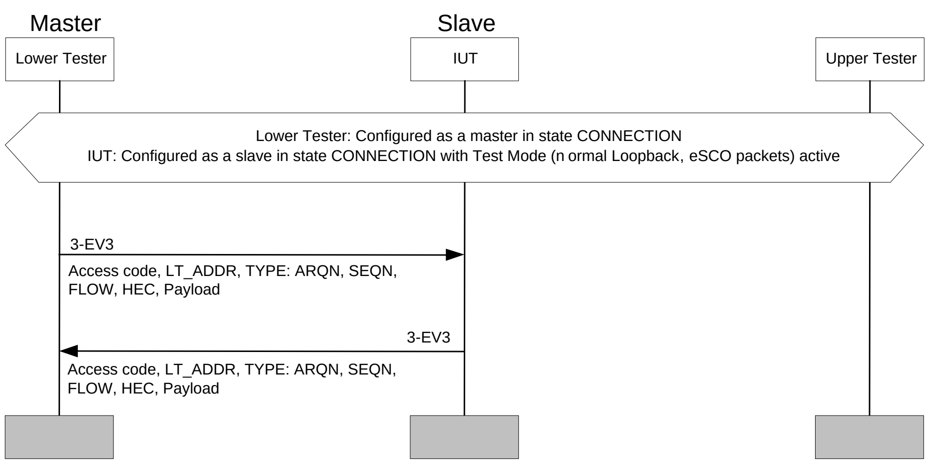

Figure 4.16: BB/PROT/COD/BV-22-C (3-EV3 packet type)

The Lower Tester transmits a 3-EV3 packet.

Access Code:

Preamble:‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer:‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address.

TYPE: '0111'B

FLOW: '1'B

ARQN: '1'B

SEQN: depends on the former transmission of the tester

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Guard time: As defined in [1]

Sync sequence: As defined in [1]

Payload Header: N/A

Payload body: 90 Bytes PRBS9 plus 16 bit CRC.

Trailer: As defined in [1]

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

4.7.1.18 BB/PROT/COD/BV-23-C [3-EV5 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a 3-EV5 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.3.7

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION and with Test Mode (Loopback, eSCO packets) active.

  Whitening on

- Test Procedure

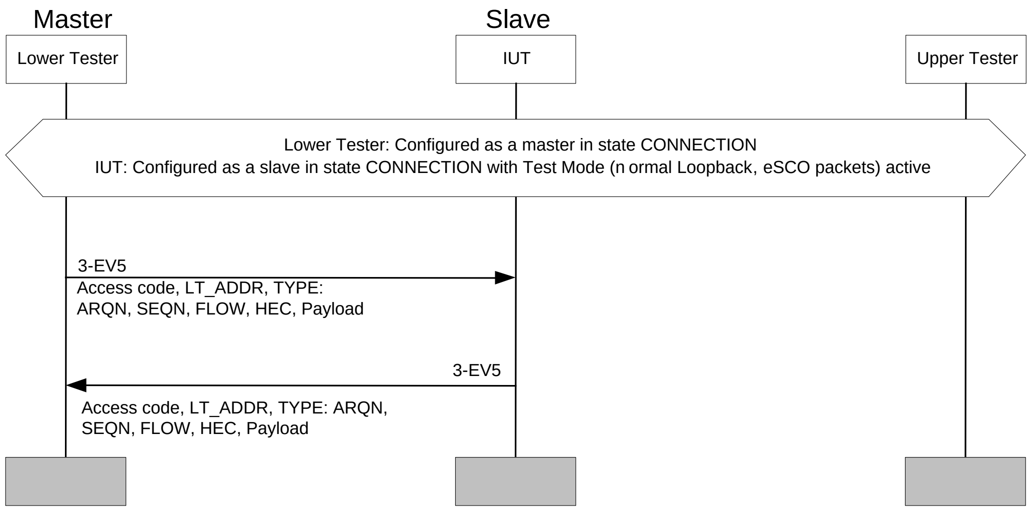

Figure 4.17: BB/PROT/COD/BV-23-C (3-EV5 packet type)

The Lower Tester transmits a 3-EV5 packet.

Access Code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer:‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address.

TYPE: '1101'B

FLOW: '1'B

ARQN: '1'B

SEQN: depends on the former transmission of the Lower Tester

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Guard time: As defined in [1]

Sync sequence: As defined in [1]

Payload Header: N/A

Payload body: 80 Bytes PRBS9 plus 16 bit CRC.

Trailer: As defined in [1]

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

4.7.1.19 BB/PROT/COD/BV-24-C [2-DH1 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a 2-DH1 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.8

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION with ptt = 1.

  IUT: Configured as Slave in state CONNECTION with ptt = 1 and with Test Mode (Loopback, ACL packets) active.

  Whitening on

- Test Procedure

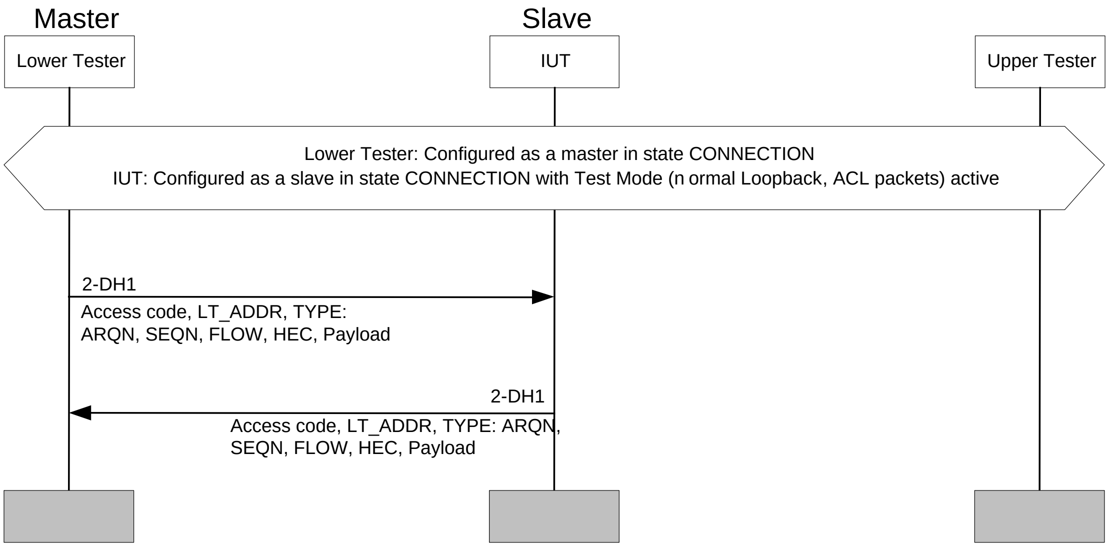

Figure 4.18: BB/PROT/COD/BV-24-C (2-DH1 packet type)

The Lower Tester transmits a 2-DH1 packet.

Access Code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer:‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address.

TYPE:'0100'B

FLOW:'1'B

ARQN:'1'B

SEQN: depends on the former transmission of the Lower Tester

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Guard time: As defined in [1]

Sync sequence: As defined in [1]

Payload Header:

L_CH: '10'B

FLOW: '1'B

LENGTH: '0000110110'B = '54'D

Payload body: 54 Bytes PRBS9 plus 16 bit CRC.

Trailer: As defined in [1]

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

4.7.1.20 BB/PROT/COD/BV-25-C [2-DH3 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a 2-DH3 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.9

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION with ptt = 1.

  IUT: Configured as Slave in state CONNECTION with ptt = 1 and with Test Mode (Loopback, ACL packets) active.

  Whitening on

- Test Procedure

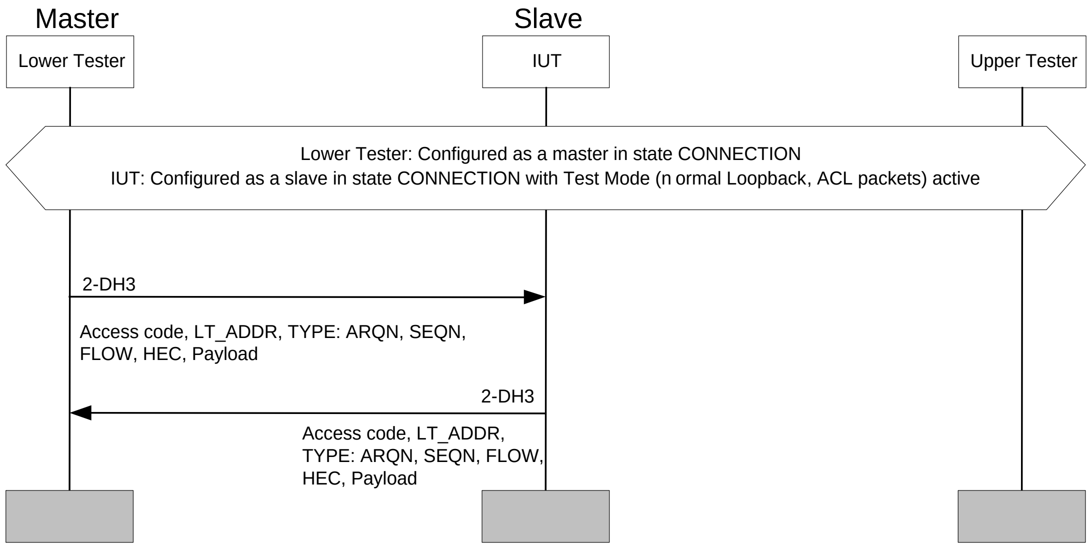

Figure 4.19: BB/PROT/COD/BV-25-C (2-DH3 packet type)

The Lower Tester transmits a 2-DH3 packet.

Access Code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer:‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address.

TYPE: '1010'B

FLOW: '1'B

ARQN: '1'B

SEQN: depends on the former transmission of the Lower Tester

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Guard time: As defined in [1]

Sync sequence: As defined in [1]

Payload Header:

L_CH: '10'B

FLOW: '1'B

LENGTH: '0101101111'B = '367'

Payload body: 367 Bytes PRBS9 plus 16 bit CRC.

Trailer: As defined in [1]

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

4.7.1.21 BB/PROT/COD/BV-26-C [2-DH5 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a 2-DH5 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.10

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION with ptt = 1.

  IUT: Configured as Slave in state CONNECTION with ptt = 1 and with Test Mode (Loopback, ACL packets) active.

  Whitening on

- Test Procedure

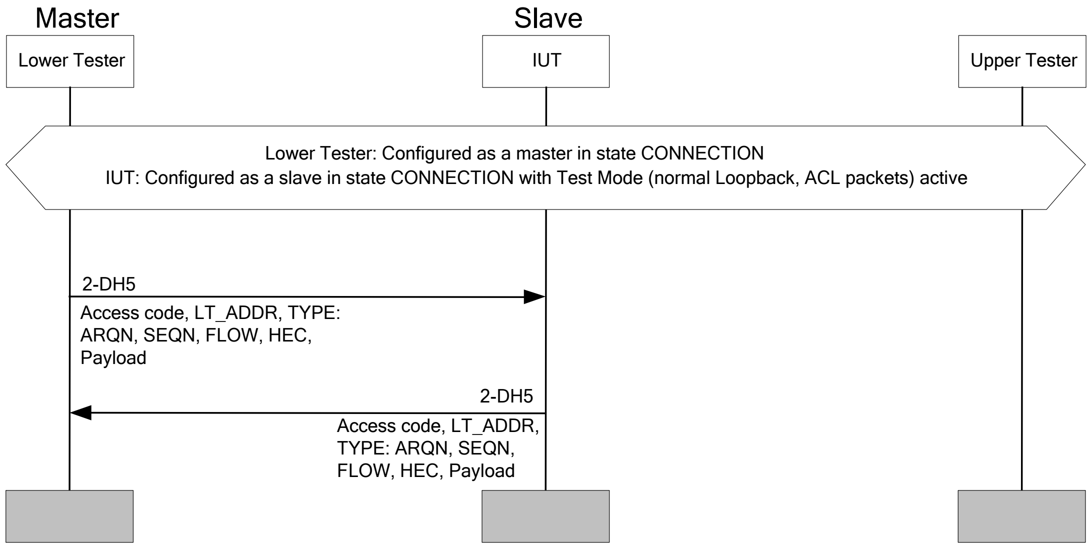

Figure 4.20: BB/PROT/COD/BV-26-C (2-DH5 packet type)

The Lower Tester transmits a 2-DH5 packet.

Access Code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively

Sync word:—derived from the 24 bit address (LAP) of the Master (CAC).

Trailer—‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address.

TYPE: '1110'B

FLOW: '1'B

ARQN: '1'B

SEQN: depends on the former transmission of the Lower Tester

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Guard time: As defined in [1]

Sync sequence: As defined in [1]

Payload Header:

L_CH: '10'B

FLOW: '1'B

LENGTH: ' 1010100111'B = '679'D

Payload body: 679 Bytes PRBS9 plus 16 bit CRC.

Trailer: As defined in [1]

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

4.7.1.22 BB/PROT/COD/BV-27-C [3-DH1 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a 3-DH1 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.11

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION with ptt = 1.

  IUT: Configured as Slave in state CONNECTION with ptt = 1 and with Test Mode (Loopback, ACL packets) active.

  Whitening on

- Test Procedure

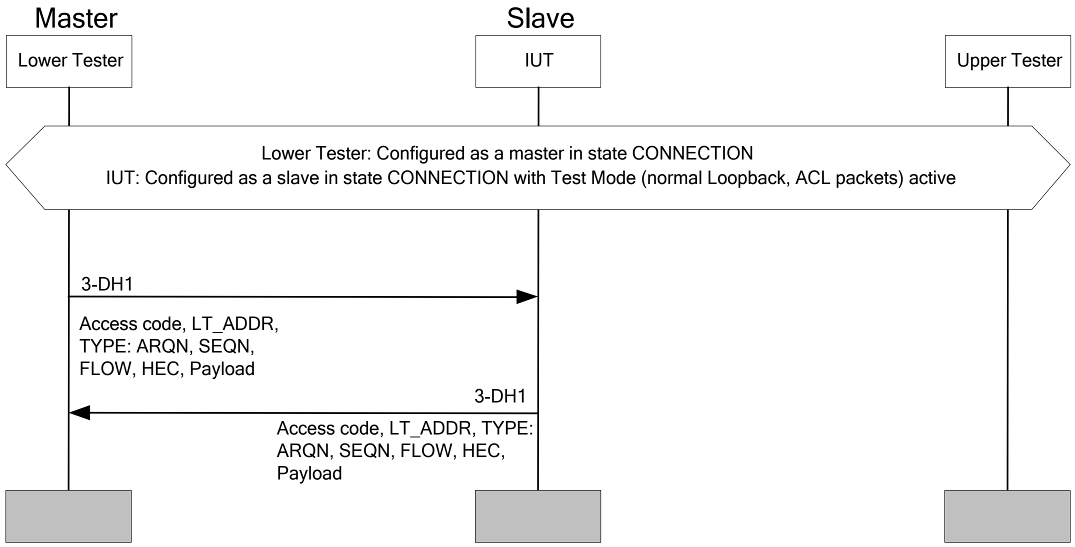

Figure 4.21: BB/PROT/COD/BV-27-C (3-DH1 packet type)

The Lower Tester transmits a 3-DH1 packet.

Access Code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: ‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address.

TYPE: '1000'B

FLOW: '1'B

ARQN: '1'B

SEQN: depends on the former transmission of the Lower Tester

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Guard time: As defined in [1]

Sync sequence: As defined in [1]

Payload Header:

L_CH: '10'B

FLOW: '1'B

LENGTH: '0001010011'B = '83'D

Payload body: 83 Bytes PRBS9 plus 16 bit CRC.

Trailer: As defined in [1]

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

4.7.1.23 BB/PROT/COD/BV-28-C [3-DH3 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a 3-DH3 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.12

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION with ptt = 1.

  IUT: Configured as Slave in state CONNECTION with ptt = 1 and with Test Mode (Loopback, ACL packets) active.

  Whitening on

- Test Procedure

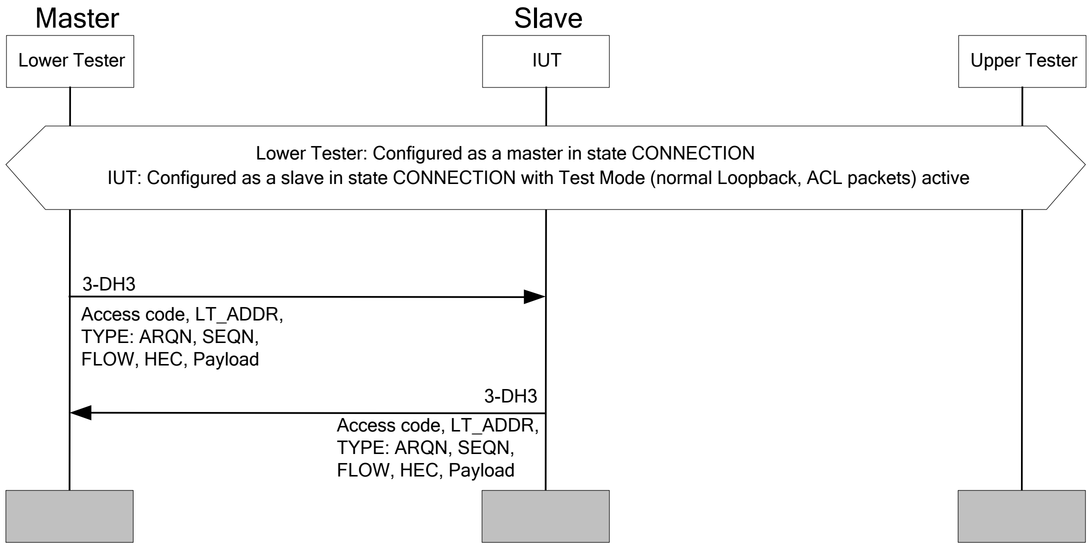

Figure 4.22: BB/PROT/COD/BV-28-C (3-DH3 packet type)

The Lower Tester transmits a 3-DH3 packet.

Access Code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: ‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address.

TYPE: '1011'B

FLOW: '1'B

ARQN: '1'B

SEQN: depends on the former transmission of the Lower Tester

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Guard time: As defined in [1]

Sync sequence: As defined in [1]

Payload Header:

L_CH: '10'B

FLOW: '1'B

LENGTH: '1000101000'B = '552'D

Payload body: 552 Bytes PRBS9 plus 16 bit CRC.

Trailer: As defined in [1]

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

4.7.1.24 BB/PROT/COD/BV-29-C [3-DH5 Packet Type]

- Test Purpose

  Verify that the IUT, upon reception of a 3-DH5 packet, decodes and encodes the packet correctly.

- Reference

  [1] 6.5.4.13

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION with ptt = 1.

  IUT: Configured as Slave in state CONNECTION with ptt = 1 and with Test Mode (Loopback, ACL packets) active.

  Whitening on

- Test Procedure

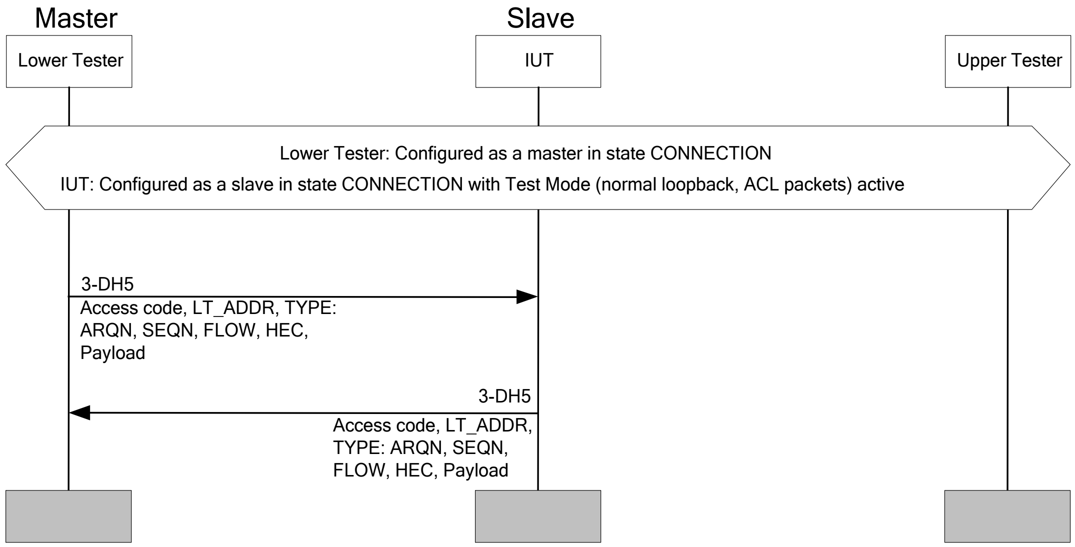

Figure 4.23: BB/PROT/COD/BV-29-C (3-DH5 packet type)

The Lower Tester transmits a 3-DH5 packet.

Access Code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: ‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address.

TYPE: '1111'B

FLOW: '1'B

ARQN: '1'B

SEQN: depends on the former transmission of the Lower Tester

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Guard time: As defined in [1]

Sync sequence: As defined in [1]

Payload Header:

L_CH: 10'B

FLOW: 1'B

LENGTH: 1111111101'B = '1021'D

Payload body: 1021 Bytes PRBS9 plus 16 bit CRC.

Trailer: As defined in [1]

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the packet correctly coded back to the Lower Tester.

- Notes

  The payload is not protected by FEC but is CRC coded.

4.7.1.25 BB/PROT/COD/BV-30-C [DM1 packet type with AES-CCM encryption and MIC]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of DM1 packets with AES-CCM encryption and MIC.

- Reference

  [1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

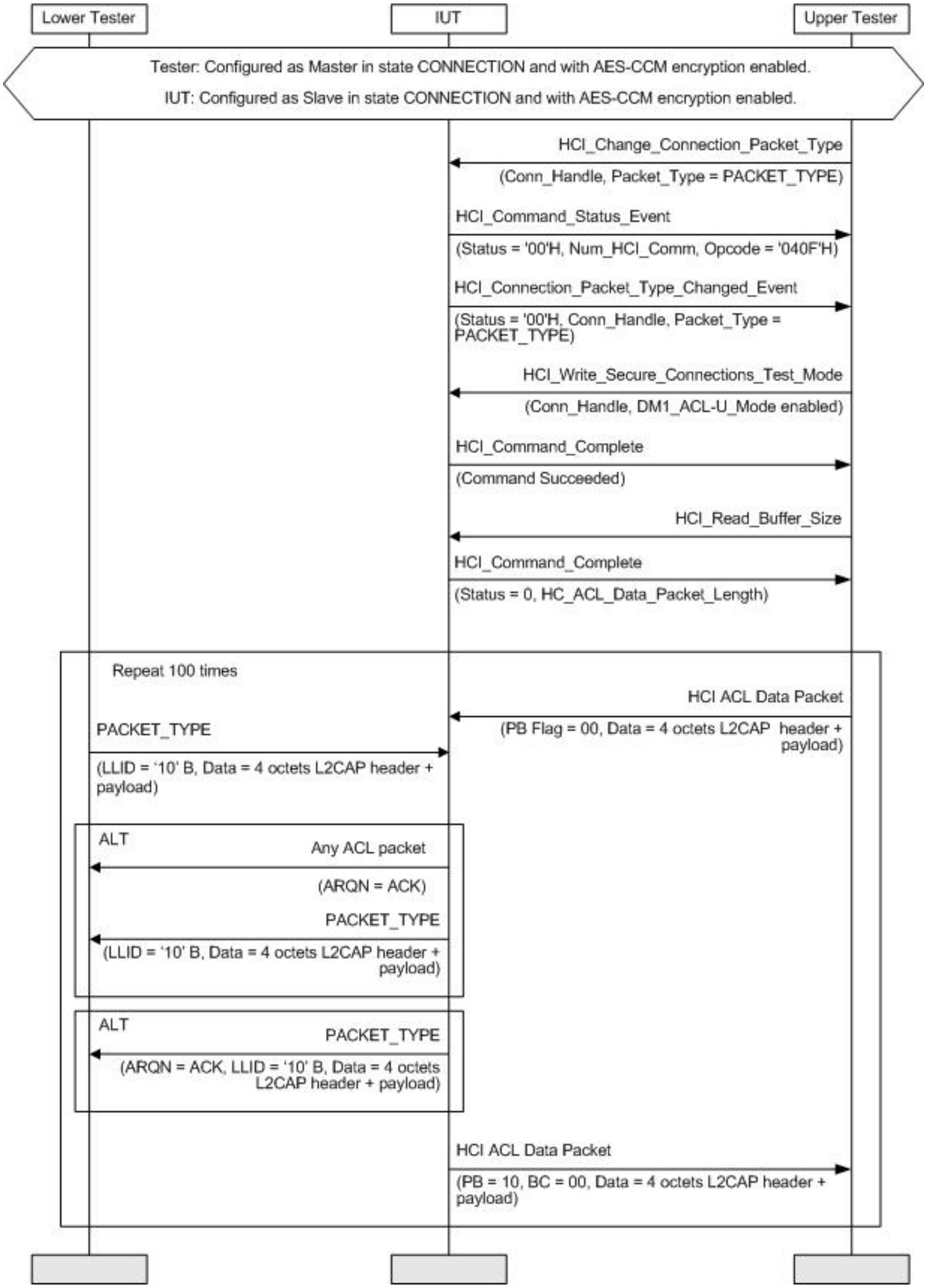

Figure 4.24: BB/PROT/COD/BV-30-C (PACKET_TYPE is DM1)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DM1 only.
b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.

c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).
d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(13, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a DM1 packet as follows:

   Access code: per [13] Section 6.3

   Packet Header: per [13] Section 6.4

      LT_ADDR: Logical Transport Address of the Slave

      FLOW: '1'B.

   Payload header: per [13] Section 6.6.2

      LLID: '10'B.

      FLOW: '1'B.

   Payload body:

      A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in e.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

  In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

  The payload is protected by FEC, is CRC coded and is authenticated by a MIC.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.26 BB/PROT/COD/BV-31-C [DH1 packet type with AES-CCM encryption and MIC]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of DH1 packets with AES-CCM encryption and MIC.

- Reference

  [1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

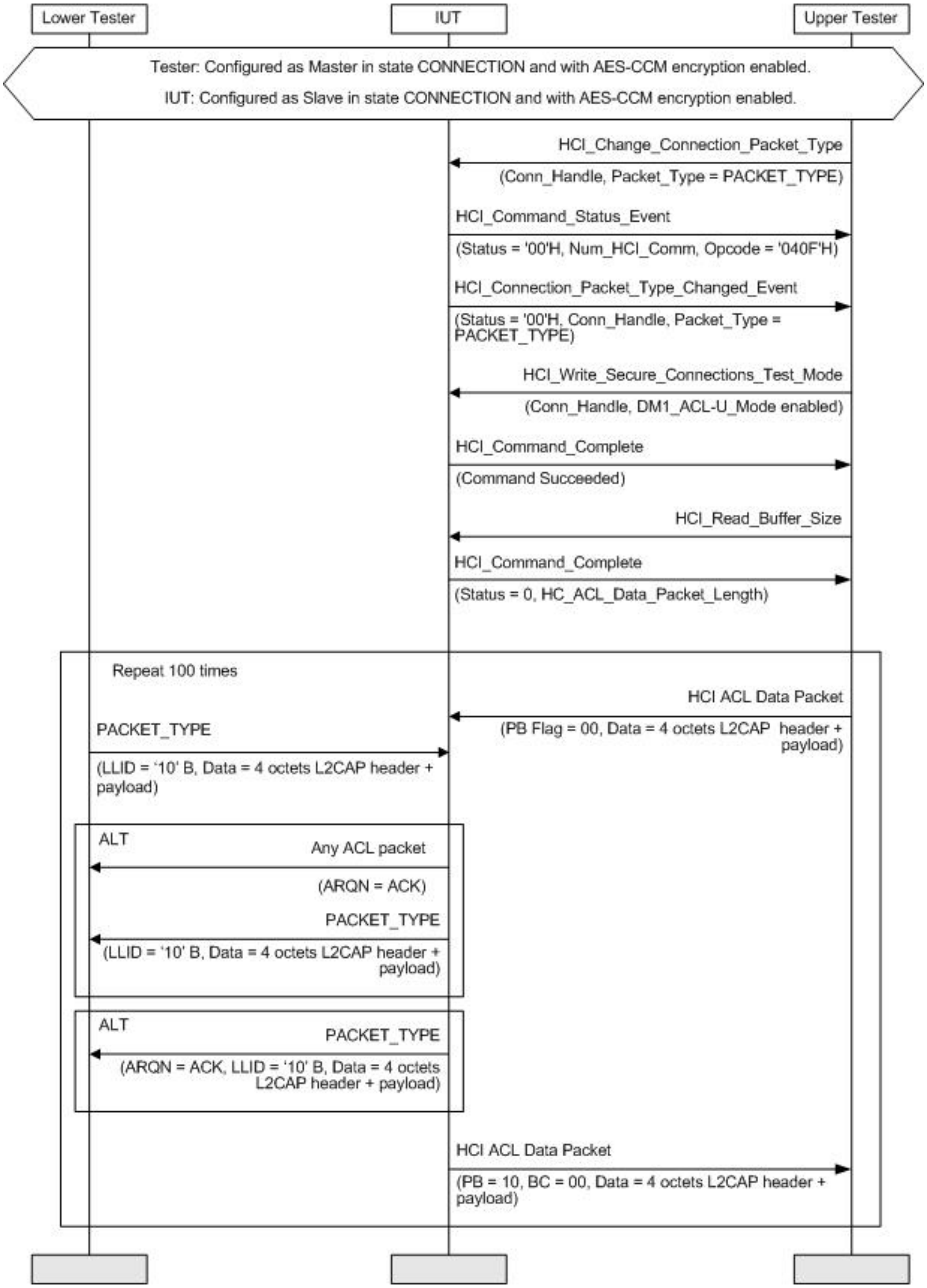

Figure 4.25: BB/PROT/COD/BV-31-C (PACKET_TYPE is DH1)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DH1 only.
b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.

c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).
d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(23, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a DH1 packet as follows:

   Access code: per [13] Section 6.3

   Packet Header: per [13] Section 6.4

      LT_ADDR: Logical Transport Address of the Slave

      FLOW: '1'B.

   Payload header: per [13] Section 6.6.2

      LLID: '10'B.

      FLOW: '1'B.

   Payload body:

      A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in d.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

  In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

  The payload is CRC coded and is authenticated by a MIC.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.27 BB/PROT/COD/BV-32-C [DM3 packet type with AES-CCM encryption and MIC]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of DM3 packets with AES-CCM encryption and MIC.

- Reference

  [1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

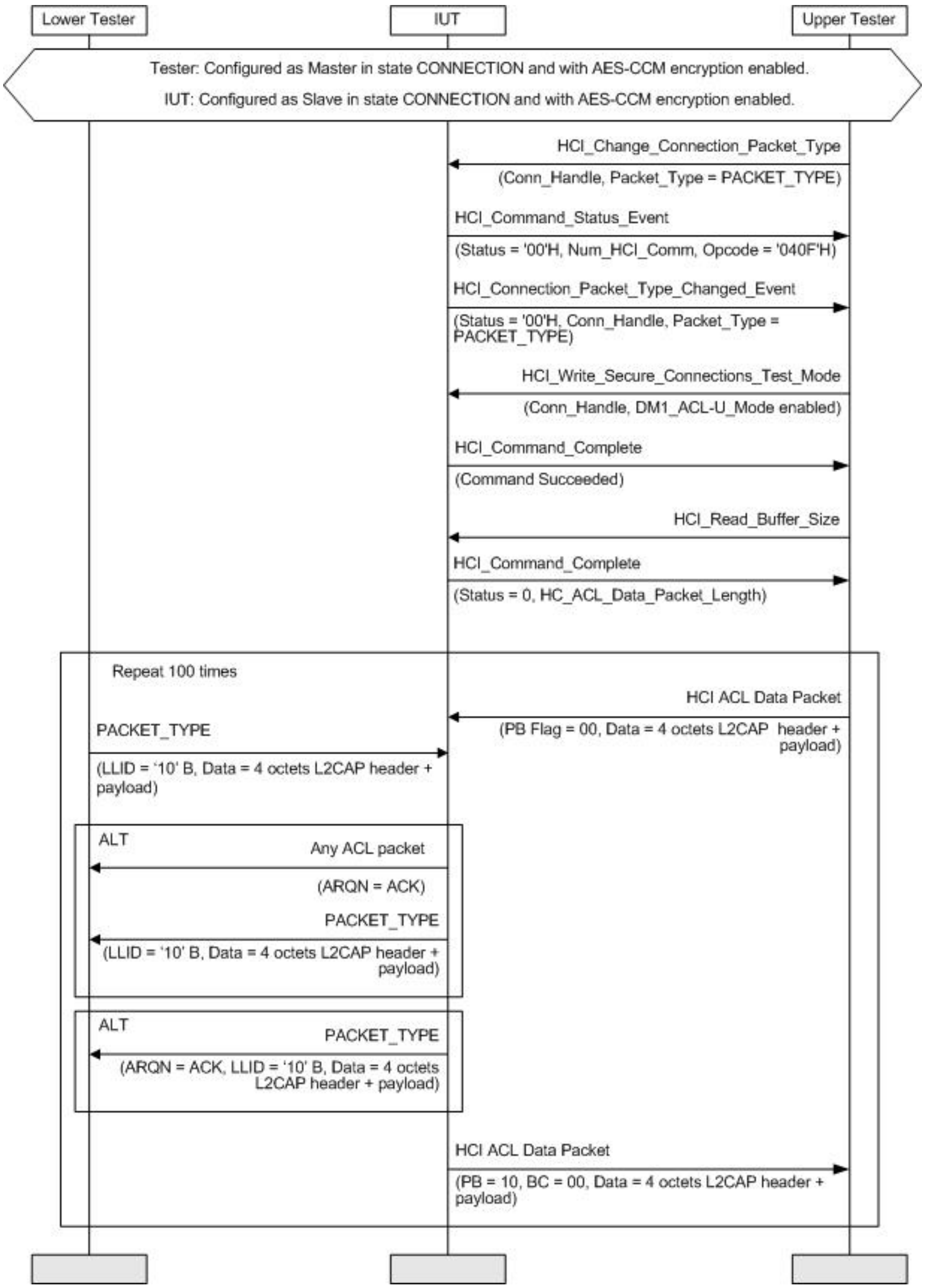

Figure 4.26: BB/PROT/COD/BV-32-C (PACKET_TYPE is DM3)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DM3 only.
b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.
c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).
d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(117, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a DM3 packet as follows:

   Access code: per [13] Section 6.3

   Packet Header: per [13] Section 6.4

      LT_ADDR: Logical Transport Address of the Slave

      FLOW: '1'B.

   Payload header: per [13] Section 6.6.2

      LLID: '10'B.

      FLOW: '1'B.

   Payload body:

      A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in e.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

  In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

  The payload is protected by FEC, is CRC coded and is authenticated by a MIC.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.28 BB/PROT/COD/BV-33-C [DH3 packet type with AES-CCM encryption and MIC]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of DH3 packets with AES-CCM encryption and MIC.

- Reference

  [1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

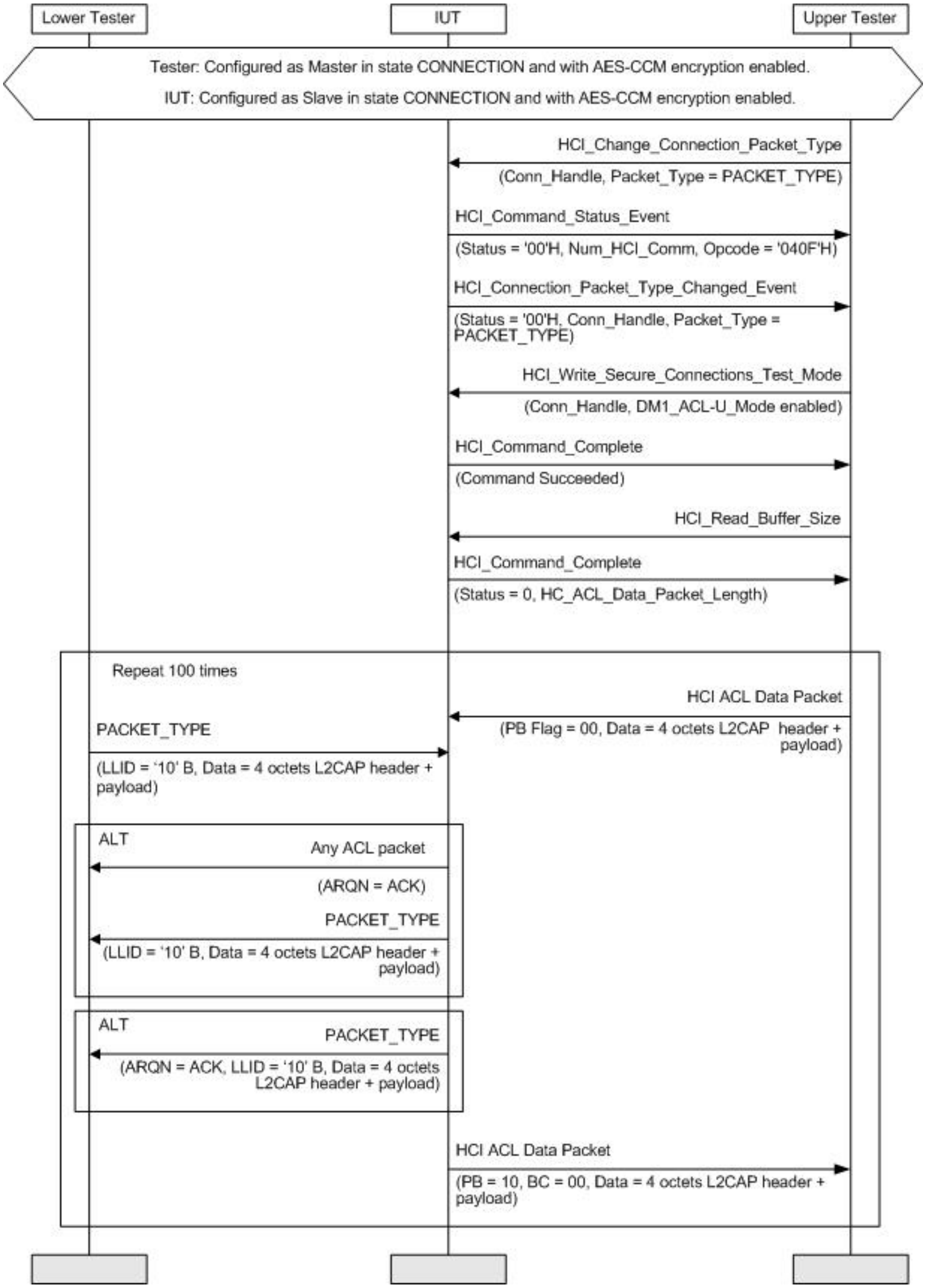

Figure 4.27: BB/PROT/COD/BV-33-C (PACKET_TYPE is DH3)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DH3 only.

b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.

c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).
d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to ‘00’B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(179, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a DH3 packet as follows:

   Access code: per [13] Section 6.3

   Packet Header: per [13] Section 6.4

      LT_ADDR: Logical Transport Address of the Slave

      FLOW: ‘1’B.

   Payload header: per [13] Section 6.6.2

      LLID: ‘10’B.

      FLOW: ‘1’B.

   Payload body:

      A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in e.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

  In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

  The payload is CRC coded and is authenticated by a MIC.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.29 BB/PROT/COD/BV-34-C [DM5 packet type with AES-CCM encryption and MIC]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of DM5 packets with AES-CCM encryption and MIC.

- Reference

  [1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

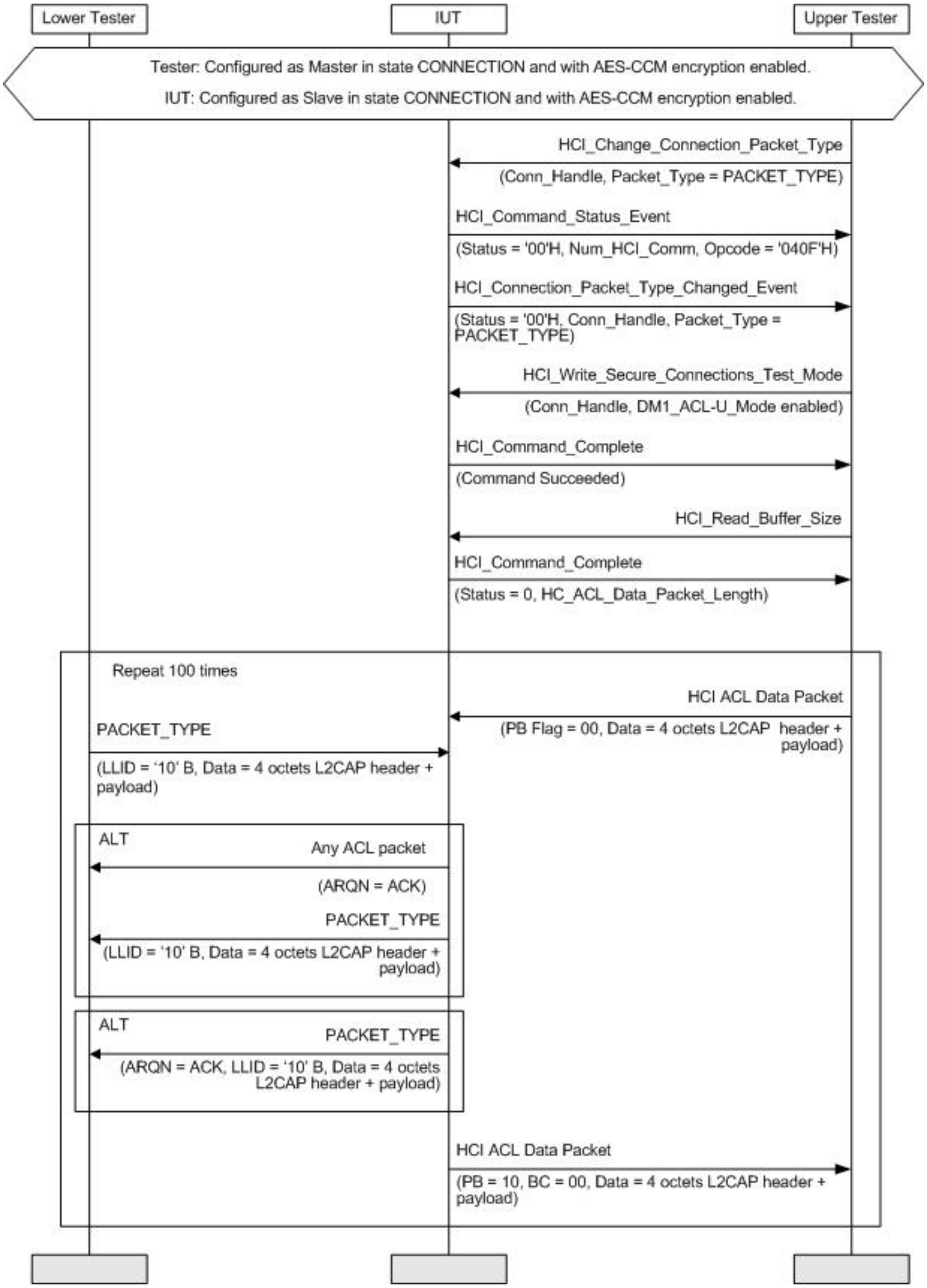

Figure 4.28: BB/PROT/COD/BV-34-C (PACKET_TYPE is DM5)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DM5 only.
b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.
c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).
d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to ‘00’B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(220, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a DM5 packet as follows:

   Access code: per [13] Section 6.3

   Packet Header: per [13] Section 6.4

      LT_ADDR: Logical Transport Address of the Slave

      FLOW: ‘1’B.

   Payload header: per [13] Section 6.6.2

      LLID: ‘10’B.

      FLOW: ‘1’B.

   Payload body:

      A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in e.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

  <u>Pass Verdict</u>

  In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

  In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

  The payload is protected by FEC, is CRC coded and is authenticated by a MIC.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.30 BB/PROT/COD/BV-35-C [DH5 packet type with AES-CCM encryption and MIC]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of DH5 packets with AES-CCM encryption and MIC.

- Reference

  [1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

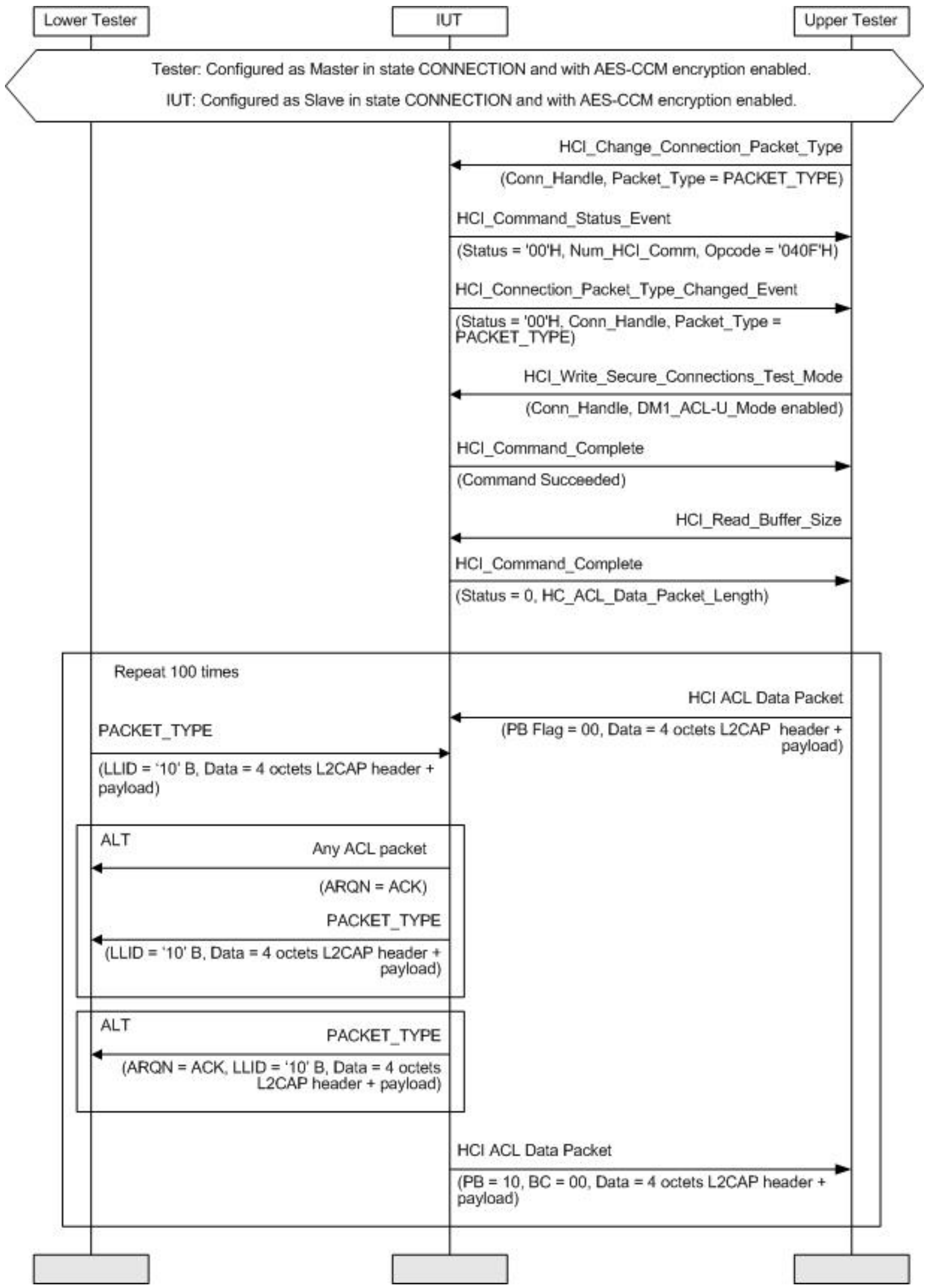

Figure 4.29: BB/PROT/COD/BV-35-C (PACKET_TYPE is DH5)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DH5 only.

b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.

c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).

d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to ‘00’B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(335, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a DH5 packet as follows:

Access code: per [13] Section 6.3

Packet Header: per [13] Section 6.4

LT_ADDR: Logical Transport Address of the Slave

FLOW: ‘1’B.

Payload header: per [13] Section 6.6.2

LLID: ‘10’B.

FLOW: ‘1’B.

Payload body:

A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in e.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

Pass Verdict

In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

The payload is CRC coded and is authenticated by a MIC.

The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.31 BB/PROT/COD/BV-36-C [2-DH1 packet type with AES-CCM encryption and MIC]

- Test Purpose

Verify that the IUT is capable of processing properly reception and transmission of 2-DH1 packets with AES-CCM encryption and MIC.

- Reference

[1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION with Secure Connection Test Mode (DM1_ACL-U_Mode) enabled and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

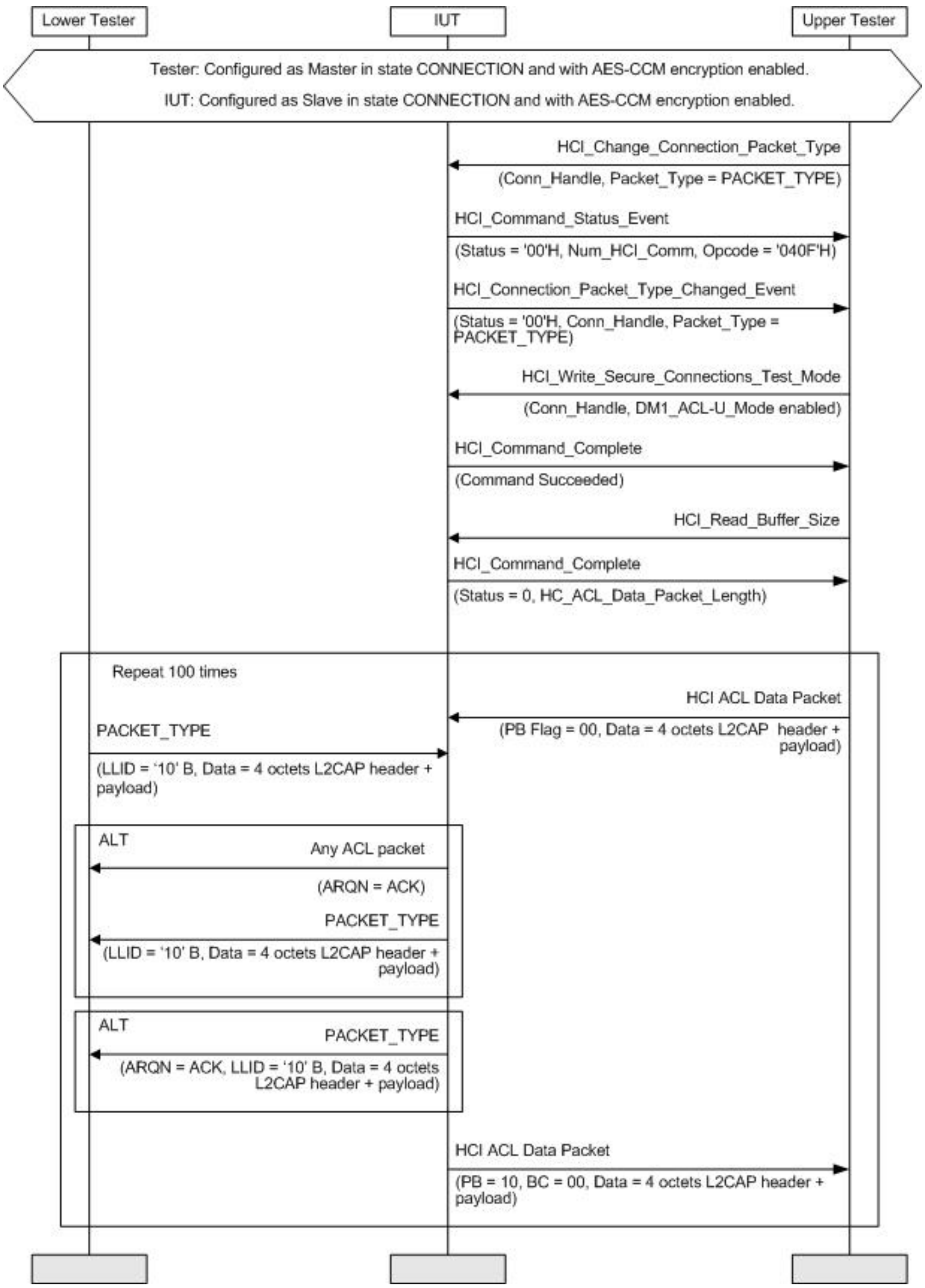

Figure 4.30: BB/PROT/COD/BV-36-C (PACKET_TYPE is 2-DH1)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to 2-DH1 only.
b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.
c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).
d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(50, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a 2-DH1 packet as follows:

   Access code: per [13] Section 6.3

   Packet Header: per [13] Section 6.4

      LT_ADDR: Logical Transport Address of the Slave

      FLOW: '1'B.

   Payload header: per [13] Section 6.6.2

      LLID: '10'B.

      FLOW: '1'B.

   Payload body:

      A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in e.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

  In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

  The payload is CRC coded and is authenticated by a MIC.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.32 BB/PROT/COD/BV-37-C [2-DH3 packet type with AES-CCM encryption and MIC]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of 2-DH3 packets with AES-CCM encryption and MIC.

- Reference

  [1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

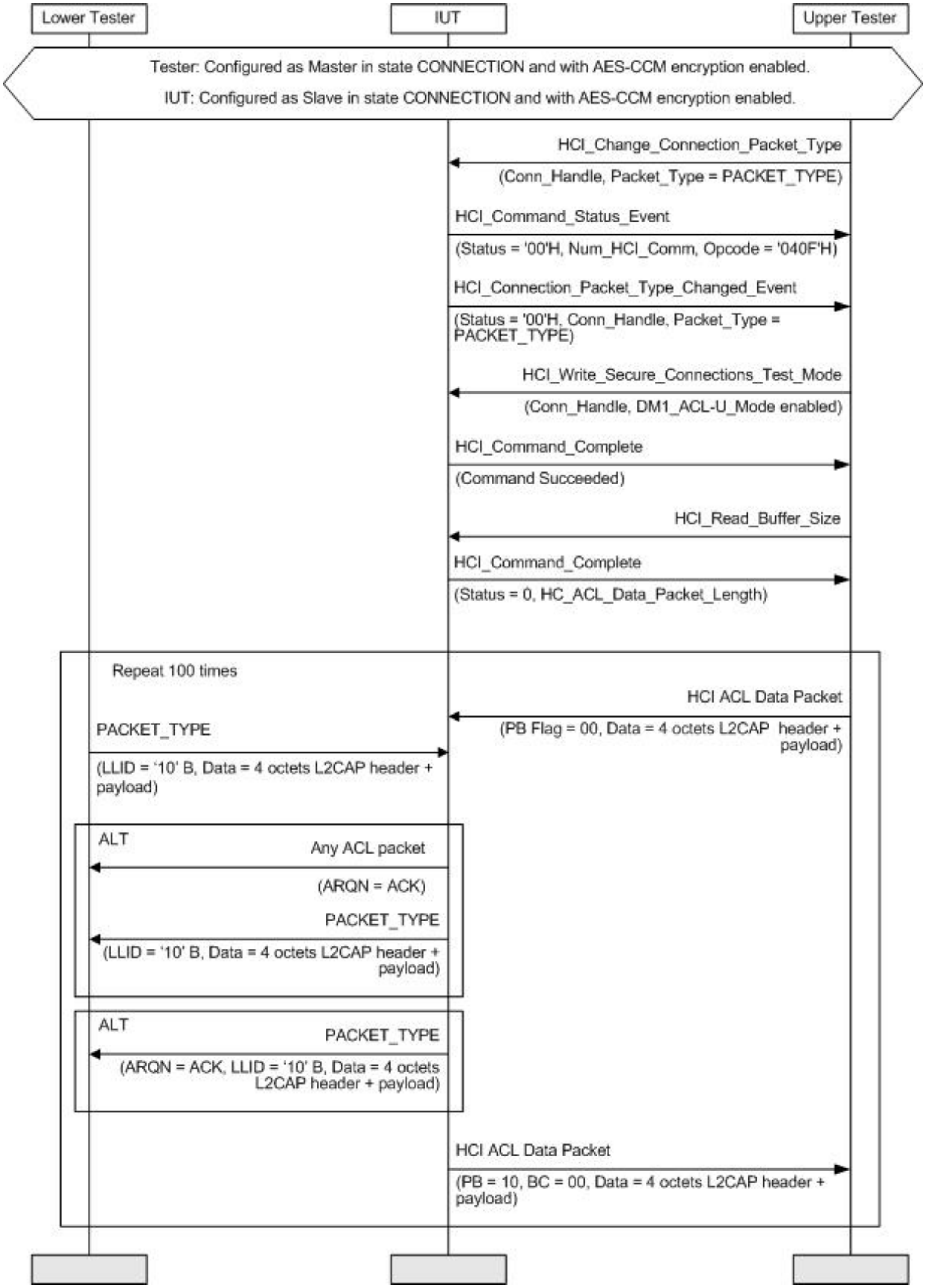

Figure 4.31: BB/PROT/COD/BV-37-C (PACKET_TYPE is 2-DH3)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to 2-DH3 only.
b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.

c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).
d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(363, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a 2-DH3 packet as follows:

   Access code: per [13] Section 6.3

   Packet Header: per [13] Section 6.4

      LT_ADDR: Logical Transport Address of the Slave

      FLOW: '1'B.

   Payload header: per [13] Section 6.6.2

      LLID: '10'B.

      FLOW: '1'B.

   Payload body:

      A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in e.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

  In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

  The payload is CRC coded and is authenticated by a MIC.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.33 BB/PROT/COD/BV-38-C [2-DH5 packet type with AES-CCM encryption and MIC]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of 2-DH5 packets with AES-CCM encryption and MIC.

- Reference

  [1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

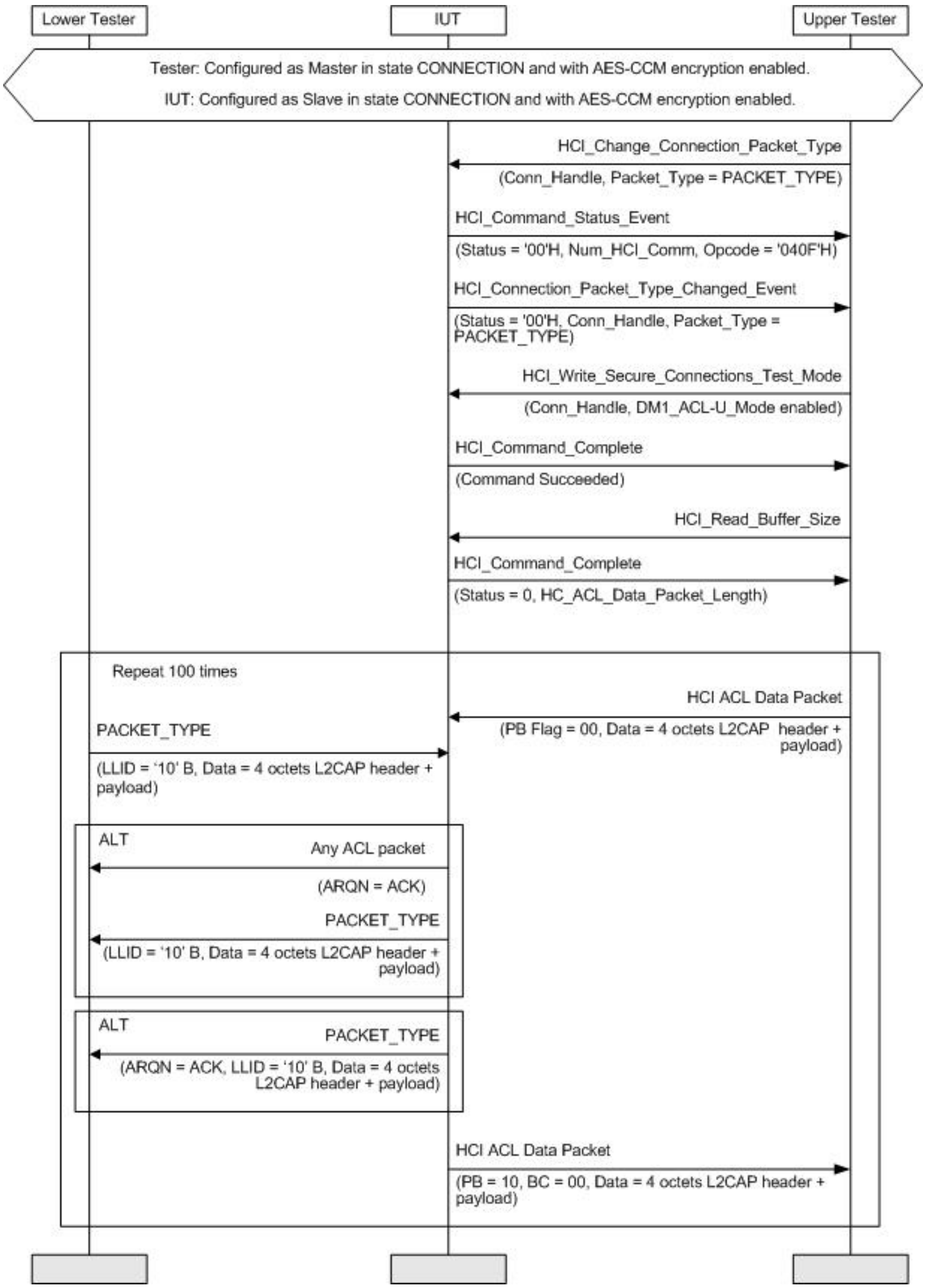

Figure 4.32: BB/PROT/COD/BV-38-C (PACKET_TYPE is 2-DH5)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to 2-DH5 only.
b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.
c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).
d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(675, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a 2-DH5 packet as follows:

    Access code: per [13] Section 6.3

    Packet Header: per [13] Section 6.4

        LT_ADDR: Logical Transport Address of the Slave

        FLOW: '1'B.

    Payload header: per [13] Section 6.6.2

        LLID: '10'B.

        FLOW: '1'B.

    Payload body:

        A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in e.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

  In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

  The payload is CRC coded and is authenticated by a MIC.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.34 BB/PROT/COD/BV-39-C [3-DH1 packet type with AES-CCM encryption and MIC]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of 3-DH1 packets with AES-CCM encryption and MIC.

- Reference

  [1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

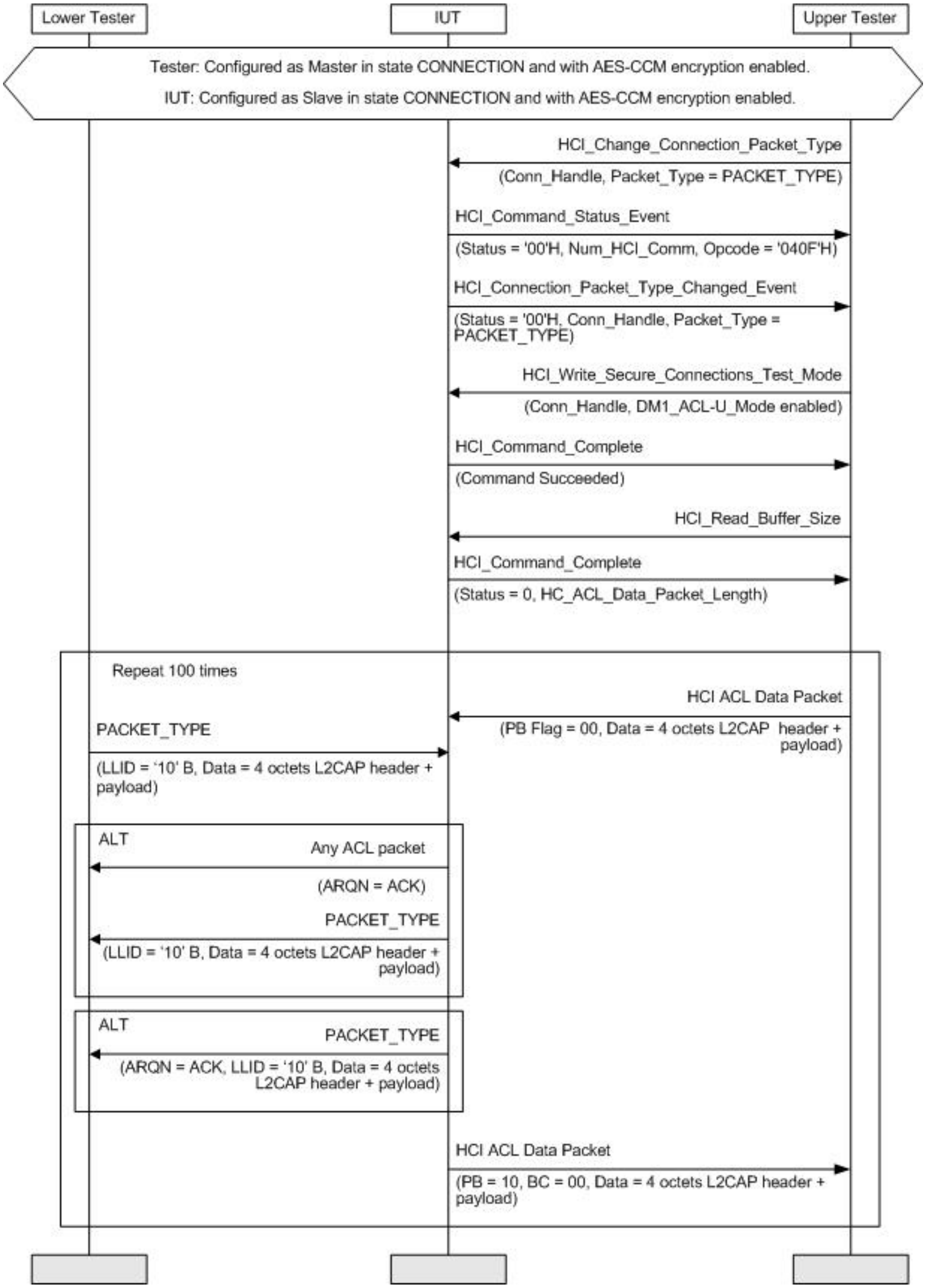

Figure 4.33: BB/PROT/COD/BV-39-C (PACKET_TYPE is 3-DH1)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to 3-DH1 only.

b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.

c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).
d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(79, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a 3-DH1 packet as follows:

   Access code: per [13] Section 6.3

   Packet Header: per [13] Section 6.4

      LT_ADDR: Logical Transport Address of the Slave

      FLOW: '1'B.

   Payload header: per [13] Section 6.6.2

      LLID: '10'B.

      FLOW: '1'B.

   Payload body:

      A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in e.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

  In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

  The payload is CRC coded and is authenticated by a MIC.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.35 BB/PROT/COD/BV-40-C [3-DH3 packet type with AES-CCM encryption and MIC]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of 3-DH3 packets with AES-CCM encryption and MIC.

- Reference

  [1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

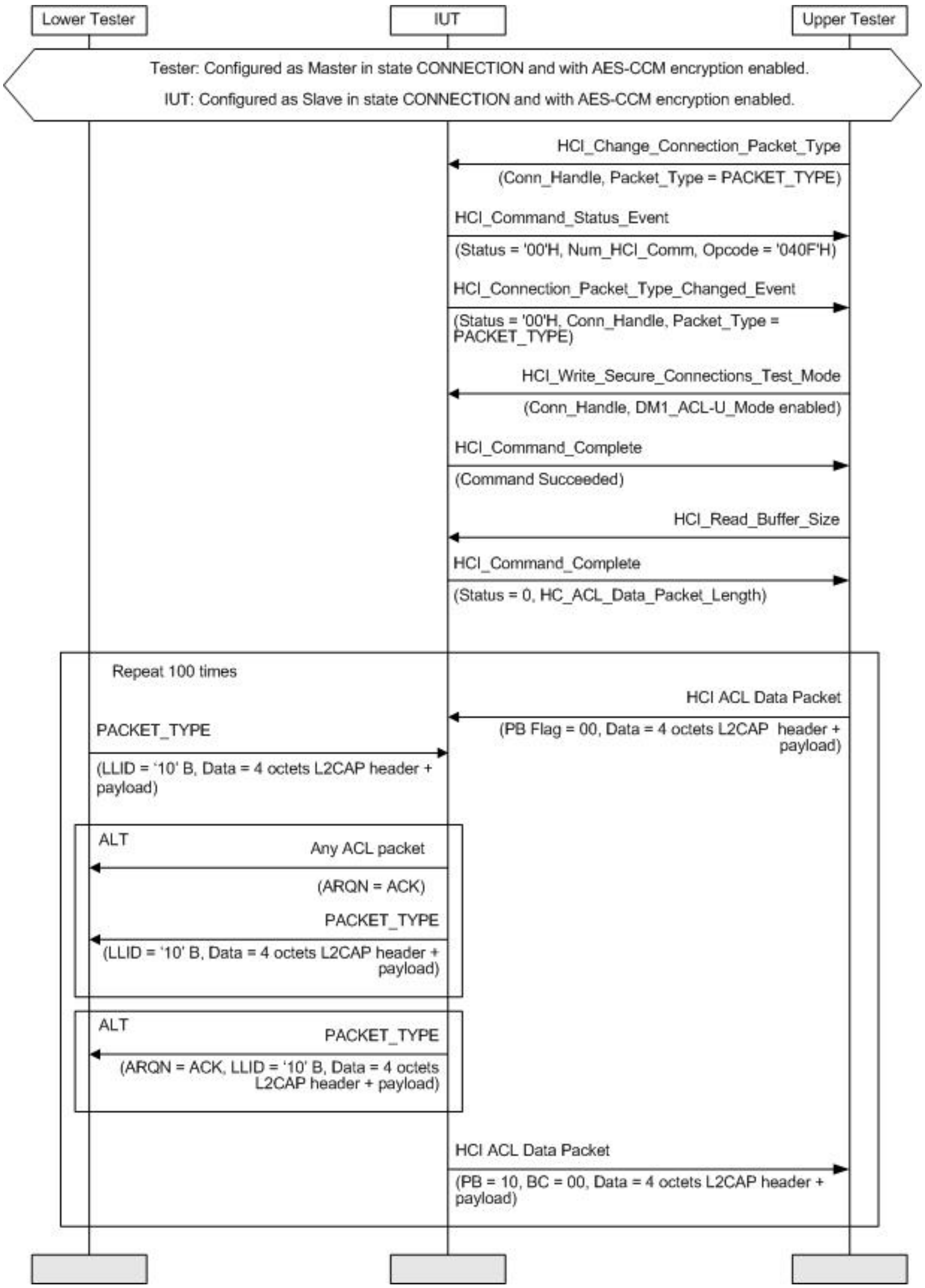

Figure 4.34: BB/PROT/COD/BV-40-C (PACKET_TYPE is 3-DH3)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to 3-DH3 only.
b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.
c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).
d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(548, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a 3-DH3 packet as follows:

   Access code: per [13] Section 6.3

   Packet header: per [13] Section 6.4

      LT_ADDR: Logical Transport Address of the Slave

      FLOW: '1'B.

   Payload header: per [13] Section 6.6.2

      LLID: '10'B.

      FLOW: '1'B.

   Payload body: per [13] Section 6.6.2

      A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in e.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

  In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

  The payload is CRC coded and is authenticated by a MIC.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.36 BB/PROT/COD/BV-41-C [3-DH5 packet type with AES-CCM encryption and MIC]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of 3-DH5 packets with AES-CCM encryption and MIC.

- Reference

  [1] 6.5.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION and with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

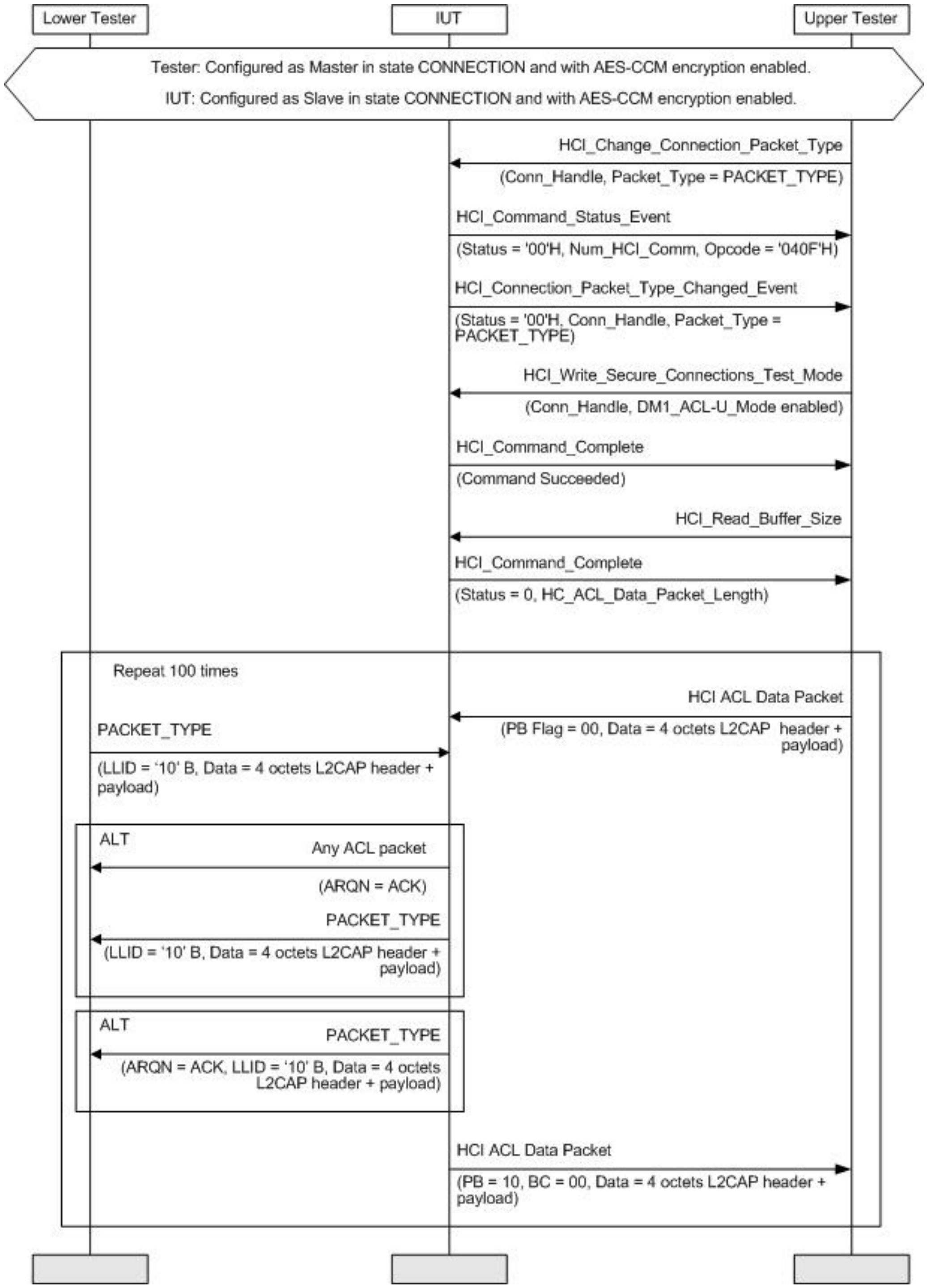

Figure 4.35: BB/PROT/COD/BV-41-C (PACKET_TYPE is 3-DH5)

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to 3-DH5 only.
b) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the DM1 ACL-U mode.
c) The Upper Tester sends HCI Read Buffer Size Command to get the value of HC_ACL_Data_Packet_Length (DATA_LENGTH).

d) The Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable) containing a valid 4-octet L2CAP header and a payload composed of non-deterministic random Bytes. The length of the payload is calculated as follows: MIN(1017, DATA_LENGTH-4), with DATA_LENGTH being the value retrieved in step c.
e) The Lower Tester sends a 3-DH5 packet as follows:

Access code: per [13] Section 6.3

Packet header: per [13] Section 6.4

LT_ADDR: Logical Transport Address of the Slave

FLOW: '1'B.

Payload header: per [13] Section 6.6.2

LLID: '10'B.

FLOW: '1'B.

Payload body:

A valid 4-octet L2CAP header plus a payload as described in step d plus a 32 bits MIC plus a 16 bit CRC.

f) The IUT sends a packet with the ARQN bit set to ACK in the next Slave to Master slot.
g) The IUT sends a packet as described in e.
h) The Lower Tester verifies that the IUT transmits the packet(s) correctly to the Lower Tester. It is valid if the IUT sends a single packet that satisfies both f and g conditions.
i) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.
j) Steps d)–i) are repeated 99 times (in addition to the first time).

- Expected Outcome

Pass Verdict

In at least 99 percent of the repetitions, the IUT transmits the packet(s) correctly to the Lower Tester as described in f to h (payload is valid and ARQN bit is set to ACK).

In at least 99 percent of the repetitions, the IUT sends the data correctly to the Upper Tester in i.

- Notes

The payload is CRC coded and is authenticated by a MIC.

The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection.

4.7.1.37 BB/PROT/COD/BV-42-C [EV3 packet type with AES-CCM encryption]

- Test Purpose

Verify that the IUT is capable of processing properly reception and transmission of EV3 packets with AES-CCM encryption.

- Reference

[1] 6.5.3

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION with AES-CCM encryption enabled.

  Whitening on.

- Test Procedure

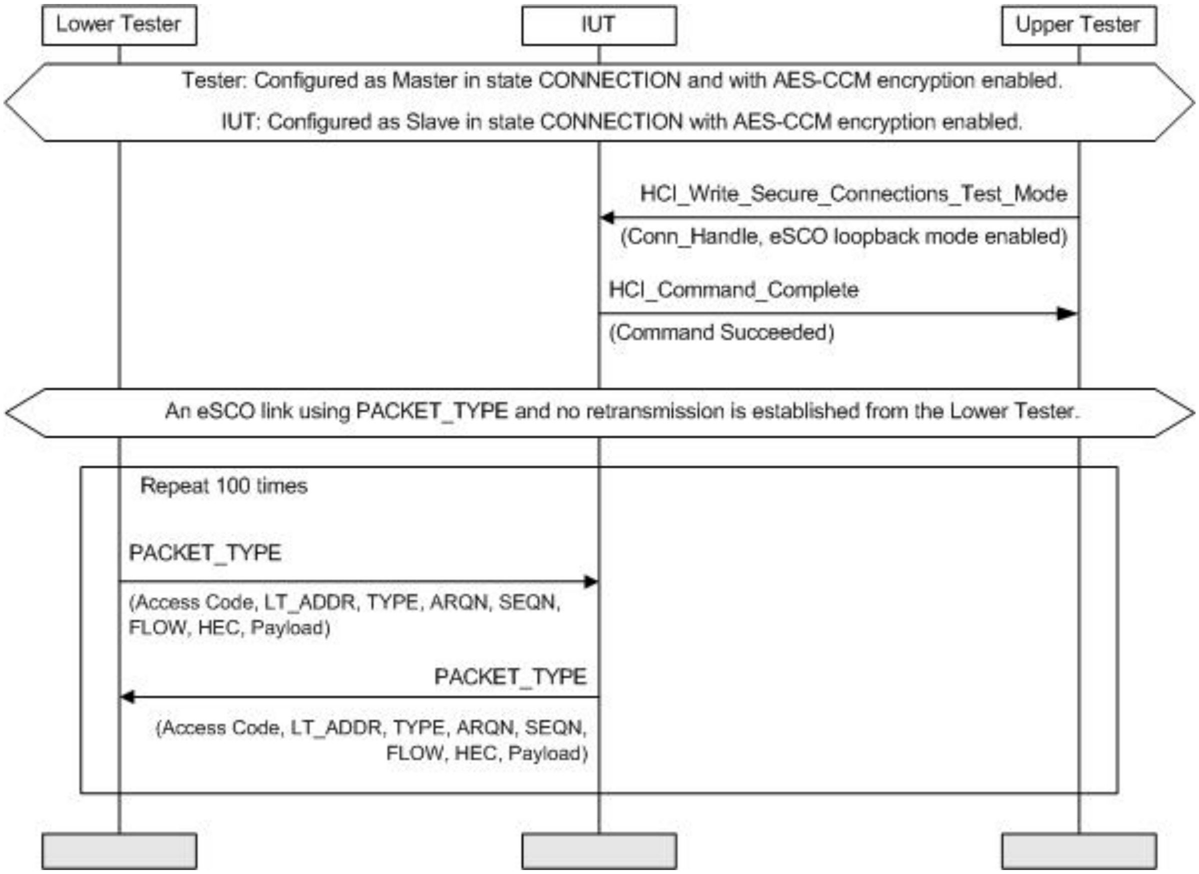

Figure 4.36: BB/PROT/COD/BV-42-C (PACKET_TYPE is EV3)

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) An eSCO link using EV3 packet type and no retransmission is established by the Lower Tester.
c) The Lower Tester transmits an EV3 packet to the IUT:

   Access code:

      Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

      Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

      Trailer: ‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

   Packet header: per [13] Section 6.4

      LT_ADDR—Logical Transport Address.

TYPE—‘0111'B

FLOW—‘1'B

ARQN—'0'B

SEQN—depends on the former transmission of the Lower Tester

Payload header: per [13] Section 6.6.2

Guard time—As defined in [1].

Sync sequence—As defined in [1].

Payload header—N/A

Payload body—30 non deterministic random Bytes of payload plus 16 bit CRC.

Trailer—As defined in [1].

d) The IUT replies with a packet of same description and ARQN bit set to ACK.
e) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
f) Steps c)–e) are repeated 99 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 100 packets containing a looped back payload.

- Expected Outcome

  Pass Verdict

  In at least 99% of the repetitions, the Lower Tester received a packet properly encrypted and containing the same payload as it transmitted.

- Notes

  The payload is not protected by FEC but is CRC coded.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.7.1.38 BB/PROT/COD/BV-43-C [EV4 packet type with AES-CCM encryption]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of EV4 packets with AES-CCM encryption.

- Reference

  [1] 6.5.3

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

IUT: Configured as Slave in state CONNECTION with Secure Connection Test Mode (eSCO_Loopback_Mode enabled) enabled and with AES-CCM encryption enabled. Whitening is on. An eSCO link using EV4 packet type and no retransmission is established.

- Test Procedure

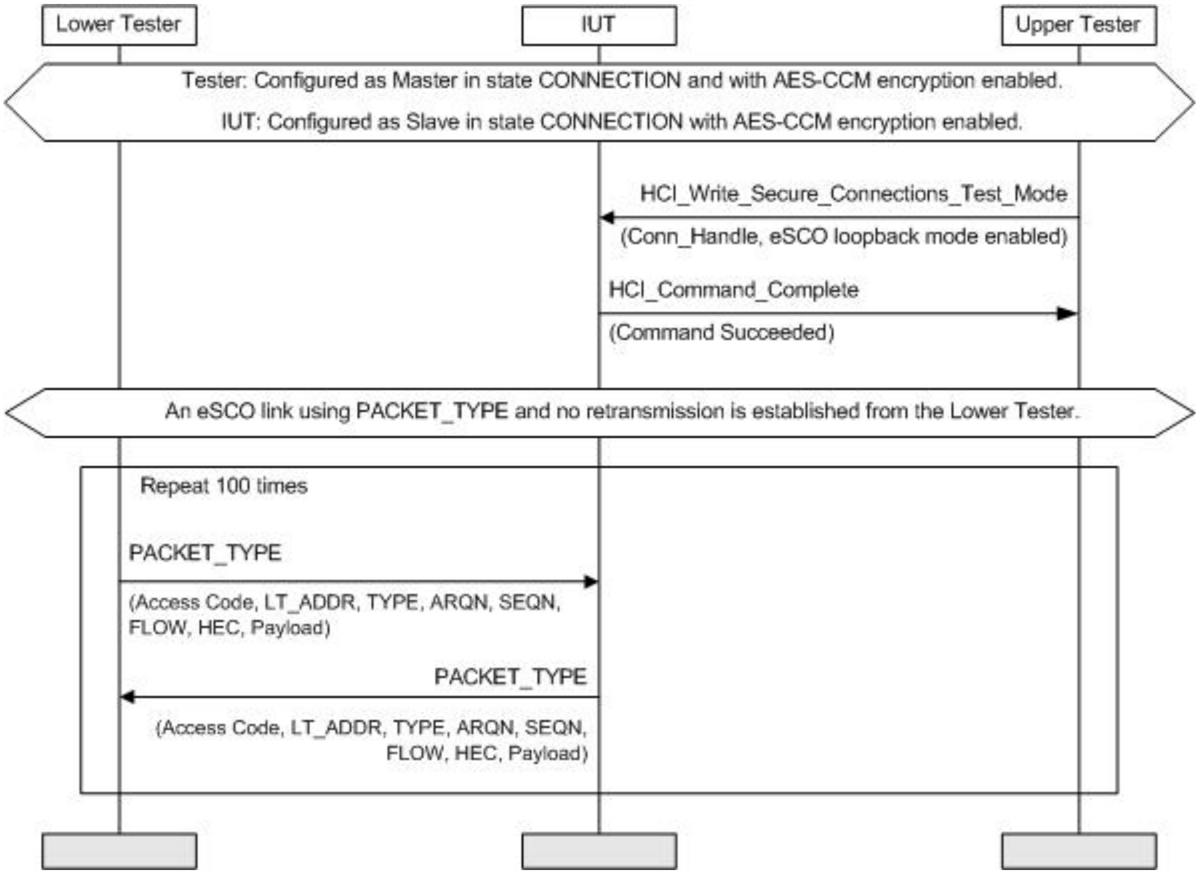

Figure 4.37: BB/PROT/COD/BV-43-C (PACKET_TYPE is EV4)

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) An eSCO link using EV4 packet type and no retransmission is established by the Lower Tester.
c) The Lower Tester transmits an EV4 packet to the IUT:

Access code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: ‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header: per [13] Section 6.4

LT_ADDR—Logical Transport Address.

TYPE—‘1100'B

FLOW—‘1'B

ARQN—'0'B

SEQN—depends on the former transmission of the Lower Tester

Payload header:

Guard time—As defined in [1].

Sync sequence—As defined in [1].

Payload header—N/A

Payload body—80 non deterministic random Bytes of payload plus 16 bit CRC.

Trailer—As defined in [1].

d) The IUT replies with a packet of same description and ARQN bit set to ACK.
e) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
f) Steps c)–e) are repeated 99 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 100 packets containing a looped back payload.

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the Lower Tester received a packet properly encrypted and containing the same payload as it transmitted.

- Notes

  The payload is protected by FEC and is CRC coded.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.7.1.39 BB/PROT/COD/BV-44-C [EV5 packet type with AES-CCM encryption]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of EV5 packets with AES-CCM encryption.

- Reference

  [1] 6.5.3

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION with Secure Connection Test Mode (eSCO_Loopback_Mode enabled) enabled and with AES-CCM encryption enabled. Whitening is on. An eSCO link using EV5 packet type and no retransmission is established.

- Test Procedure

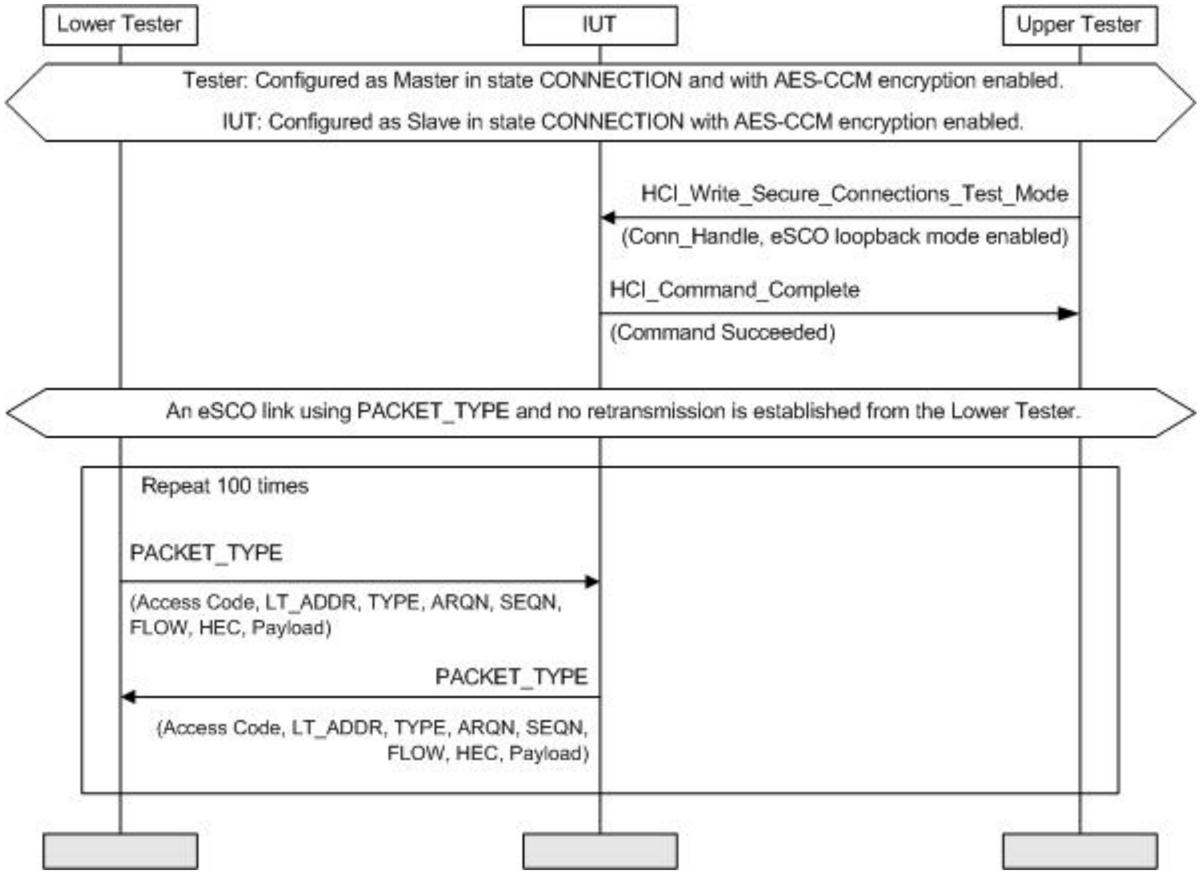

Figure 4.38: BB/PROT/COD/BV-44-C (PACKET_TYPE is EV5)

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) An eSCO link using EV5 packet type and no retransmission is established by the Lower Tester.
c) The Lower Tester transmits an EV5 packet to the IUT:

Access code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: ‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR—Logical Transport Address.

TYPE—‘1101'B

FLOW—‘1'B

ARQN—'0'B

SEQN—depends on the former transmission of the Lower Tester

Payload header:

Guard time—As defined in [1].

Sync sequence—As defined in [1].

Payload header—N/A

Payload body—80 non deterministic random Bytes of payload plus 16 bit CRC.

Trailer—As defined in [1].

d) The IUT replies with a packet of same description and ARQN bit set to ACK.
e) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
f) Steps c)–e) are repeated 99 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 100 packets containing a looped back payload.

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the Lower Tester received a packet properly encrypted and containing the same payload as it transmitted.

- Notes

  The payload is not protected by FEC but is CRC coded.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.7.1.40 BB/PROT/COD/BV-45-C [2-EV3 packet type with AES-CCM encryption]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of 2-EV3 packets with AES-CCM encryption.

- Reference

  [1] 6.5.3

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION with Secure Connection Test Mode (eSCO_Loopback_Mode enabled) enabled and with AES-CCM encryption enabled. Whitening is on. An eSCO link using 2-EV3 packet type and no retransmission is established.

- Test Procedure

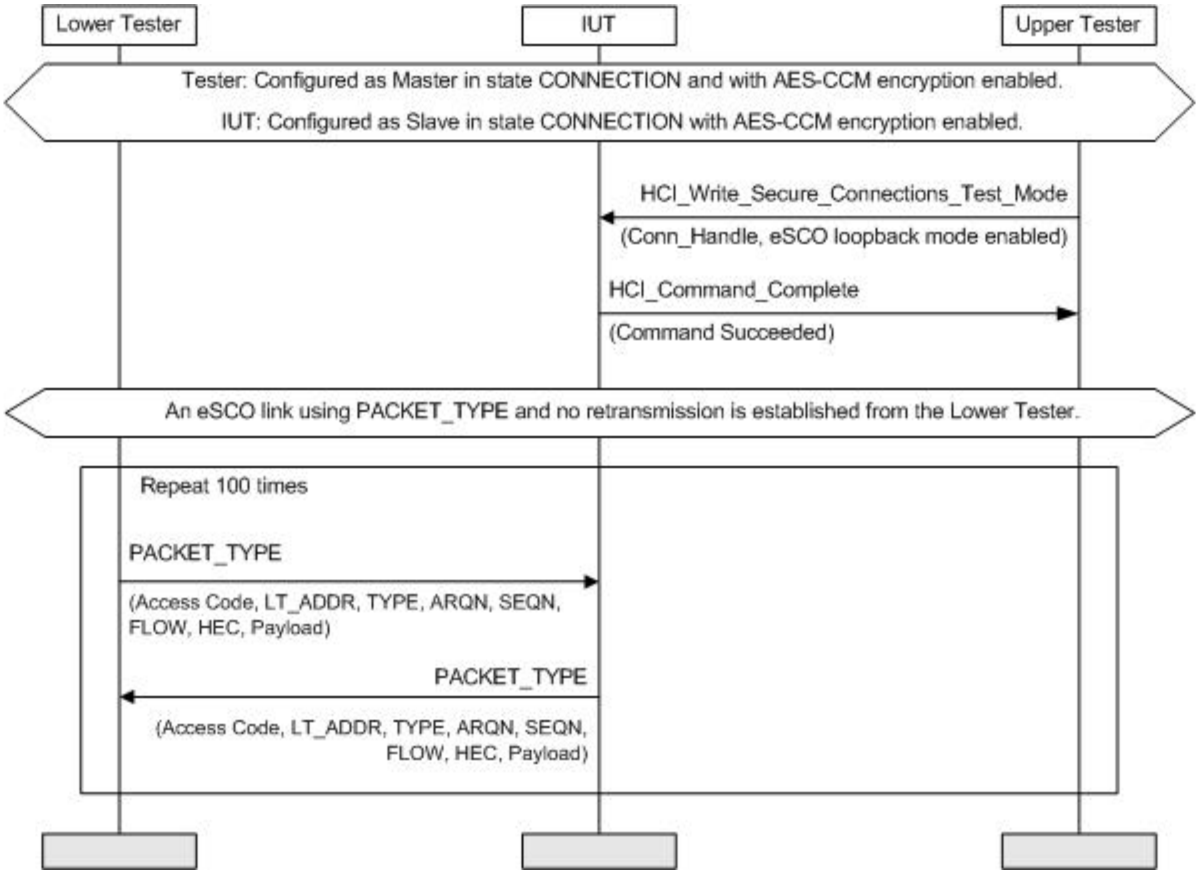

Figure 4.39: BB/PROT/COD/BV-45-C (PACKET_TYPE is 2-EV3)

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) An eSCO link using 2-EV3 packet type and no retransmission is established by the Lower Tester.
c) The Lower Tester transmits a 2-EV3 packet to the IUT:

Access code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: ‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet header: per [13] Section 6.4

LT_ADDR—Logical Transport Address.

TYPE—‘0110'B

FLOW—‘1'B

ARQN—'0'B

SEQN—depends on the former transmission of the Lower Tester

Payload header: per [13] Section 6.6.2

Payload body—60 non deterministic random Bytes of payload plus 16 bit CRC.

d) The IUT replies with a packet of same description and ARQN bit set to ACK.
e) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
f) Steps c)–e) are repeated 99 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 100 packets containing a looped back payload.

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the Lower Tester received a packet properly encrypted and containing the same payload as it transmitted.

- Notes

  The payload is not protected by FEC but is CRC coded.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.7.1.41 BB/PROT/COD/BV-46-C [2-EV5 packet type with AES-CCM encryption]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of 2-EV5 packets with AES-CCM encryption.

- Reference

  [1] 6.5.3

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION with Secure Connection Test Mode (eSCO_Loopback_Mode enabled) enabled and with AES-CCM encryption enabled. Whitening is on. An eSCO link using 2-EV5 packet type and no retransmission is established.

- Test Procedure

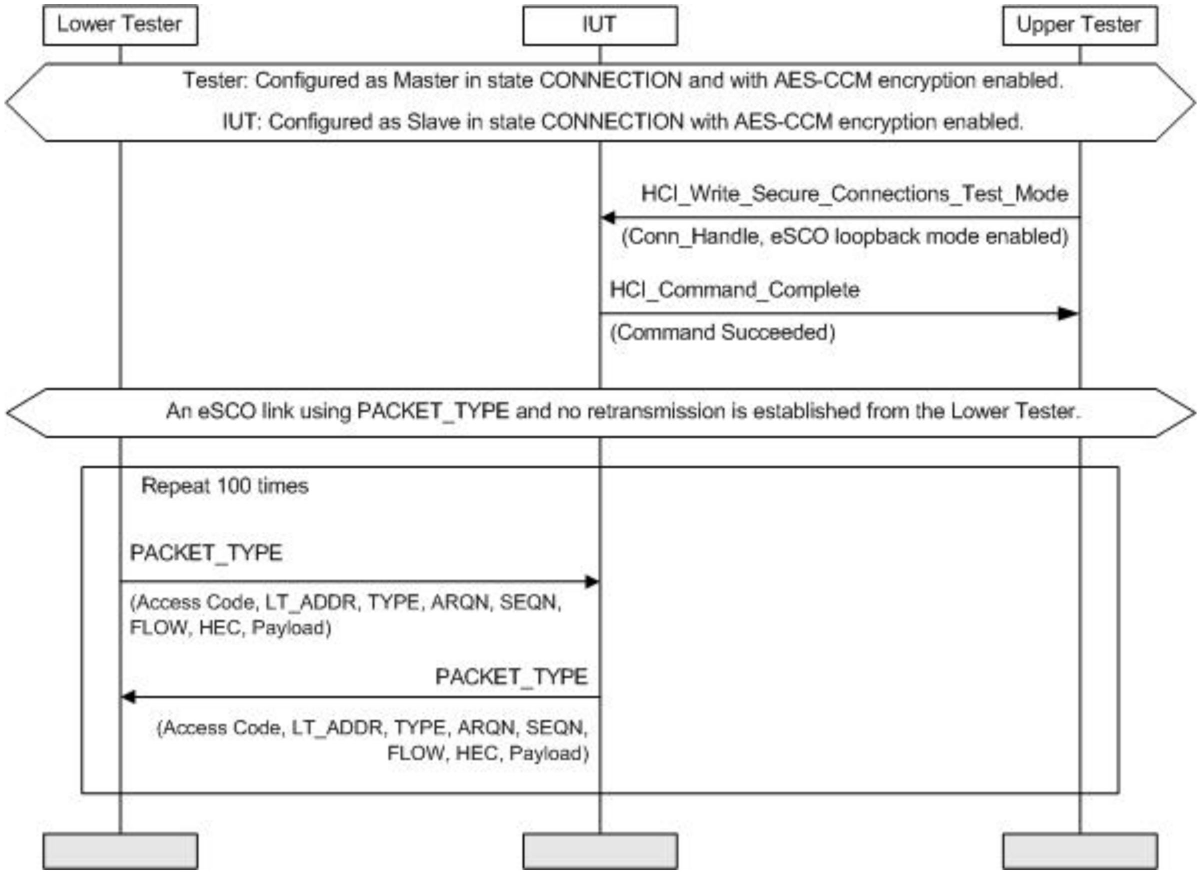

Figure 4.40: BB/PROT/COD/BV-46-C (PACKET_TYPE is 2-EV5)

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) An eSCO link using 2-EV5 packet type and no retransmission is established by the Lower Tester.
c) The Lower Tester transmits a 2-EV5 packet to the IUT:

Access code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: ‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet header: per [13] Section 6.4

LT_ADDR—Logical Transport Address.

TYPE—‘1100'B

FLOW—‘1'B

ARQN—'0'B

SEQN—depends on the former transmission of the Lower Tester

Payload header: per [13] Section 6.6.2

Payload body—80 non deterministic random Bytes of payload plus 16 bit CRC.

d) The IUT replies with a packet of same description and ARQN bit set to ACK.
e) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
f) Steps c)–e) are repeated 99 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 100 packets containing a looped back payload.

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the Lower Tester received a packet properly encrypted and containing the same payload as it transmitted.

- Notes

  The payload is not protected by FEC but is CRC coded.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.7.1.42 BB/PROT/COD/BV-47-C [3-EV3 packet type with AES-CCM encryption]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of 3-EV3 packets with AES-CCM encryption.

- Reference

  [1] 6.5.3

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION with Secure Connection Test Mode (eSCO_Loopback_Mode enabled) enabled and with AES-CCM encryption enabled. Whitening is on. An eSCO link using 3-EV3 packet type and no retransmission is established.

- Test Procedure

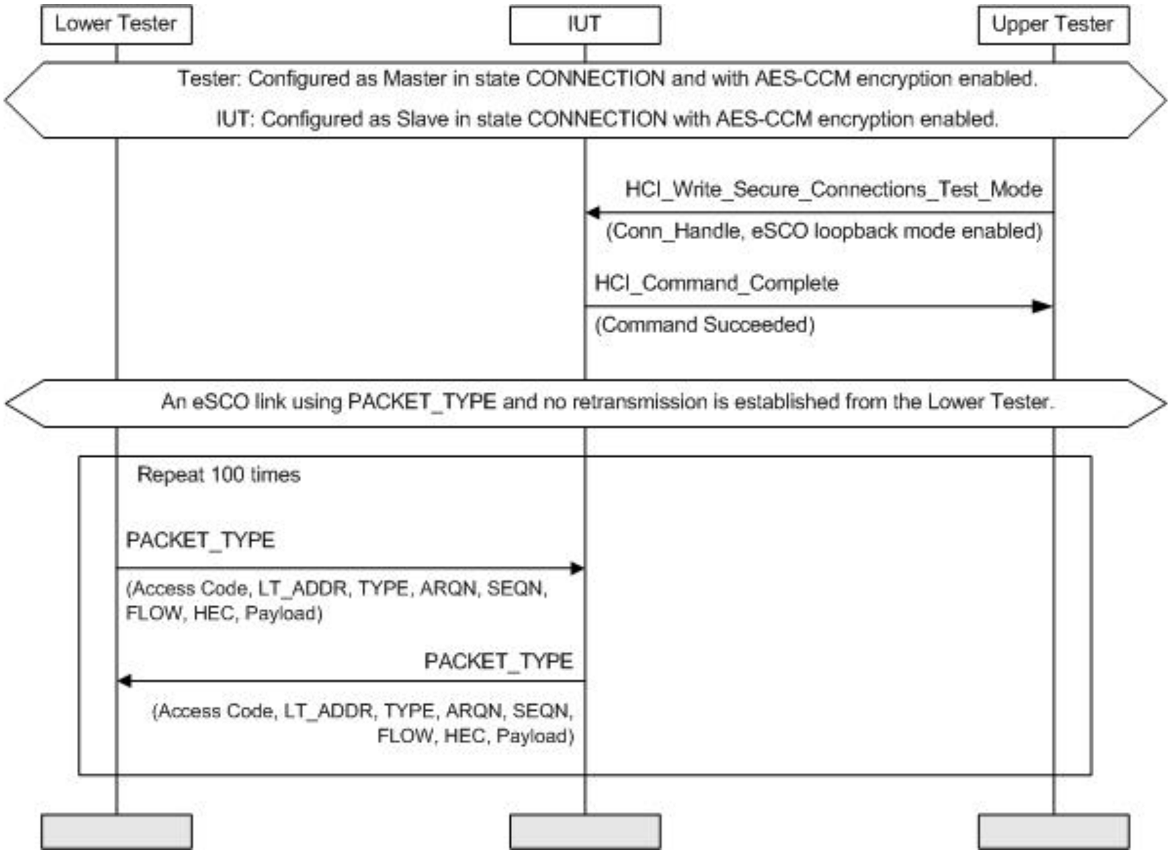

Figure 4.41: BB/PROT/COD/BV-47-C (PACKET_TYPE is 3-EV3)

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) An eSCO link using 3-EV3 packet type and no retransmission is established by the Lower Tester.
c) The Lower Tester transmits a 3-EV3 packet to the IUT:

Access code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: ‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet header: per [13] Section 6.4

LT_ADDR—Logical Transport Address.

TYPE—‘0111'B

FLOW—‘1'B

ARQN—'0'B

SEQN—depends on the former transmission of the Lower Tester

Payload header: per [13] Section 6.6.2

Payload header—N/A

Payload body—90 non deterministic random Bytes of payload plus 16 bit CRC.

d) The IUT replies with a packet of same description and ARQN bit set to ACK.
e) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
f) Steps c)–e) are repeated 99 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 100 packets containing a looped back payload.

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the Lower Tester received a packet properly encrypted and containing the same payload as it transmitted.

- Notes

  The payload is not protected by FEC but is CRC coded.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.7.1.43 BB/PROT/COD/BV-48-C [3-EV5 packet type with AES-CCM encryption]

- Test Purpose

  Verify that the IUT is capable of processing properly reception and transmission of 3-EV5 packets with AES-CCM encryption.

- Reference

  [1] 6.5.3

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION and with AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION with Secure Connection Test Mode (eSCO_Loopback_Mode enabled) enabled and with AES-CCM encryption enabled. Whitening is on. An eSCO link using 3-EV5 packet type and no retransmission is established.

- Test Procedure

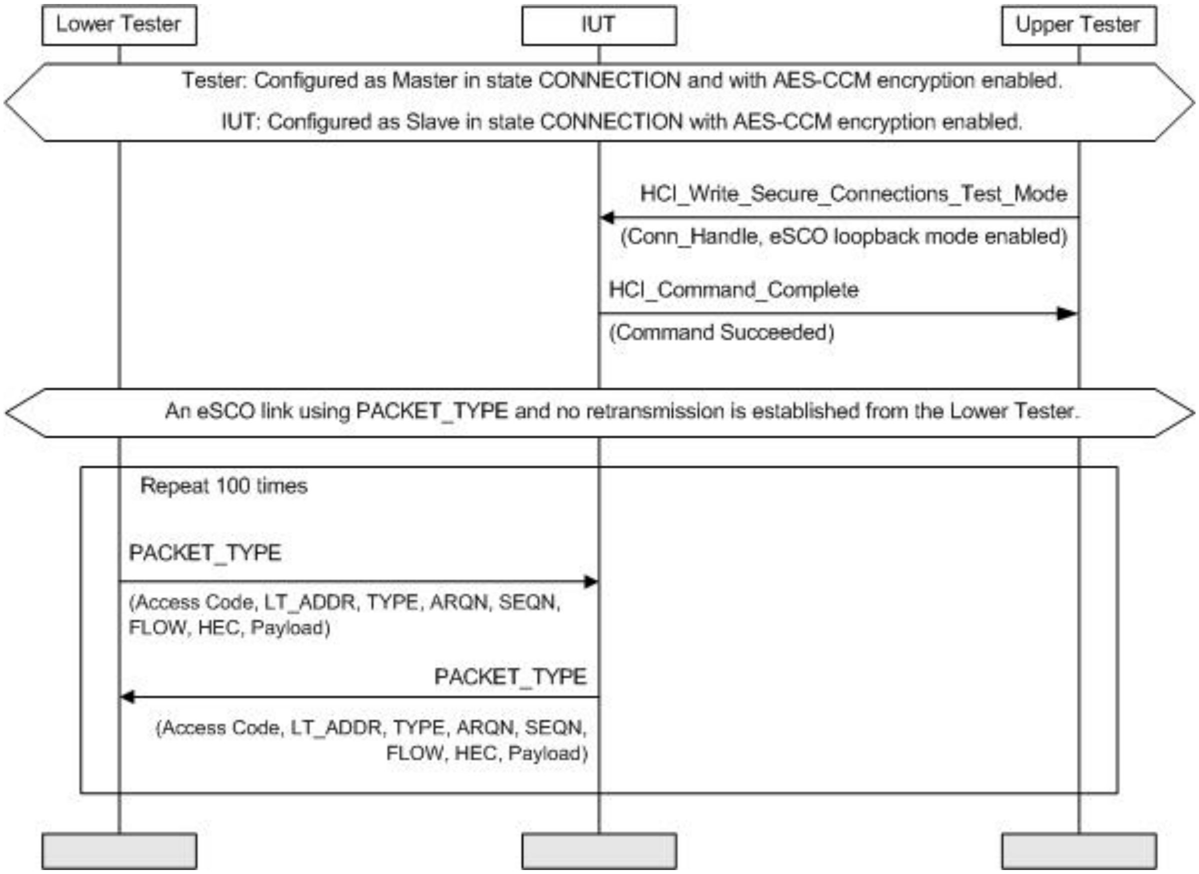

Figure 4.42: BB/PROT/COD/BV-48-C (PACKET_TYPE is 3-EV5)

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) An eSCO link using 3-EV5 packet type and no retransmission is established by the Lower Tester.
c) The Lower Tester transmits a 3-EV5 packet to the IUT:

Access code:

Preamble: ‘1010’B or ‘0101’B sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: ‘1010’B or ‘0101’B sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet header: per [13] Section 6.4

LT_ADDR—Logical Transport Address.

TYPE—‘1101'B

FLOW—‘1'B

ARQN—'0'B

SEQN—depends on the former transmission of the Lower Tester

Payload header: per [13] Section 6.6.2

Payload body—80 non deterministic random Bytes of payload plus 16 bit CRC.

d) The IUT replies with a packet of same description and ARQN bit set to ACK.
e) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
f) Steps c)–e) are repeated 99 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 100 packets containing a looped back payload.

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the Lower Tester received a packet properly encrypted and containing the same payload as it transmitted.

- Notes

  The payload is not protected by FEC but is CRC coded.

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.7.2 FEC (R=1/3)

Test subgroup objectives:

To verify that the Forward Error Correction, Rate = 1/3, is correctly implemented.

4.7.2.1 BB/PROT/COD/BV-12-C [Correctable Packet Header]

- Test Purpose

  Verify that the IUT, upon reception of a DM1 packet with a correctable error in the packet header, decodes and encodes the packet correctly.

- Reference

  [1] 7.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, ACL packets) active.

- Test Procedure

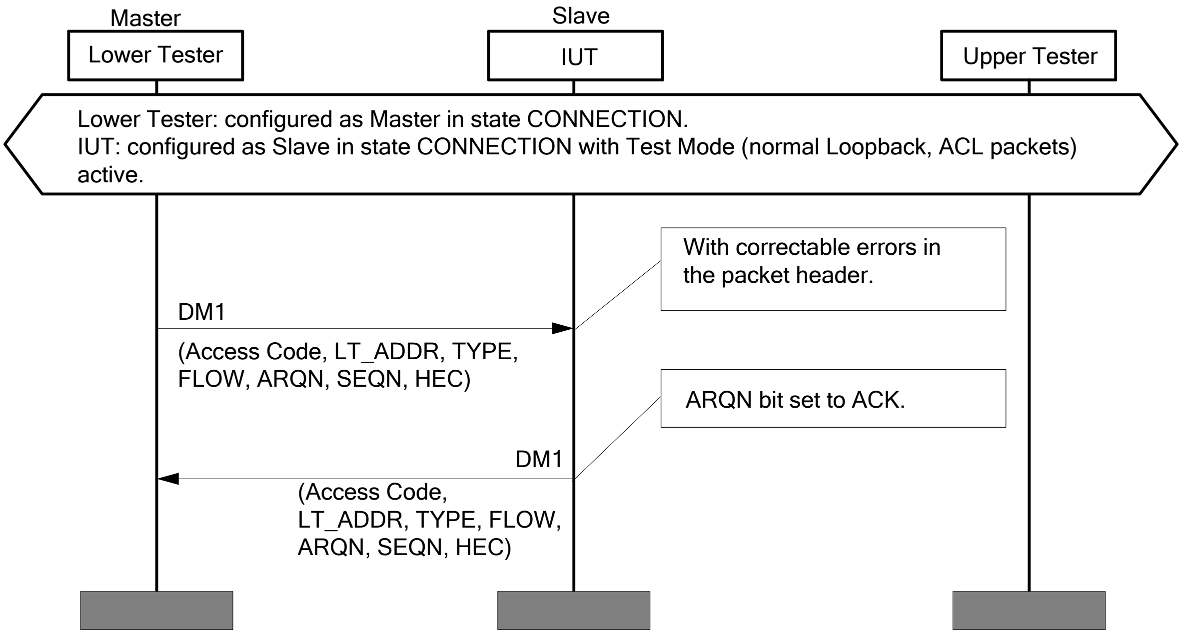

Figure 4.43: BB/PROT/COD/BV-12-C (Correctable packet header)

The Lower Tester transmits a DM1 packet with a correctable error in the packet header.

<u>DM1</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload Header:

LLID: '10'B indicating no fragmentation.

FLOW: '1'B.

LENGTH: '00000'B = '0'D.

Payload body: 0 Bytes.

The packet header is FEC 1/3 coded. After the coding procedure has successfully performed errors have to be inserted. In packets of three bits one bit will be changed.

The Lower Tester verifies that the IUT transmits the same packet back to the Lower Tester with the ARQN bit set to ACK.

This Test Procedure is repeated 100 times. The inserted correctable errors must be distributed in all possible bit error positions in the 100 packets, with only one error per packet.

- Expected Outcome

  Pass Verdict

  The IUT transmits the same packet with the ARQN bit set to ACK for at least or equal than 95% of the repetitions.

4.7.2.2 BB/PROT/COD/BV-14-C [Correctable Error HV1 Payload]

- Test Purpose

  Verify that the IUT, upon reception of a HV1 packet with a correctable error in the payload, decodes and encodes the packet correctly.

- Reference

  [1] 7.4

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, Synchronous packets) active.

- Test Procedure

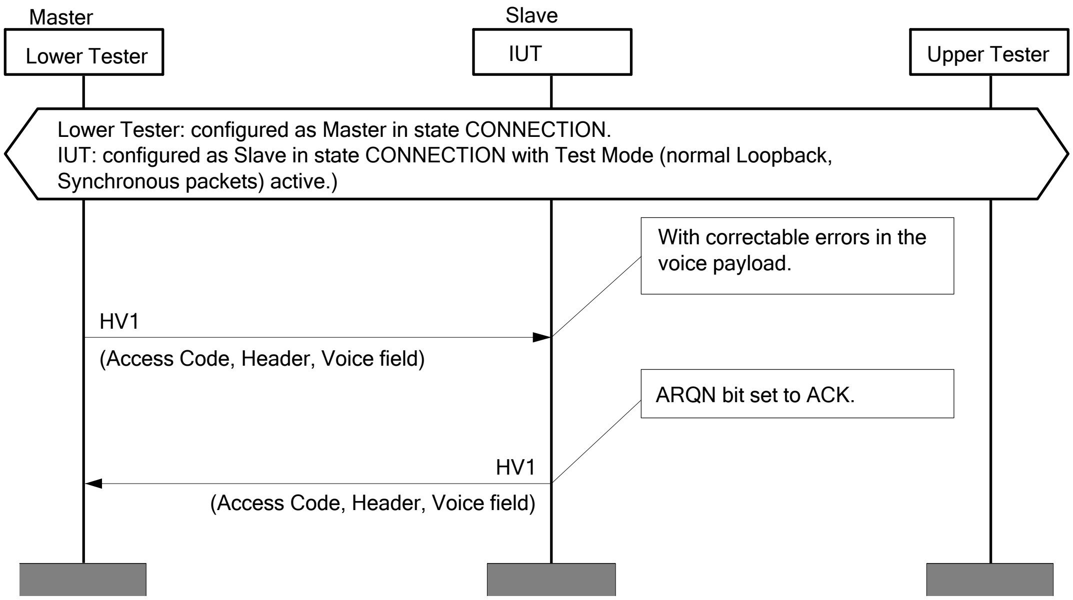

Figure 4.44: BB/PROT/COD/BV-14-C (Correctable error HV1 payload)

The Lower Tester transmits a HV1 packet with a correctable error in the payload.

<u>HV1</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0101'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Any value because data without CRC information is used.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload body: 10 Byte user payload.

The payload body is FEC 1/3 coded. After the coding procedure has been successfully performed errors have to be inserted. In blocks of three bits one bit will be changed.

The Lower Tester verifies that the IUT sends the packet correctly coded back to the Lower Tester with the ARQN bit set to ACK.

This Test Procedure is repeated 240 times to cover all bit positions after FEC is applied. The inserted correctable errors must be distributed in all 240 possible bit positions in the 240 packets, with only one error per packet.

- Expected Outcome

  Pass Verdict

  The IUT transmits the same packet with the ARQN bit set to ACK for at least or equal than 95% of the repetitions.

4.7.3 FEC (R=2/3)

Test subgroup objectives:

To verify that the Forward Error Correction, Rate = 2/3, is correctly implemented.

4.7.3.1 BB/PROT/COD/BV-16-C [Correctable Error DM1 Payload]

- Test Purpose

  Verify that the IUT, upon reception of a DM1 packet with a correctable error in the payload, decodes and encodes the packet correctly.

- Reference

  [1] 7.5

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION.

  IUT: Configured as Slave in state CONNECTION with Test Mode (Loopback, ACL packets) active.

- Test Procedure

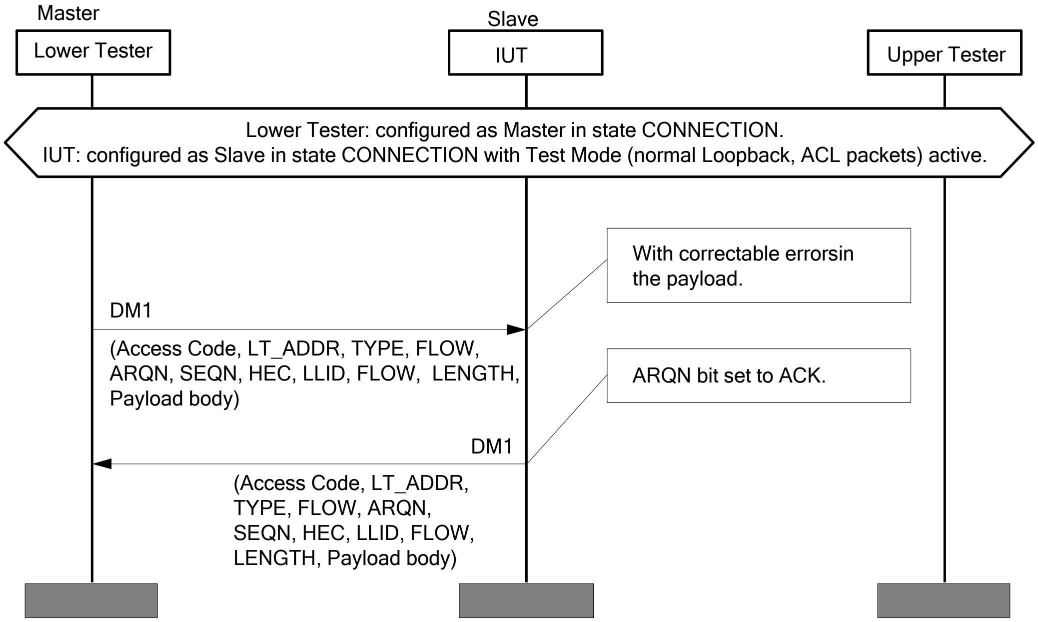

Figure 4.45: BB/PROT/COD/BV-16-C (Correctable error DM1 payload)

The Lower Tester transmits a DM1 packet with a correctable error in the payload.

DM1

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload Header:

LLID: '10'B indicating no fragmentation.

FLOW: '1'B.

LENGTH: '01001'B = '9'D.

Payload body: 9 Bytes PRBS.

This corresponds to 100 bits payload contents (1 Byte packet header 9 Bytes payload body and 2 Bytes CRC corresponds to 96 bits plus 4 zero bits for FEC coding) before FEC 2/3 coding. After FEC 2/3 coding the payload consists of 150 bits. In blocks of 15 bits one bit will be changed.

The Lower Tester verifies that the IUT transmits the packet correctly coded back to the Lower Tester with the ARQN bit set to ACK.

This Test Procedure is repeated 150 times to cover all bits positions after FEC is applied. The inserted correctable errors must be distributed in all 150 possible bit positions in the 150 packets, with only one error per packet.

- Expected Outcome

  Pass Verdict

  The IUT correctly acknowledges the DM1 packet sent by the Lower Tester.

  The IUT transmits the same DM1 packet, possibly after a loopback delay, for at least 95% of the repetitions.

4.8 ARQ

Test group objectives:

To verify that correct Automatic Repeat Request scheme is used.

4.8.1 ARQ Procedures - Master

Test subgroup objectives:

To verify that the ARQ scheme used by the Master is correct.

4.8.1.1 BB/PROT/ARQ/BV-01-C [Explicit NAK]

- Test Purpose

  Verify that the IUT configured as Master, upon reception of a packet with its ARQN bit set to NAK (explicit NAK), retransmits the packet again.

- Reference

  [1] 6.4.4, 7.6, 7.6.2

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

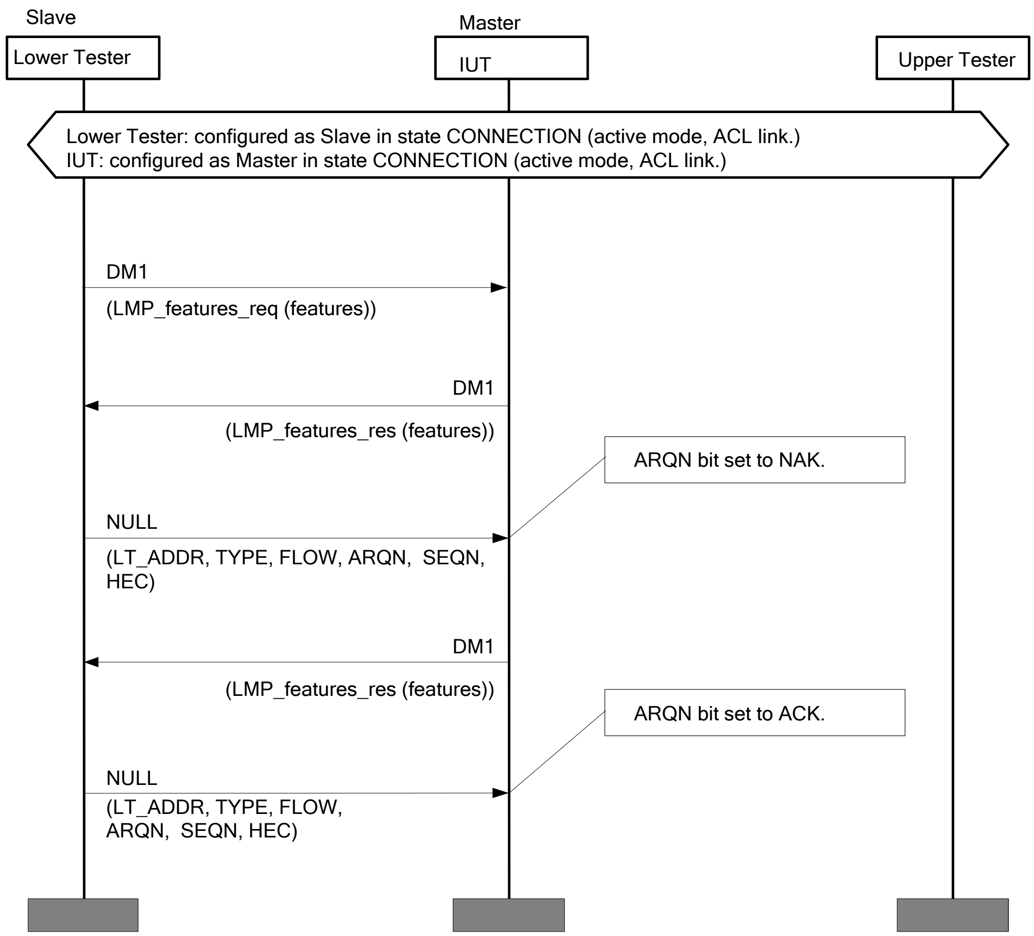

Figure 4.46: BB/PROT/ARQ/BV-01-C (Explicit NAK)

The Lower Tester transmits an *LMP_features_req* message.

The Lower Tester verifies that the IUT transmits a DM1 packet containing *LMP_features_res*.

The Lower Tester acknowledges the packet with a NULL packet with ARQN bit set to NAK.

<u>NULL</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0000'B.

FLOW: '1'B.

ARQN: '0'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

The Lower Tester verifies that the IUT retransmits the packet.

- Expected Outcome

  Pass Verdict

  The IUT retransmits the packet after receiving the NULL packet with the ARQN bit set to NAK.

4.8.1.2 BB/PROT/ARQ/BV-02-C [Implicit NAK]

- Test Purpose

  Verify that the IUT configured as Master, when the acknowledgement is left out (implicit NAK), retransmits the packet again.

- Reference

  [1] 6.4.4, 7.6

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

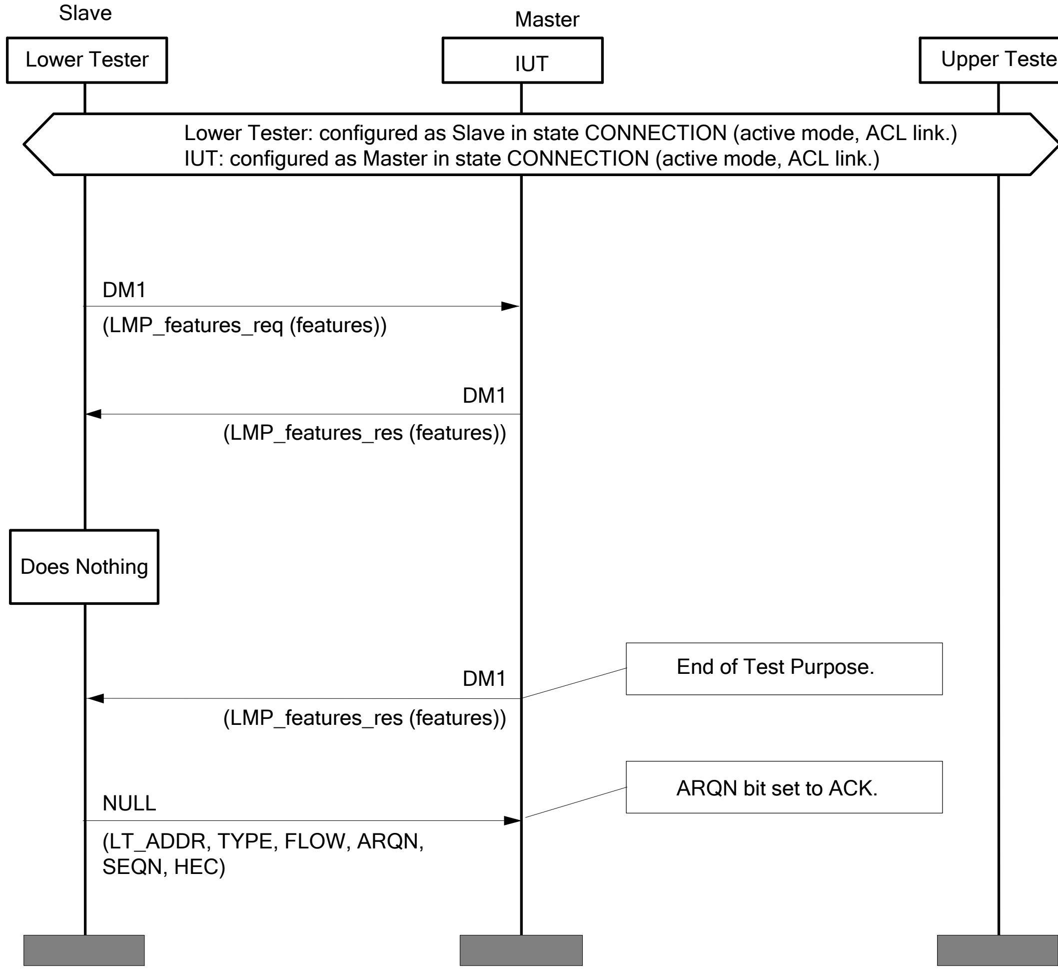

Figure 4.47: BB/PROT/ARQ/BV-02-C (Implicit NAK)

The Lower Tester transmits an *LMP_features_req* message.

The Lower Tester verifies that the IUT transmits a DM1 packet containing *LMP_features_res*.

The Lower Tester does not send any packet.

The Lower Tester verifies that the IUT retransmits the packet.

- Expected Outcome

Pass Verdict

The IUT retransmits the packet after not receiving any response from the Lower Tester.

4.8.1.3 BB/PROT/ARQ/BV-03-C [Uncorrectable Packet Header]

- Test Purpose

Verify that the IUT configured as Master, upon reception of a packet with uncorrectable errors in the packet header, transmits the next packet addressing the same Slave with the ARQN bit set to NAK.

- Reference

  [1] 6.4.4, 7.6

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

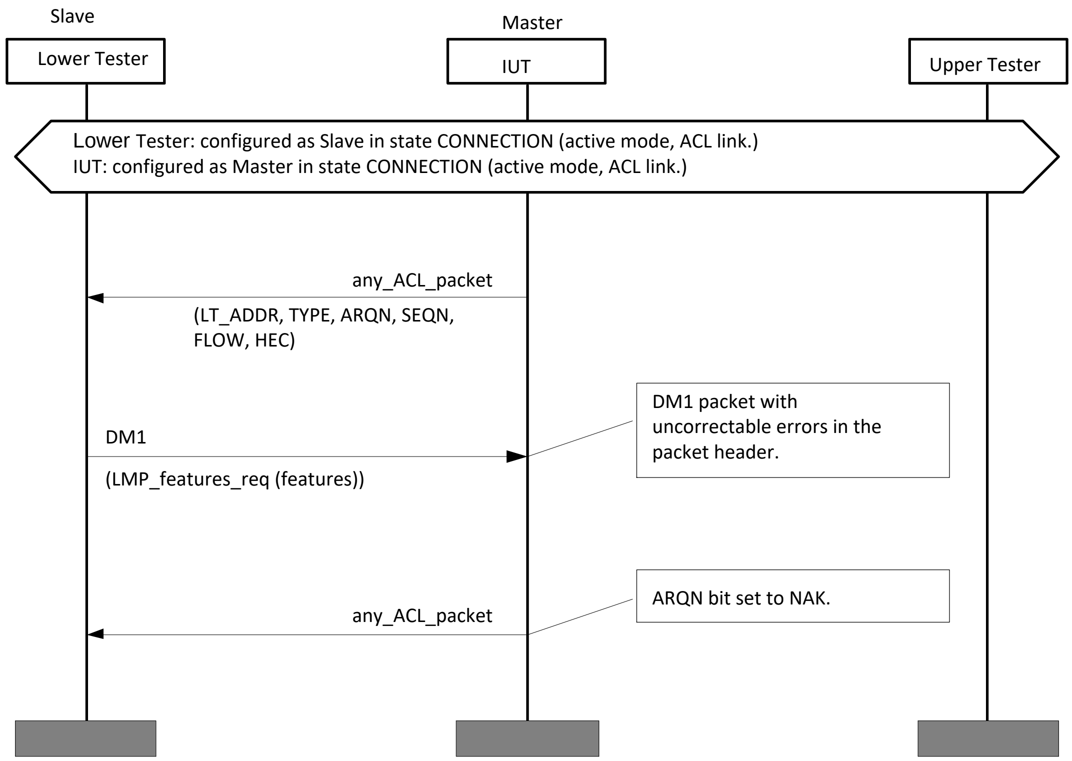

Figure 4.48: BB/PROT/ARQ/BV-03-C (Uncorrectable packet header)

The Lower Tester transmits a DM1 packet containing the *LMP_features_req* message with an uncorrectable error in the packet header.

<u>DM1</u>

Access Code:

> Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.
>
> Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).
>
> Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the previous transmission from the Lower Tester and ACK or NAK from the IUT.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

The packet header is FEC 1/3 coded. After the coding procedure has successfully performed errors have to be inserted. The maximum number of inserted errors depends on the Hamming distance provided by the HEC.

Payload Header:

LLID: '11'B indicating a LMP message.

FLOW: '1'B.

LENGTH: '01001'B = '9'D.

Payload body: 9 Bytes.

1. Byte = '4F'H Transaction ID and OpCode.

2. to 9. Byte = '00'H.

The Lower Tester verifies that the IUT transmits an ACL packet with the ARQN bit set to NAK in the next Master to Slave transmission.

This Test Procedure is repeated 100 times. The inserted uncorrectable errors must be statistically distributed.

- Expected Outcome

  Pass Verdict

  For at least 99 percent of the repetitions the IUT transmits a packet with the ARQN bit set to NAK in the next transmission to the Slave.

- Notes

  This test should lead to the Lower Tester transmitting 100 consecutive packets with uncorrectable errors.

4.8.1.4 BB/PROT/ARQ/BV-04-C [Uncorrectable Payload]

- Test Purpose

  Verify that the IUT configured as Master, upon reception of a DM1 packet with uncorrectable errors in the payload transmits a packet with the ARQN bit set to NAK.

- Reference

  [1] 6.4.4, 7.6

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

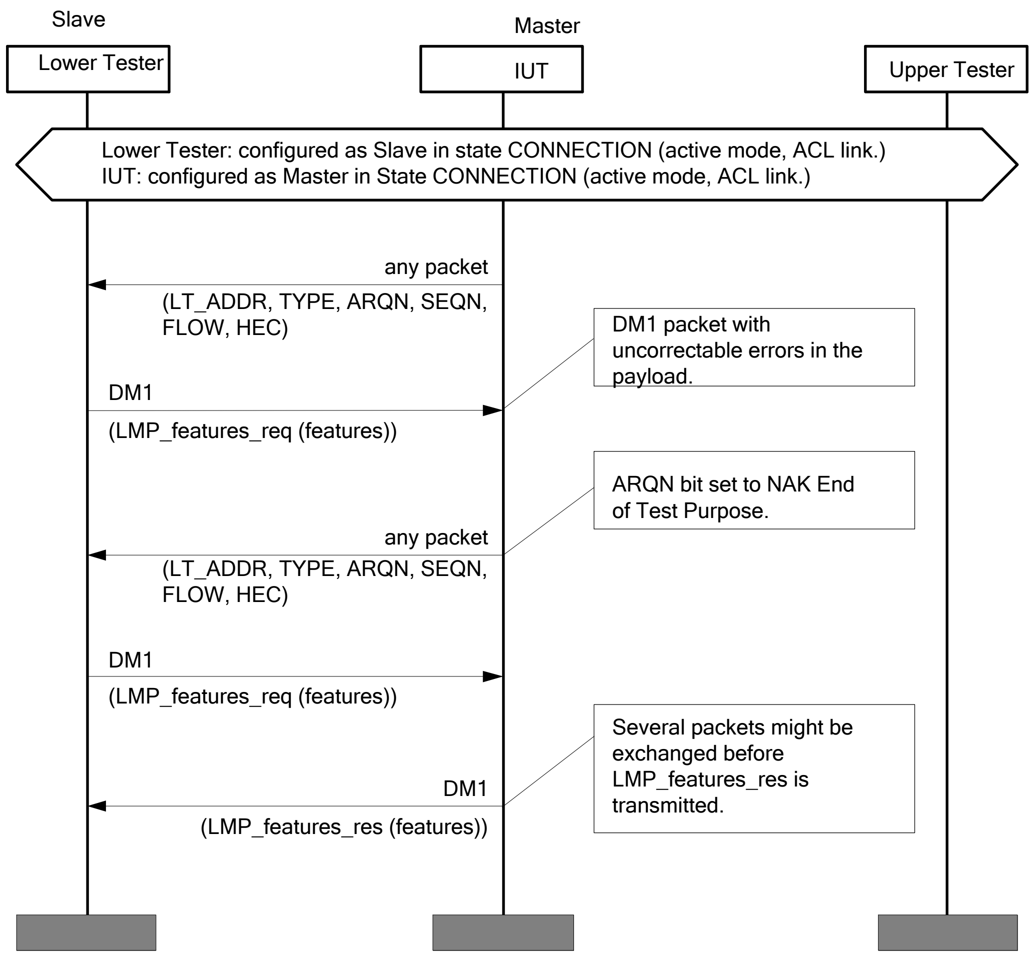

Figure 4.49: BB/PROT/ARQ/BV-04-C (Uncorrectable payload)

The Lower Tester transmits a DM1 packet containing the LMP_features_req message with an uncorrectable error in the payload.

DM1

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the previous transmission from the Lower Tester and ACK or NAK from the IUT.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload Header:

LLID: '11'B indicating a LMP message.

FLOW: '1'B.

LENGTH: '01001'B = '9'D.

Payload body: 9 Bytes.

1. Byte = ‘4F’H Transaction ID and OpCode.

2. to 9. Byte = '00'H.

This corresponds to 90 bits payload contents (1 Byte packet header 8 Bytes payload body and 2 Bytes CRC corresponds to 88 bits plus 2 zero bits for FEC coding) before FEC 2/3 coding. After FEC 2/3 coding the payload consists of 135 bits. The maximum number of inserted errors depends on the Hamming distance provided by the CRC.

Then the Lower Tester verifies that the IUT transmits any packet with the ARQN bit set to NAK.

This Test Procedure is repeated 100 times. The inserted uncorrectable errors must be statistically distributed.

- Expected Outcome

  Pass Verdict

  For at least 99 percent of the repetitions the IUT transmits a packet with the ARQN bit set to NAK in the next transmission to the Slave.

4.8.1.5 BB/PROT/ARQ/BV-05-C [SEQN]

- Test Purpose

  Verify that the IUT configured as Master, respects SEQN values in the transmit case.

- Reference

  [1] 7.6.2

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  The Lower Tester does not support any feature.

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

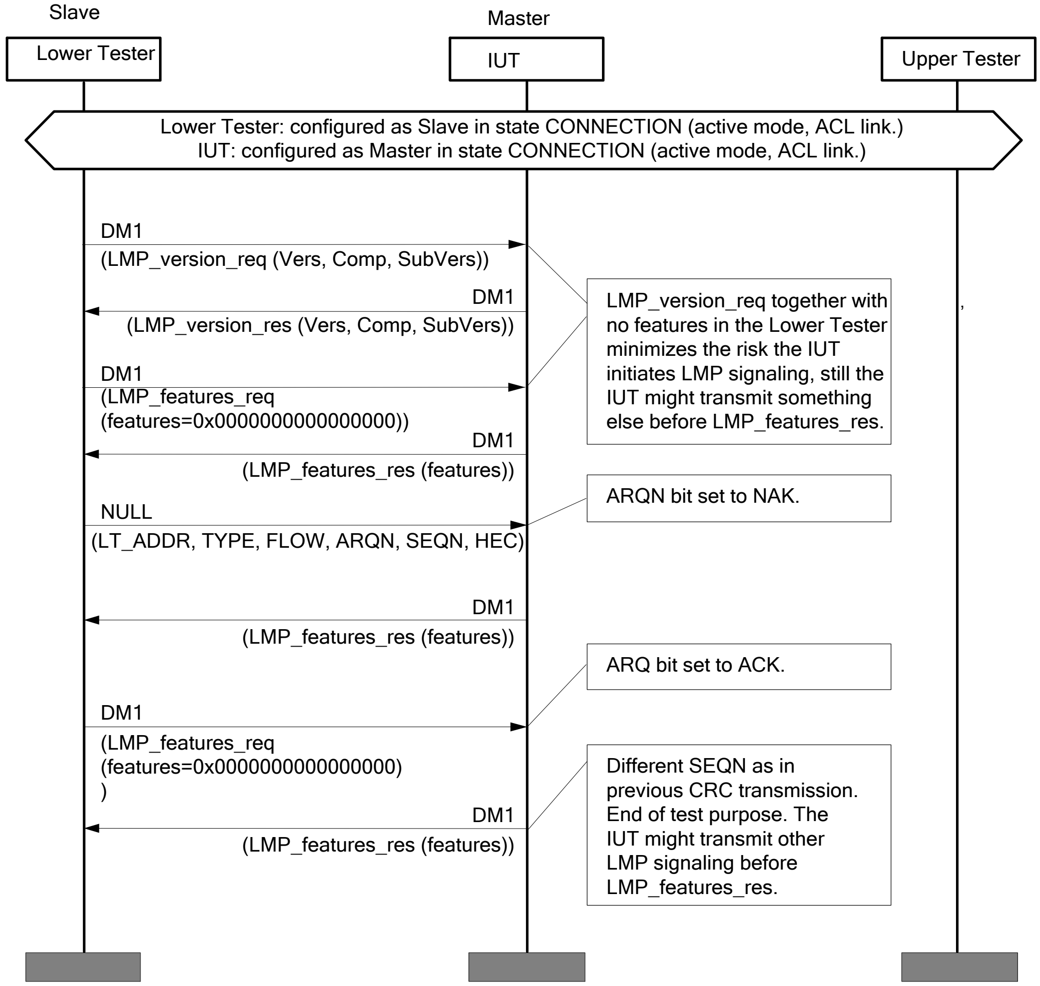

Figure 4.50: BB/PROT/ARQ/BV-05-C (SEQN)

The Lower Tester transmits LMP_features_req. The Lower Tester verifies that the IUT transmits a DM1 packet containing LMP_features_res. The Lower Tester has to store the SEQN value (first SEQN value) contained in the packet header.

The Lower Tester acknowledges the packet with a NULL packet with the ARQN bit set to NAK.

<u>NULL</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0000'B.

FLOW: '1'B.

ARQN: '0'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

The Lower Tester verifies that the IUT retransmits the DM1 packet containing LMP_features_res with the same SEQN value (second SEQN value) as in the previous transmission. The Lower Tester has to store the SEQN value contained in the packet header.

The Lower Tester transmits a DM1 packet containing the LMP_features_req again with the ARQN bit set to ACK.

The Lower Tester verifies that the IUT transmits a DM1 packet with a different SEQN value (third SEQN value) compared to the previous transmissions.

- Expected Outcome

  Pass Verdict

  The second SEQN value is the same as the first SEQN value. The third SEQN value is not the same as the second SEQN value.

- Notes

  The IUT might transmit unsolicited LMP signaling changing the intended Test Procedure. This risk is minimized by having the Lower Tester transmit LMP_version_req immediately after connection establishment and always indicate no feature is supported.

4.8.1.6 BB/PROT/ARQ/BV-06-C [FLOW Control]

- Test Purpose

  Verify that the IUT configured as Master, stops transmitting upon receiving STOP indication, switch to default packet types and resumes to transmit when GO indication is received.

- Reference

  [1] 4.5.3

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

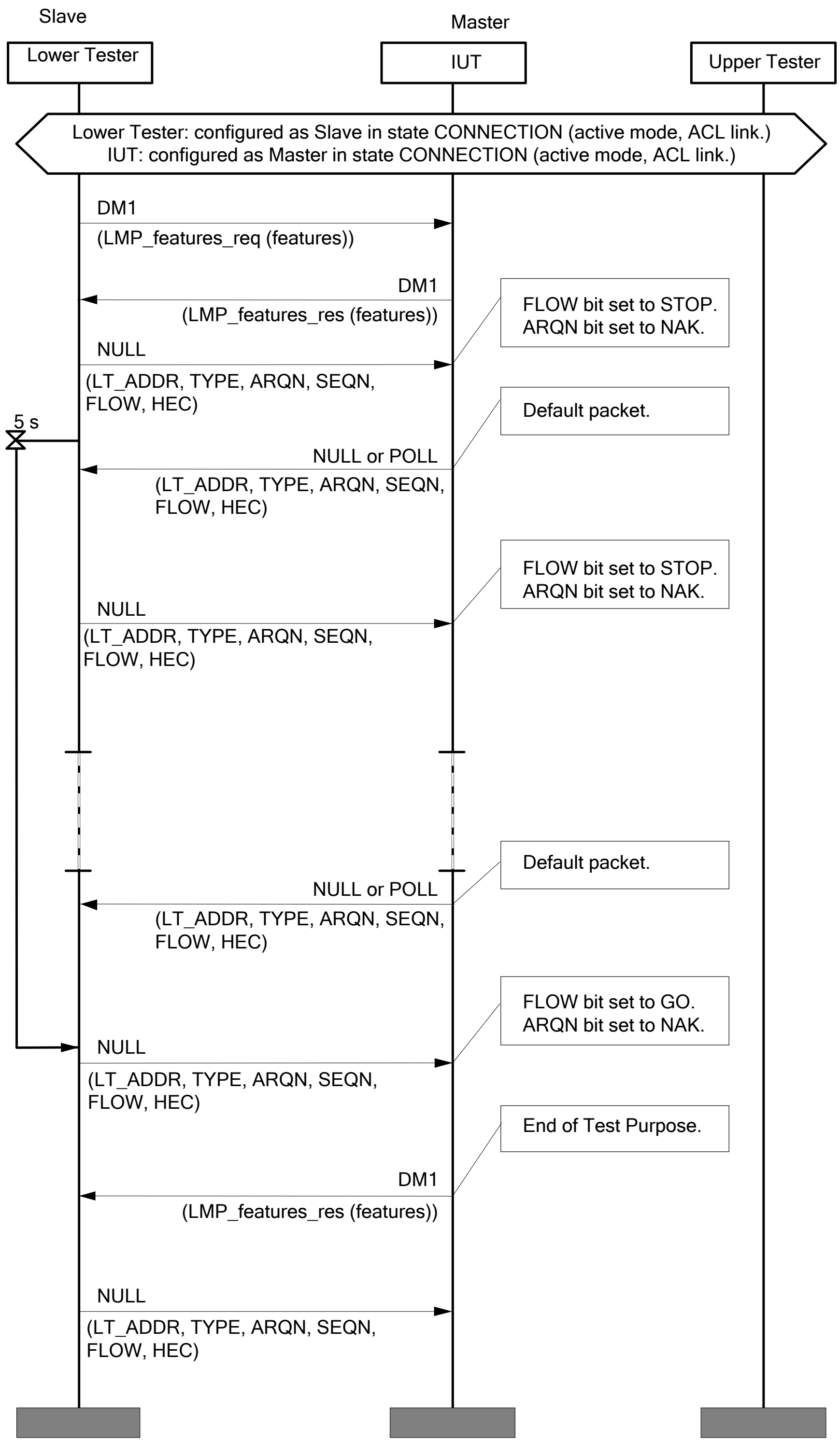

Figure 4.51: BB/PROT/ARQ/BV-06-C (FLOW control)

The Lower Tester transmits *LMP_features_req*. The Lower Tester verifies that the IUT transmits a DM1 packet containing *LMP_features_res*. The Lower Tester responds the next 5 s with NULL packets with the FLOW bit set to '0'B indicating STOP and the ARQN bits set to NAK to guarantee a retransmission after indicating GO.

The Lower Tester verifies that the IUT stops transmission and switches to the default packet type (NULL or POLL).

The Lower Tester sends a NULL packet with FLOW bit set to '1'B indicating GO after the 5 s.

NULL

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0000'B.

FLOW: '1'B.

ARQN: '0'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

The Lower Tester verifies that the IUT transmits a DM1 packet containing an *LMP_features_res*.

- Expected Outcome

  Pass Verdict

  The IUT stops transmitting upon receiving STOP, switch to the default packet type and resumes to transmit when the GO indication is received. Maximum 5% of the NULL packets sent by the Lower Tester with the FLOW bit indicating STOP is answered by the IUT sending LMP_features_res.

- Notes

  If the IUT misses a packet from the Lower Tester, it might interpret this as implicit GO and transmit the LMP_features_res even though the Lower Tester did not remove the stop indication. This would result in a false failure so the IUT is allowed to send the response for 5% of the given STOP indications.

4.8.1.7 BB/PROT/ARQ/BV-08-C [Implicit GO]

- Test Purpose

  Verify that the IUT configured as Master, goes back to normal transmission mode when the Lower Tester sends implicit GO.

- Reference

  [1] 4.5.3

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

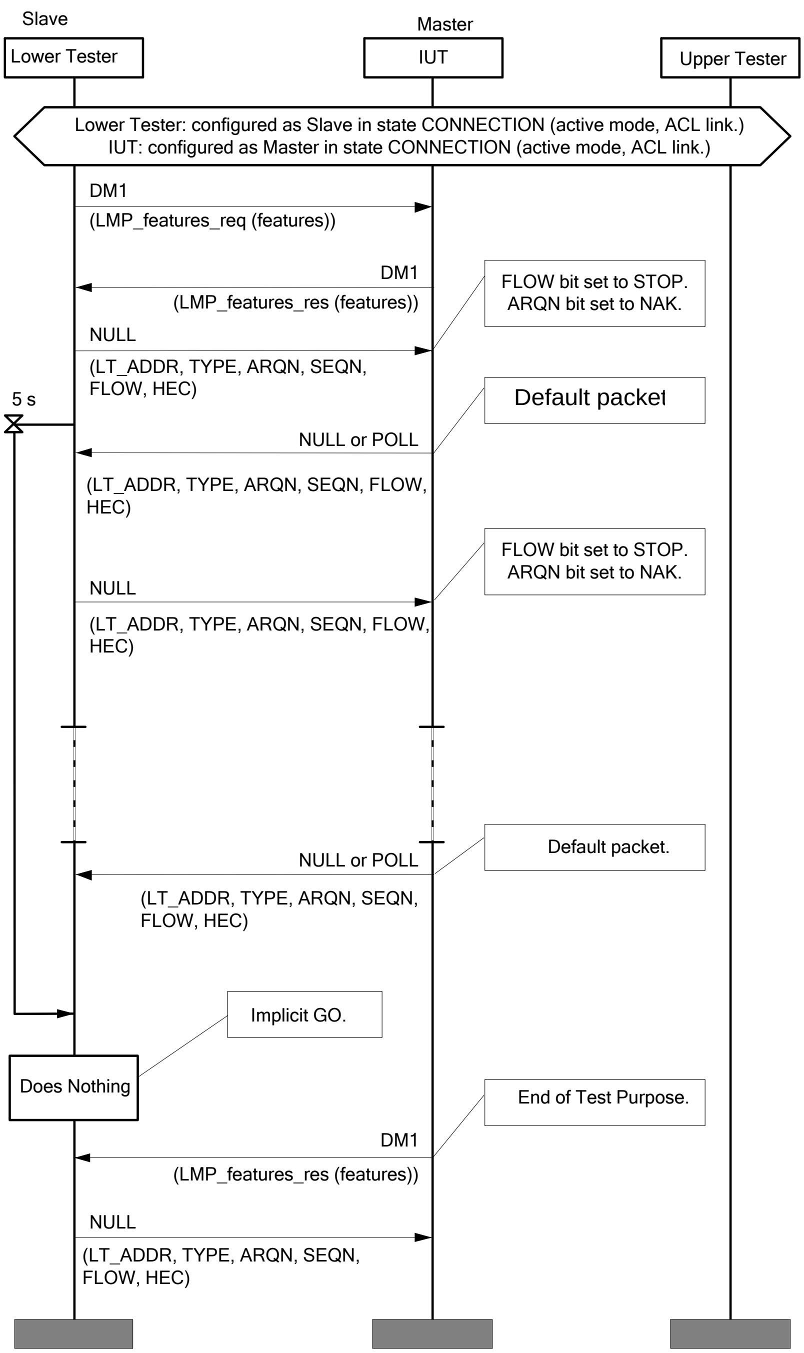

Figure 4.52: BB/PROT/ARQ/BV-08-C (Implicit GO)

The Lower Tester transmits LMP_features_req. The Lower Tester verifies that the IUT transmits a DM1 packet containing LMP_features_res. The Lower Tester responds the next 5 s with NULL packets with the FLOW bit set to '0'B indicating STOP and the ARQN bits set to NAK to guarantee a retransmission after indicating GO.

The Lower Tester verifies that the IUT stops transmission and switches to the default packet type (NULL or POLL).

The Lower Tester verifies that the IUT transmits a DM1 packet containing LMP_features_res.

- Expected Outcome

  Pass Verdict

  The IUT goes back to normal transmission mode upon reception of an implicit GO. Maximum 5 percent of the NULL packets sent by the Lower Tester with the FLOW bit indicating STOP is answered by the IUT sending LMP_features_res.

- Notes

  If the IUT misses a packet from the Lower Tester, it might interpret this as implicit GO and transmit the LMP_features_res even though the Lower Tester did not remove the stop indication. This would result in a false failure so the IUT is allowed to send the response for 5% of the given STOP indications.

4.8.1.8 BB/PROT/ARQ/BV-10-C [Same SEQN Value]

- Test Purpose

  Verify that the ARQN bit is set to ACK and the data are disregarded if a packet with CRC information with a correct header is received that has the same SEQN value as in the previous reception.

- Reference

  [1] 7.6.1

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

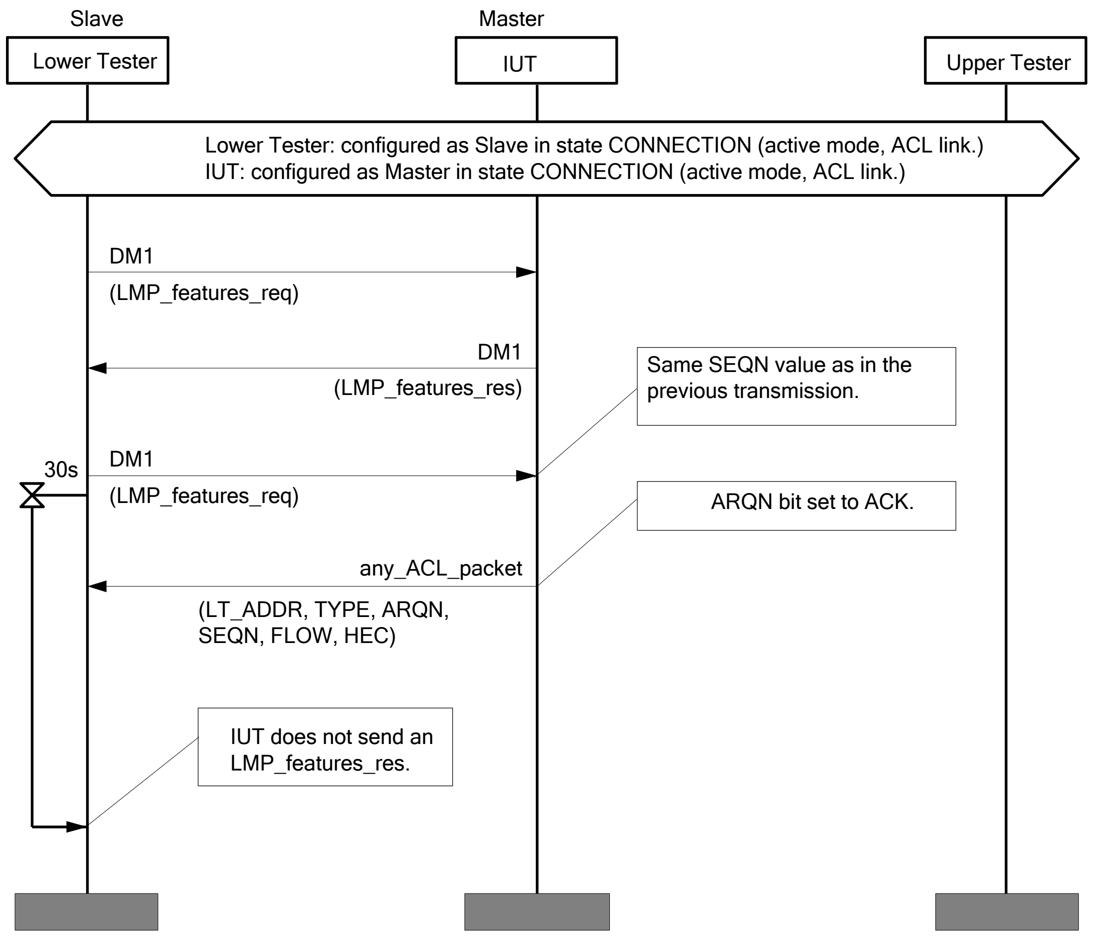

Figure 4.53: BB/PROT/ARQ/BV-10-C (Same SEQN value)

The Lower Tester sends a DM1 packet containing LMP_features_req message.

The Lower Tester verifies that the IUT sends a DM1 packet containing an LMP_features_res message.

The Lower Tester repeats the former DM1 packet containing the LMP_features_req message (same SEQN value).

The Lower Tester verifies that the IUT sends a packet with the ARQN bit set to ACK and verifies that the IUT does not respond to the 2nd LMP_features_req message with an LMP_features_res the next 30s.

- Expected Outcome

<u>Pass Verdict</u>

The IUT acknowledges with a packet with the ARQN bit set ACK and does not respond to the 2nd LMP_features_req message with an LMP_features_res for the next 30s.

4.8.1.9 BB/PROT/ARQ/BV-27-C [Explicit NAK – eSCO Master]

- Test Purpose

  Verify that the IUT when configured as Master, upon reception of an eSCO packet with its ARQN bit set to NAK (explicit NAK) prior to the end of the retransmission window, transmits the packet again.

- Reference

  [1] 6.4.4, 7.6

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

  An eSCO link with the following parameters is set up between the Lower Tester and the IUT:

  - eSCO handle: Any valid number.
  - eSCO *LT_ADDR*: Set by IUT.
  - Timing control flags: Derived from IUT Master clock.
  - Desco: Set by IUT.
  - Tesco: 6 slots.
  - Wesco: 2 slots.
  - Packet type M→S: EV3.
  - Packet type S→M: EV3.
  - Packet length M→S: 30 bytes.
  - Packet length S→M: 30 bytes.
  - Air mode: Any supported air mode.
  - Negotiation Flag: Initiate Negotiation.

- Test Procedure

  1. The Lower Tester verifies that the IUT transmits an EV3 packet at the eSCO instant.
  2. The Lower Tester transmits an EV3 packet in the following slot:

  <u>EV3</u>

  Access Code:

    Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

    Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

    Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the eSCO link.

TYPE: ‘0111’B.

FLOW: ‘1’B.

ARQN: ‘0’B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial ‘647’O in respect to the UAP of the Master.

Payload Header:

N/A

Payload:

30 bytes PRBS plus 16 bit CRC.

1. The Lower Tester verifies that the IUT retransmits the EV3 packet.

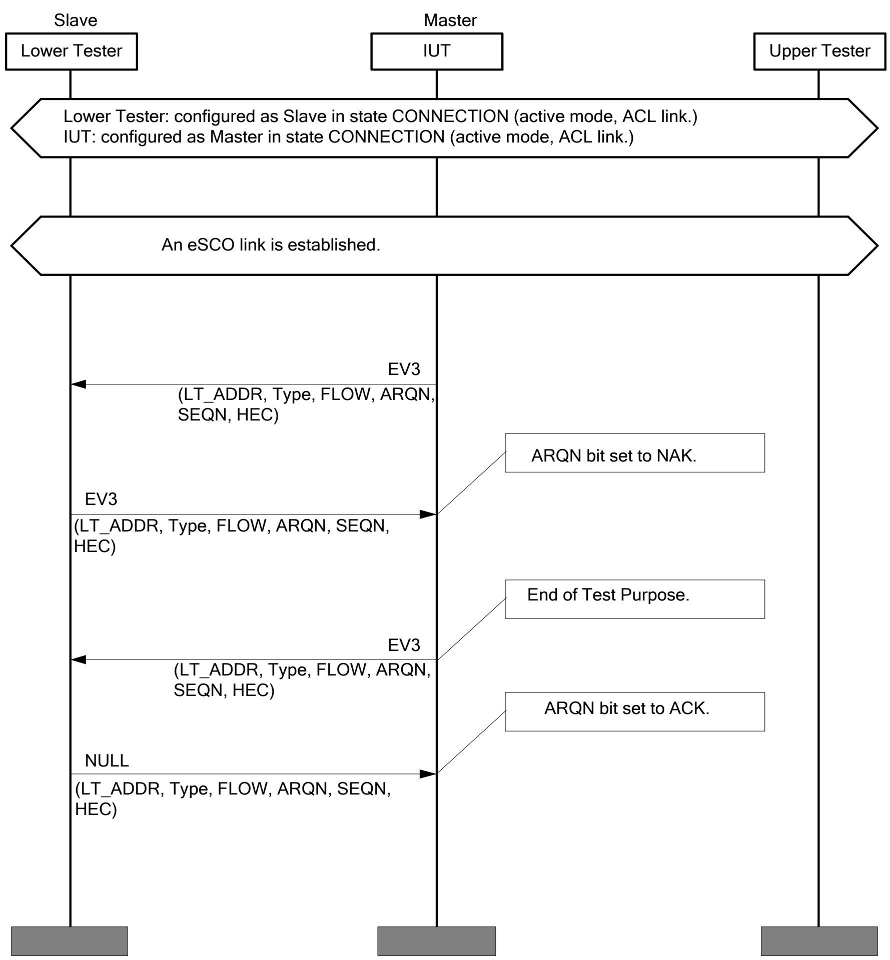

Figure 4.54: BB/PROT/ARQ/BV-27-C (Explicit NAK – eSCO Master)

- Expected Outcome

  Pass Verdict

  The IUT retransmits the packet after receiving the EV3 packet with the ARQN bit set to NAK.

- Notes

  An IXIT [14] statement is used to distinguish between IUTs requiring HCI interaction to generate EV packets and IUTs transmitting the packets without HCI interaction. Optionally the IUT might send HCI eSCO packets to the Upper Tester.

4.8.1.10 BB/PROT/ARQ/BV-28-C [Implicit NAK – eSCO Master]

- Test Purpose

  Verify that the IUT when configured as Master, when the acknowledgement is left out (implicit NAK) prior to the end of the retransmission window, transmits the packet again.

- Reference

  [1] 6.4.4, 7.6

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

  An eSCO link with the following parameters is set up between the Lower Tester and the IUT:

  - eSCO handle: Any valid number.
  - eSCO LT_ADDR: Set by IUT.
  - Timing control flags: Derived from IUT Master clock.
  - Desco: Set by IUT.
  - Tesco: 6 slots.
  - Wesco: 2 slots.
  - Packet type M→S: EV3.
  - Packet type S→M: EV3.
  - Packet length M→S: 30 bytes.
  - Packet length S→M: 30 bytes.
  - Air mode: Any supported air mode.
  - Negotiation Flag: Initiate Negotiation.

- Test Procedure

  1. The Lower Tester verifies that the IUT transmits an EV3 packet at the eSCO instant.
  2. The Lower Tester transmits nothing in the following slot.
  3. The Lower Tester verifies that the IUT retransmits the EV3 packet.

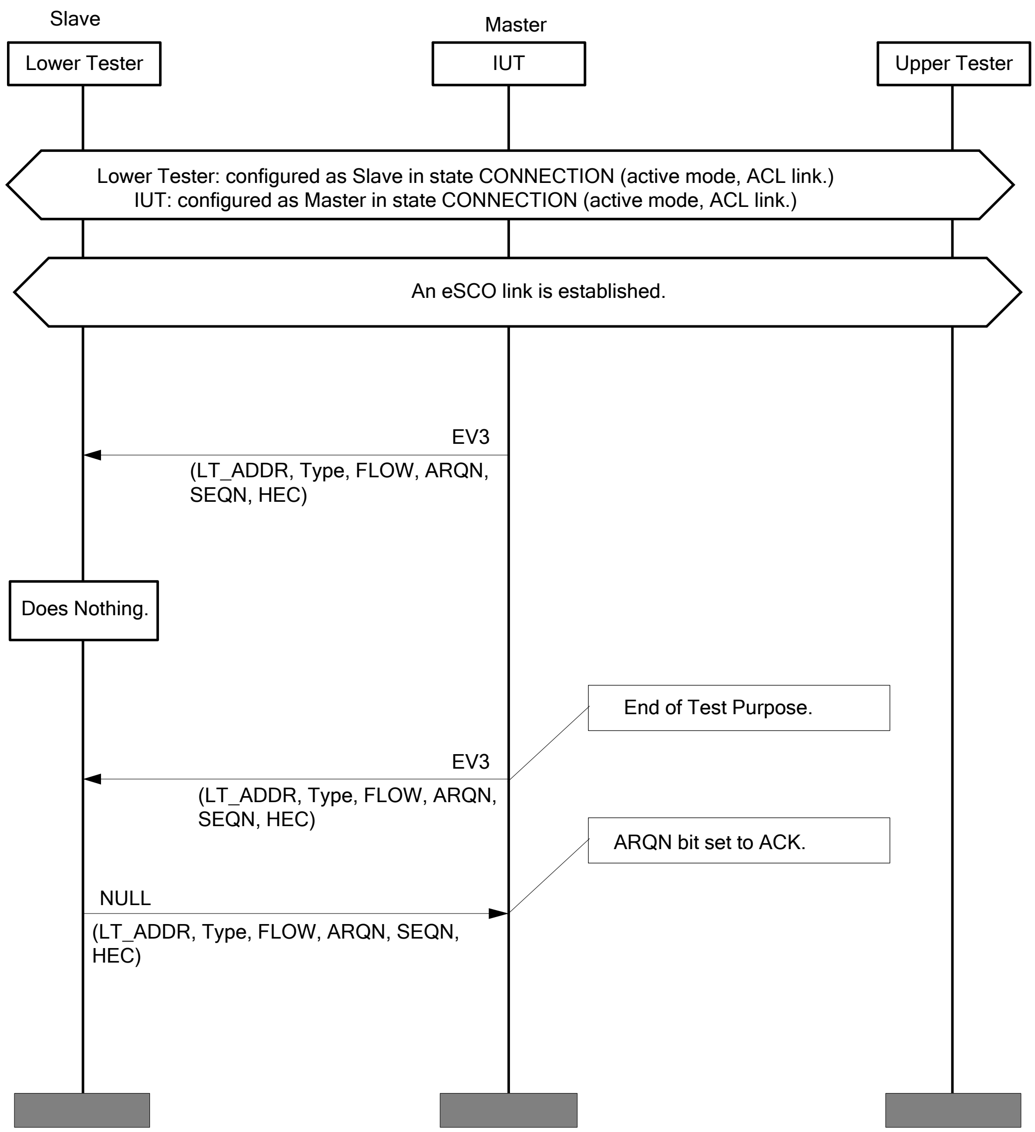

Figure 4.55: BB/PROT/ARQ/BV-28-C (Implicit NAK – eSCO Master)

- Expected Outcome

  Pass Verdict

  The IUT retransmits the packet.

- Notes

  An IXIT [14] statement is used to distinguish between IUTs requiring HCI interaction to generate EV packets and IUTs transmitting the packets without HCI interaction. Optionally the IUT might send HCI eSCO packets to the Upper Tester.

4.8.1.11 BB/PROT/ARQ/BV-30-C [Uncorrectable Header – eSCO Master]

- Test Purpose

  Verify that the IUT when configured as Master, upon reception of a packet with uncorrectable errors in the packet header of an eSCO transmission prior to the end of the retransmission window, will transmit the next packet addressing the same Slave with the ARQN bit set to NAK.

- Reference

  [1] 6.4.4, 7.6

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

  An eSCO link with the following parameters is set up between the Lower Tester and the IUT:

  - eSCO handle: Any valid number.
  - eSCO LT_ADDR: Set by IUT.
  - Timing control flags: Derived from IUT Master clock.
  - Desco: Set by IUT.
  - Tesco: 6 slots.
  - Wesco: 2 slots.
  - Packet type M→S: EV3.
  - Packet type S→M: EV3.
  - Packet length M→S: 30 bytes.
  - Packet length S→M: 30 bytes.
  - Air mode: Any supported air mode.
  - Negotiation Flag: Initiate Negotiation.

- Test Procedure

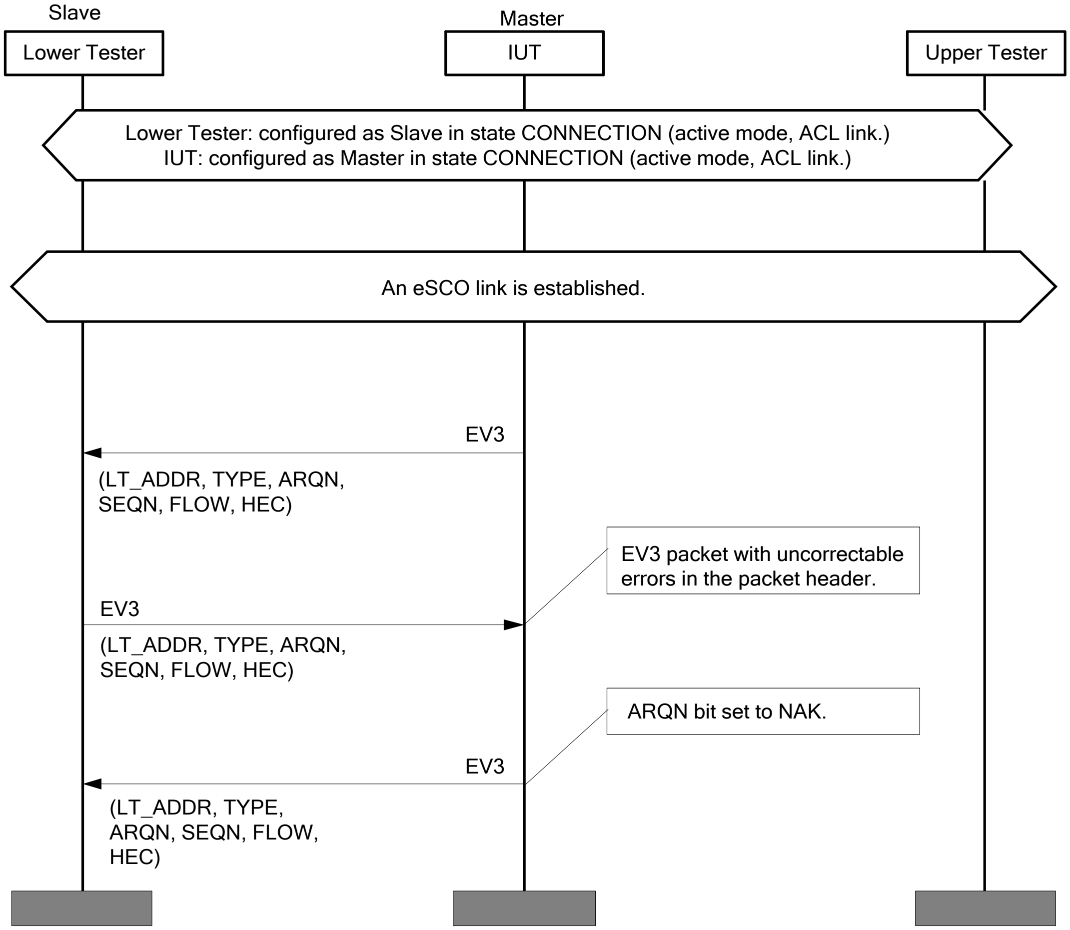

Figure 4.56: BB/PROT/ARQ/BV-30-C (Uncorrectable header – eSCO Master)

1. The Lower Tester verifies that the IUT transmits an EV3 packet at the eSCO instant.
2. The Lower Tester transmits an EV3 packet in the following slot:

<u>EV3</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the eSCO link.

TYPE: ‘0111’B.

FLOW: ‘1’B.

ARQN: ‘1’B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial ‘647’O in respect to the UAP of the Master. The packet header is FEC 1/3 encoded. After the coding procedure the Lower Tester shall insert uncorrectable errors in the header in a random way.

Payload Header:

N/A

Payload:

30 bytes PRBS plus 16 bit CRC.

1. The Lower Tester verifies that the IUT retransmits the EV3 packet with the ARQN bit set to NAK. Received retransmitted packet shall be classified in the following way:

   Correct Packet: Packet contains HEC pass, eSCO LT_ADDR, correct packet type, SEQN same as the original, CRC pass, data same as the original.

   Incorrect Packet: Packet contains HEC pass, eSCO LT_ADDR, (wrong packet type OR SEQN different to the original OR (CRC pass, data different to the original)).

   Ignore Packet: HEC fail OR other LT_ADDR OR CRC fail.

2. The Test Procedure is repeated, with randomly drawn uncorrectable error patterns, until at least 100 correct and/or Incorrect Packets have been received.

- Expected Outcome

  Pass Verdict

  The IUT retransmits the packet inside the retransmission window, with the ARQN bit set to NAK, for at least 90 percent of the repetitions (i.e. Correct Packets/(Correct + Incorrect Packets) >= 0.90).

- Notes

  ACL packets used to poll the slave have higher priority than eSCO retransmissions so the IUT might use the ACL *LT_ADDR* in the retransmission window.

  An IXIT [14] statement is used to distinguish between IUTs requiring HCI interaction to generate EV packets and IUTs transmitting the packets without HCI interaction. Optionally the IUT might send HCI eSCO packets to the Upper Tester.

4.8.1.12 BB/PROT/ARQ/BV-48-C [Invalid MIC as Master]

- Test Purpose

  Verify that the IUT, configured as Master, has the proper behavior in case of MIC failures:

  - The IUT, upon reception of a DM1 packet with AES-CCM encryption, a valid CRC and an invalid MIC, transmits a packet with ARQN bit set to NAK.
  - No more than three authentication failures shall be permitted during the lifetime of an encryption key with a given IV.
  - The third authentication failure shall initiate an encryption key refresh.
  - If a fourth authentication failure occurs prior to the encryption key refresh procedure completing, the link shall be disconnected with reason code Connection Rejected Due to Security Reasons (0x0E).

- Reference

  [1] 7.6.1

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link) and AES-CCM encryption enabled.

  IUT: Configured as Master in state CONNECTION (active mode, ACL link) and AES-CCM encryption enabled.

  No authentication failure has occurred since the encryption key has been created or refreshed.

- Test Procedure

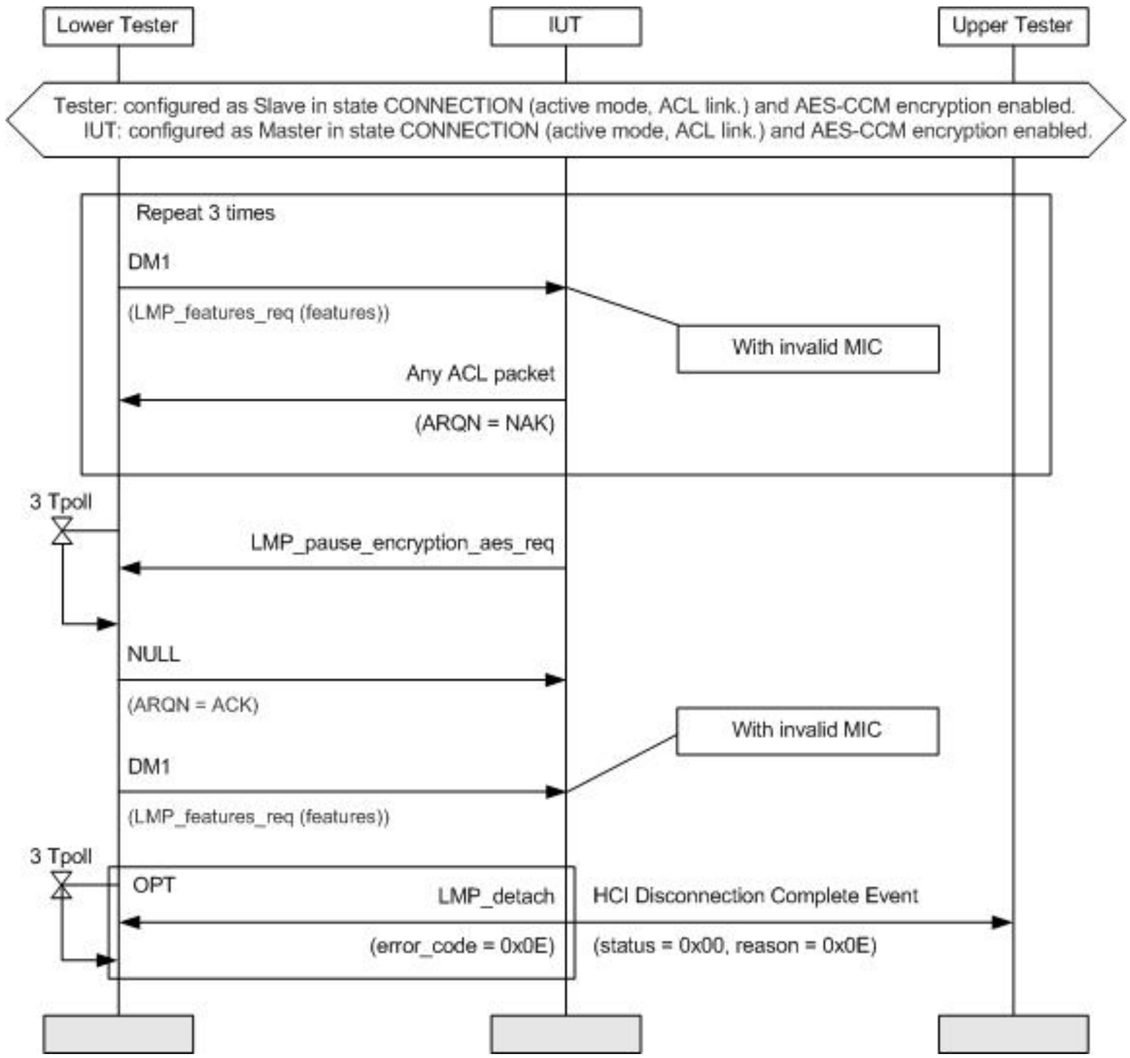

Figure 4.57: BB/PROT/ARQ/BV-48-C (invalid MIC)

a) The Lower Tester transmits a DM1 packet containing the LMP_features_req message with an invalid MIC.

DM1

Access code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet header: per [13] Section 6.4

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the previous transmission from the Lower Tester and ACK or NAK from the IUT.

Payload header: per [13] Section 6.6.2

LLID: '11'B indicating a LMP message.

FLOW: '1'B.

LENGTH: '01001'B = '9'D.

Payload body: 9 Bytes.

Byte 1 = ‘4F’H Transaction ID and OpCode.

Bytes 2 to 9 = '00'H.

MIC: 4 Bytes

CRC: 2 Bytes

b) The Lower Tester verifies that the IUT transmits any ACL packet with the ARQN bit set to NAK.
c) Steps a and b are repeated 2 times (in addition to the first time).
d) The Lower Tester verifies that the IUT initiates an encryption key refresh by sending an LMP_pause_encryption_aes_req PDU.
e) The Lower Tester sends a NULL packet with ARQN bit set to ACK.
f) The Lower Tester transmits a DM1 packet with an invalid MIC (repeat of step a).
g) The Upper Tester verifies that the IUT sends an HCI Disconnection Complete event with reason 0x0E (Connection Rejected Due to Security Reasons).

- Test Condition

  If additional valid packets are sent from the IUT, they need to be ACKed by the Lower Tester.

- Expected Outcome

  Pass Verdict

  For all the occurrences of step b, the IUT sends a packet with the ARQN bit set to NAK in the next transmission to the Lower Tester.

  Before step e, the IUT initiates an encryption key refresh by sending an LMP_pause_encryption_aes_req PDU.

  After step f, the IUT notifies the disconnection by sending an HCI Disconnection Complete event with reason 0x0E (Connection Rejected Due to Security Reasons) within a three Tpoll time interval.

4.8.1.13 BB/PROT/ARQ/BV-49-C [Secure Connections and Uncorrectable payload as Master]

- Test Purpose

  Verify that the IUT configured as a Master, upon receipt of a DM1 packet with AES-CCM encryption and uncorrectable errors in the payload transmits a packet with the ARQN bit set to NAK.

- Reference

  [1] 7.6.1

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link) and AES-CCM encryption enabled.

  IUT: Configured as Master in state CONNECTION (active mode, ACL link) and AES-CCM encryption enabled.

- Test Procedure

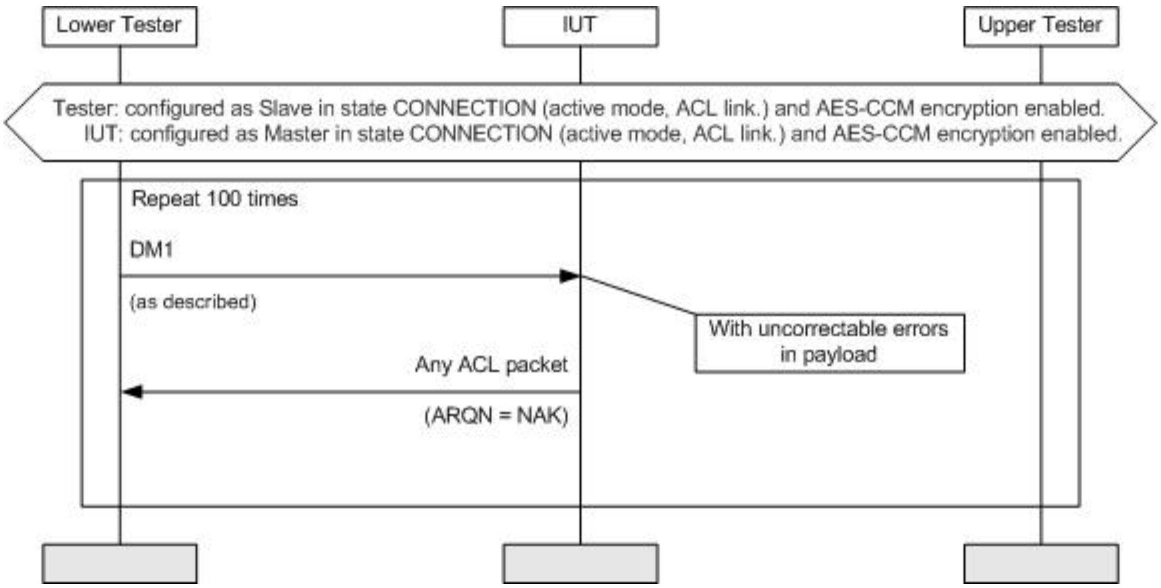

Figure 4.58: BB/PROT/ARQ/BV-49-C

a) The Lower Tester transmits a DM1 packet with uncorrectable errors in the payload.

<u>DM1</u>

Access code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header: per [13] Section 6.4

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the previous transmission from the Lower Tester and ACK or NAK from the IUT.

Payload header:

LLID: '11'B indicating a LMP message.

FLOW: '1'B.

LENGTH: '01001'B = '9'D.

Payload body: 9 Bytes.

1. Byte = ‘4F’H Transaction ID and OpCode.

2. to 9. Byte = '00'H.

b) This corresponds to 128 bits payload contents (1 Byte payload header, 9 Bytes payload body, 4 Bytes MIC and 2 Bytes CRC) before FEC 2/3 coding. The maximum number of inserted errors depends on the Hamming distance provided by the CRC.
c) The Lower Tester verifies that the IUT transmits any ACL packet with the ARQN bit set to NAK.
d) This test procedure is repeated 100 times.

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions the IUT sends a packet with the ARQN bit set to NAK in the next transmission to the Lower Tester.

  The IUT does not send an LMP_pause_encryption_aes_req PDU.

  The IUT does not disconnect the link.

4.8.2 ARQ Procedures - Slave

Test subgroup objectives:

To verify that the ARQ scheme used by the Slave is correct.

4.8.2.1 BB/PROT/ARQ/BV-14-C [Uncorrectable Packet Header]

- Test Purpose

  Verify that the IUT configured as Slave, upon reception of a packet with uncorrectable errors in the packet header, does not transmit any packet.

- Reference

  [1] 6.4.4, 7.6

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link).

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

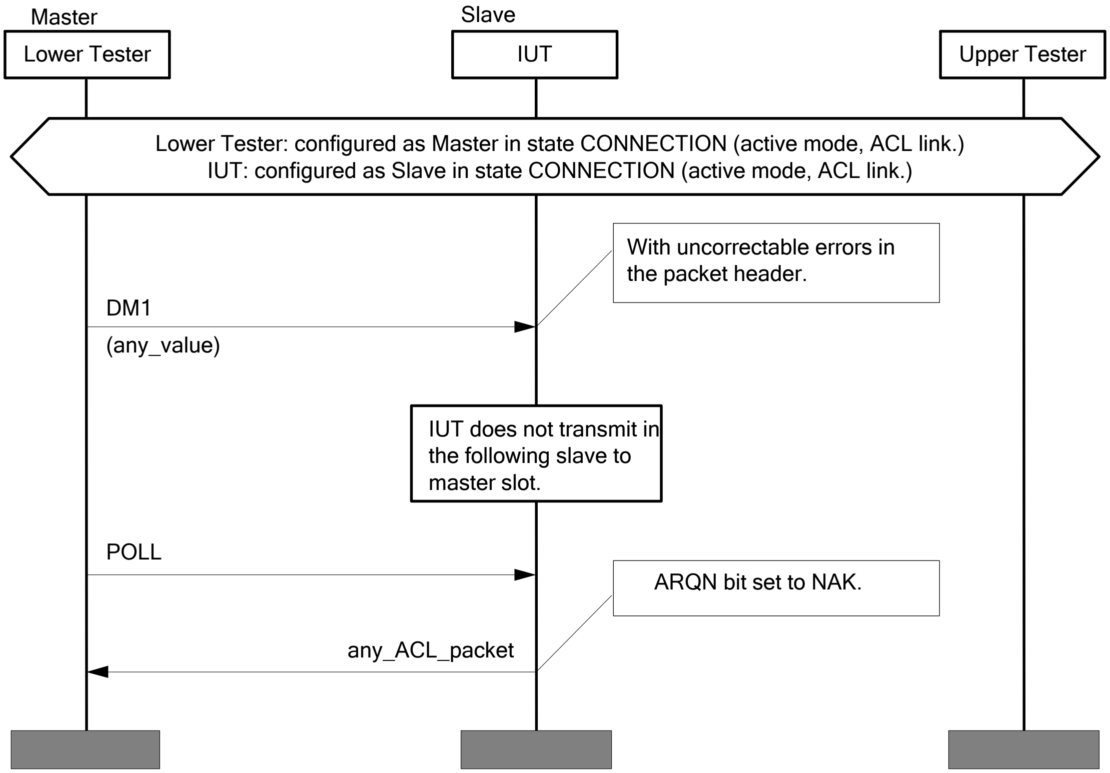

Figure 4.59: BB/PROT/ARQ/BV-14-C (Uncorrectable packet header)

The Lower Tester transmits a DM1 packet with an uncorrectable error in the packet header.

<u>DM1</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the previous transmission from the Lower Tester and ACK or NAK from the IUT.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

The packet header is FEC 1/3 coded. After the coding procedure has successfully performed errors have to be inserted. The maximum number of inserted errors depends on the Hamming distance provided by the HEC.

Payload Header:

LLID: '11'B indicating LMP message.

FLOW: '1'B.

LENGTH: '10001'B = '17'D.

Payload body: 17 Bytes PRBS plus 2 bytes CRC.

The Lower Tester verifies that the IUT does not transmit any packet in the following Slave to Master slot.

The Lower Tester verifies that the IUT transmits an ACL packet with the ARQN bit set to NAK after the next POLL interval of the Lower Tester.

This Test Procedure is repeated 100 times. The inserted uncorrectable errors must be statistically distributed.

- Expected Outcome

  Pass Verdict

  For at least 99 percent of the repetitions the IUT does not transmit any packet in the next Slave to Master slot. After the next POLL the IUT sets the ARQN bit to NAK.

4.8.2.2 BB/PROT/ARQ/BV-15-C [Uncorrectable Payload]

- Test Purpose

  Verify that the IUT configured as Slave, upon reception of a DM1 packet with uncorrectable errors in the payload, either transmits a packet with ARQN bit set to NAK or does not answer.

- Reference

  [1] 6.4.4, 7.6

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link).

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

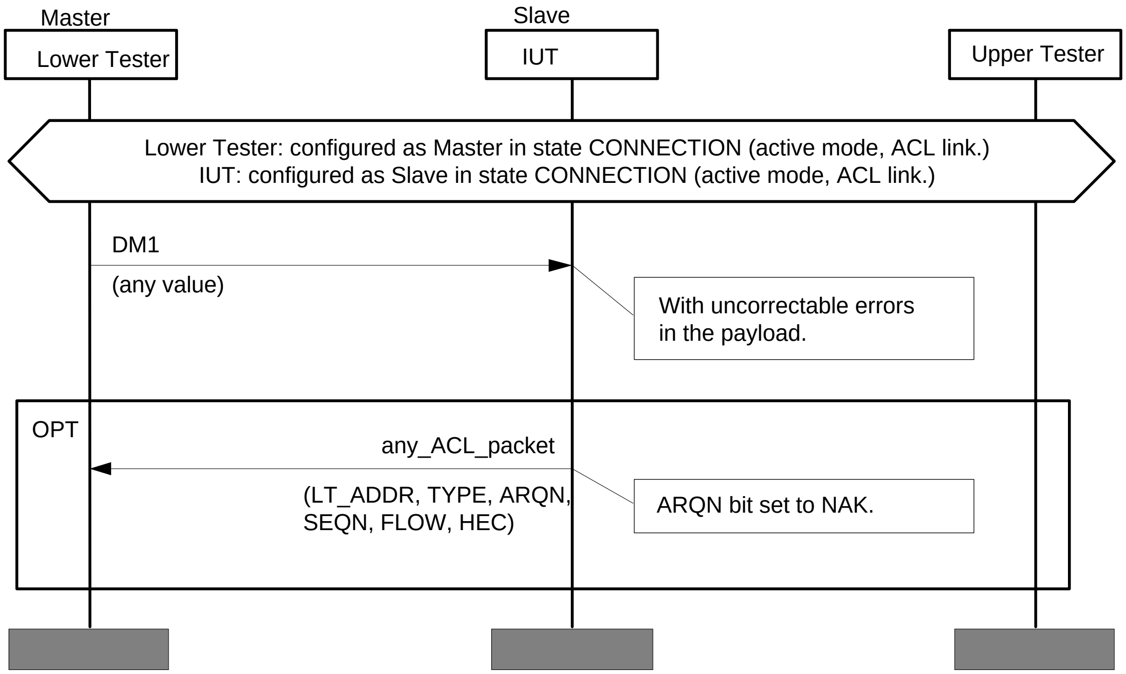

Figure 4.60: BB/PROT/ARQ/BV-15-C (Uncorrectable payload)

The Lower Tester transmits a DM1 packet with an uncorrectable error in the payload.

<u>DM1</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the previous transmission from the Lower Tester and ACK or NAK from the IUT.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload Header:

LLID: '11'B indicating LMP message.

FLOW: '1'B.

LENGTH: '10001'B = '17'D.

Payload body: 17 Bytes PBRS plus 2 bytes CRC.

This corresponds to 160 bits payload contents (1 Byte packet header 17 Bytes payload body and 2 Bytes CRC) before FEC 2/3 coding. After FEC 2/3 coding the payload consists of 240 bits. The maximum number of inserted errors depends on the Hamming distance provided by the CRC.

The Lower Tester verifies that the IUT transmits any ACL packet with the ARQN bit set to NAK, or no packet at all.

This Test Procedure is repeated 100 times. The inserted uncorrectable errors must be statistically distributed.

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions the IUT sends a packet with the ARQN bit set to NAK or no packet at all in the next Slave to Master slot.

- Notes

  This test should lead to the Lower Tester transmitting 100 consecutive packets with uncorrectable errors.

4.8.2.3 BB/PROT/ARQ/BV-16-C [Explicit NAK]

- Test Purpose

  Verify that the IUT configured as Slave, upon reception of a packet with its ARQN bit set to NAK (explicit NAK), retransmits the packet again.

- Reference

  [1] 6.4.4, 7.6, 7.6.2

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link).

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

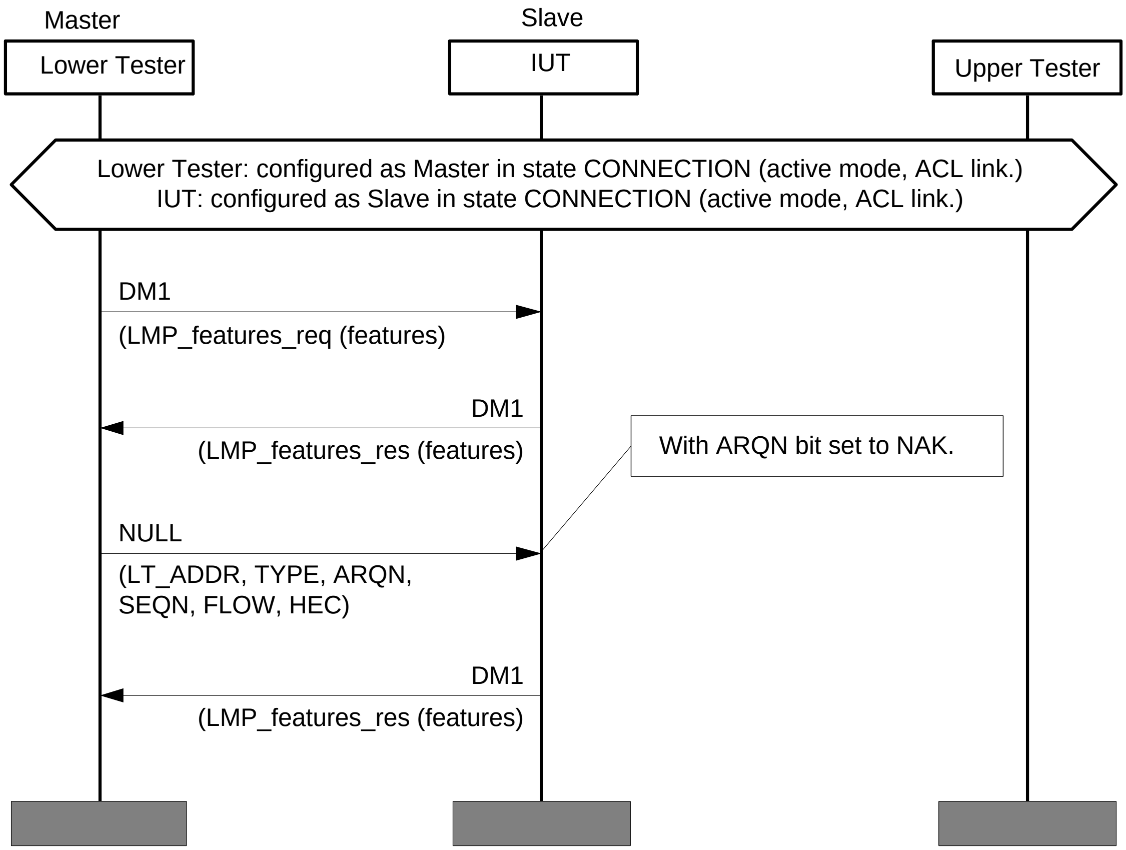

Figure 4.61: BB/PROT/ARQ/BV-16-C (Explicit NAK)

The Lower Tester sends a DM1 packet containing an LMP_features_req message.

The Lower Tester verifies that the IUT responds with the LMP_features_res message by using a DM1 packet.

The Lower Tester acknowledges the packet with a NULL packet with the ARQN bit set to NAK.

The Lower Tester verifies that the IUT retransmits the DM1 packet again containing the LMP_features_res message.

- Expected Outcome

<u>Pass Verdict</u>

The IUT retransmits the packet after receiving the NULL packet with the ARQN bit set to NAK.

4.8.2.4 BB/PROT/ARQ/BV-18-C [SEQN]

- Test Purpose

Verify that the IUT configured as Slave, respects SEQN values in the transmit case.

- Reference

  [1] 7.6.2

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link).

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

  The Lower Tester does not support any feature.

- Test Procedure

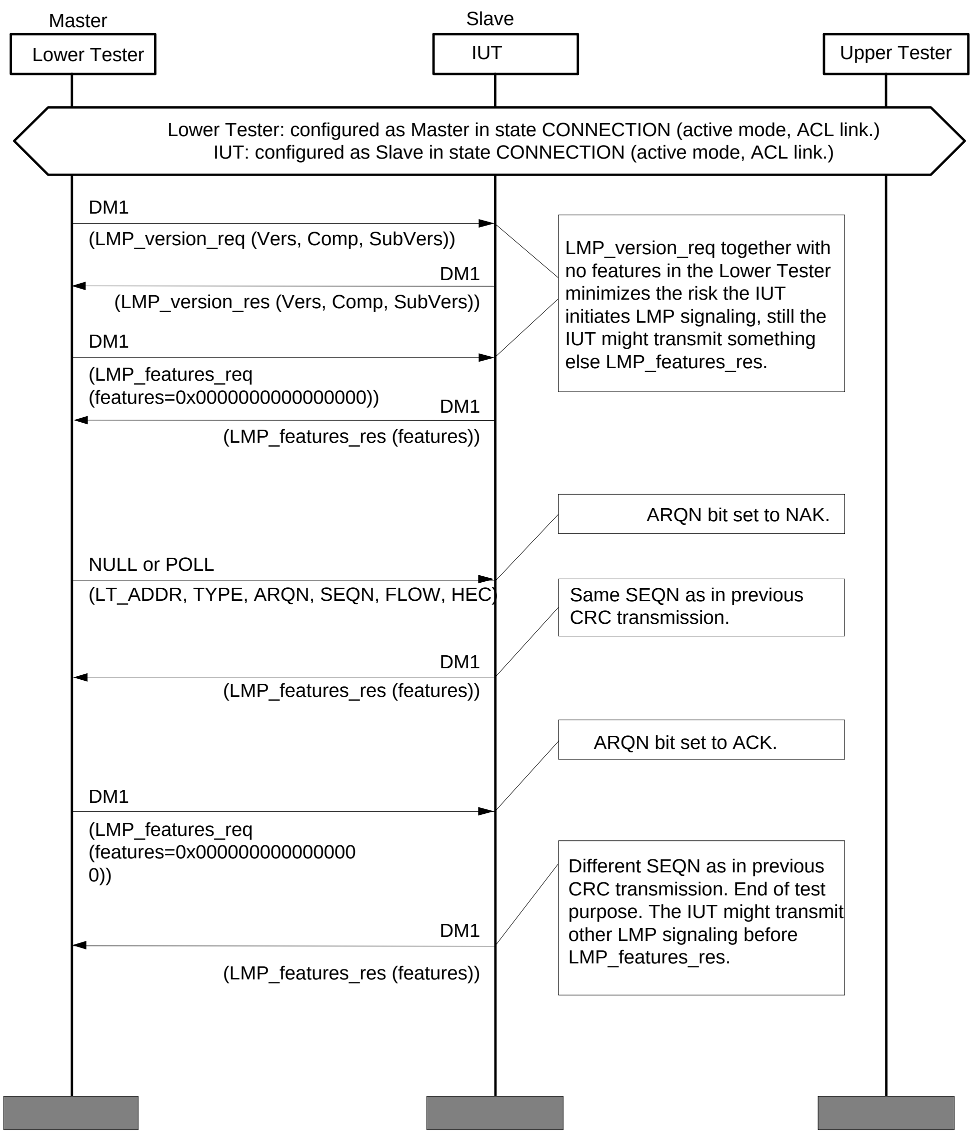

Figure 4.62: BB/PROT/ARQ/BV-18-C (SEQN)

The Lower Tester transmits a DM1 packet containing LMP_features_req message.

<u>DM1</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

Payload Header:

LLID: 11'B indicating LMP message.

FLOW: '1'B.

LENGTH: '01001'B = '9'D.

Payload body: 9 Bytes.

1. Byte = '4E'H Transaction ID and OpCode.

2. to 9. Byte = '00'H.

The Lower Tester verifies that the IUT transmits a DM1 packet containing LMP_features_res message. The Lower Tester has to store the SEQN value (first SEQN value) contained in the packet header.

The Lower Tester acknowledges the packet with NULL or POLL packets with the ARQN bit set to NAK.

The Lower Tester verifies that the IUT retransmits the DM1 packet containing LMP_features_res message with the same SEQN value (second SEQN value) as in the previous transmission. The Lower Tester has to store the SEQN value contained in the packet header.

The Lower Tester transmits a DM1 packet containing LMP_features_req message again with the ARQN bit set to ACK.

The Lower Tester verifies that the IUT transmits a DM1 packet with a different SEQN value (third SEQN value) compared to the previous transmissions.

- Expected Outcome

  Pass Verdict

  The second SEQN value is the same as the first SEQN value. The third SEQN value is not the same as the second SEQN value.

- Notes

  The IUT might transmit unsolicited LMP signaling changing the intended Test Procedure. This risk is minimized by having the Lower Tester transmit LMP_version_req immediately after connection establishment and always indicate no feature is supported.

4.8.2.5 BB/PROT/ARQ/BV-19-C [FLOW Control]

- Test Purpose

  Verify that the IUT configured as Slave, stops transmitting upon receiving STOP indication, switch to the default packet type and resumes to transmit when GO indication is received.

- Reference

  [1] 4.5.3

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link).

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

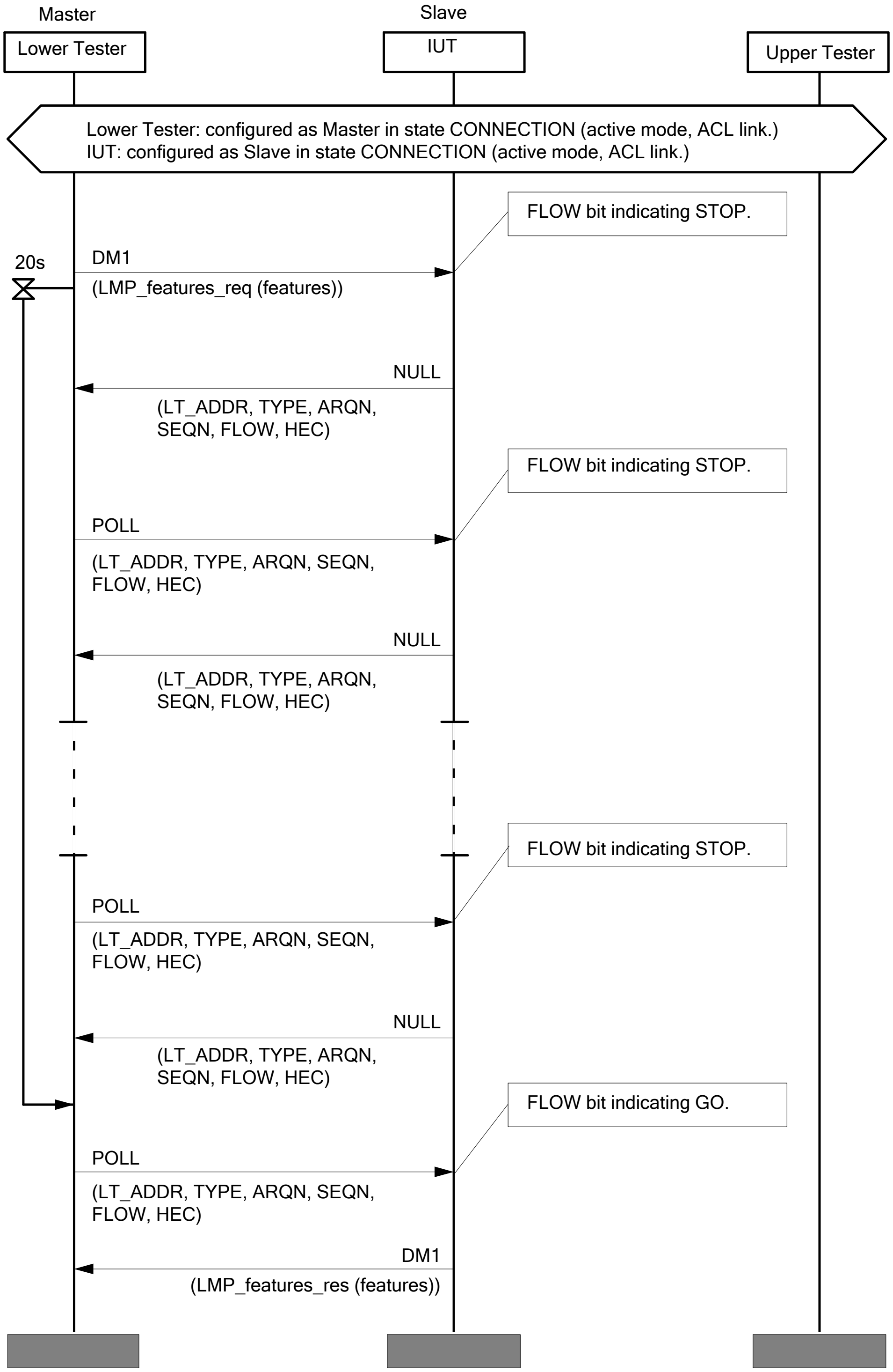

Figure 4.63: BB/PROT/ARQ/BV-19-C (FLOW control)

The Lower Tester sends a DM1 packet containing a LMP_features_req message with the FLOW bit set to '0'B indicating STOP.

The Lower Tester verifies that the IUT stops transmission and switches to the default packet type (NULL). Since LM does not work in real time a value of 20s was chosen to ensure that the

LMP_features_res message is ready before the GO indication will be sent from the tester. In this 20 s the Lower Tester sends POLL packets with the FLOW bit set to STOP.

After expiration of the 20s the Lower Tester sends a POLL packet with the FLOW bit set to GO.

The Lower Tester verifies that the IUT responds with the LMP_features_res message by using a DM1 packet.

- Expected Outcome

  Pass Verdict

  The IUT stops transmitting upon receiving STOP for at least 20s.

  The IUT switches to the default packet type for at least 20s.

  The IUT resumes to transmit when GO indication is received.

4.8.2.6 BB/PROT/ARQ/BV-23-C [Same SEQN Value]

- Test Purpose

  Verify that the ARQN bit is set to ACK and the data is disregarded if a packet with CRC information with a correct header is received that has the same SEQN value as in the previous reception.

- Reference

  [1] 7.6.1

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link).

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

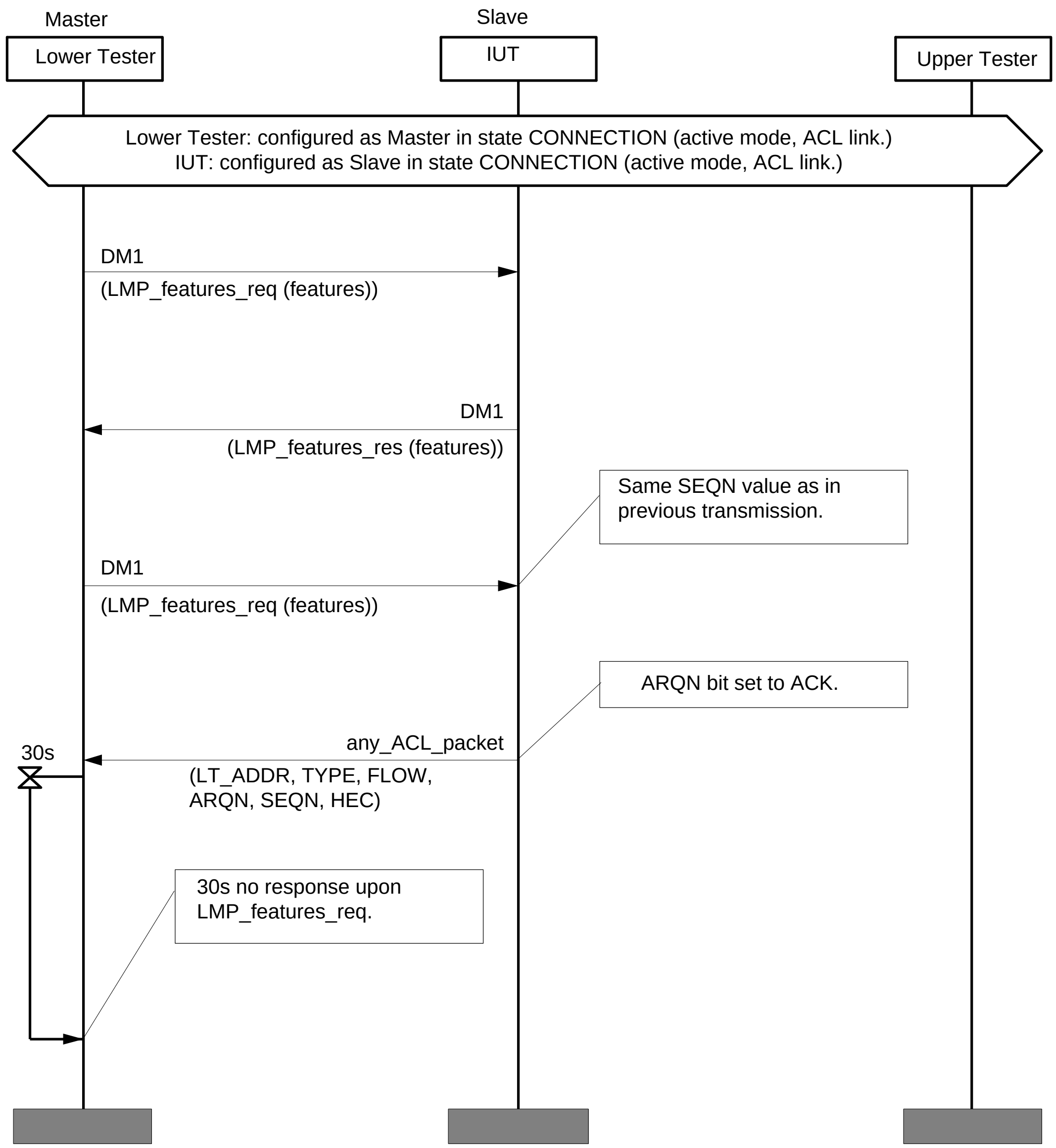

Figure 4.64: BB/PROT/ARQ/BV-23-C (Same SEQN value)

The Lower Tester sends a DM1 packet containing an LMP_features_req message.

The Lower Tester verifies that the IUT transmits a DM1 packet containing an LMP_features_res message.

The Lower Tester sends a DM1 packet containing an LMP_features_req message again with the same SEQN bit as set in the previous transmission.

The Lower Tester verifies that the IUT sends a packet with the ARQN bit set to ACK and discards the payload.

Since LM does not work in real time the Lower Tester waits for 30s to ensure that the LMP_feature_res is not sent from the IUT.

- Expected Outcome

  Pass Verdict

  The IUT sends a packet with the ARQN bit set to ACK and the IUT disregards the new data.

4.8.2.7 BB/PROT/ARQ/BV-25-C [Retransmission of DV Packet]

- Test Purpose

  Verify that the data payload of a DV packet is retransmitted upon reception of the ARQN bit set to NAK.

- Reference

  [1] 6.5.2.4

- Initial Condition

  Lower Tester: Configured as Master.

  IUT: Configured as Slave.

  A SCO connection is established.

- Test Procedure

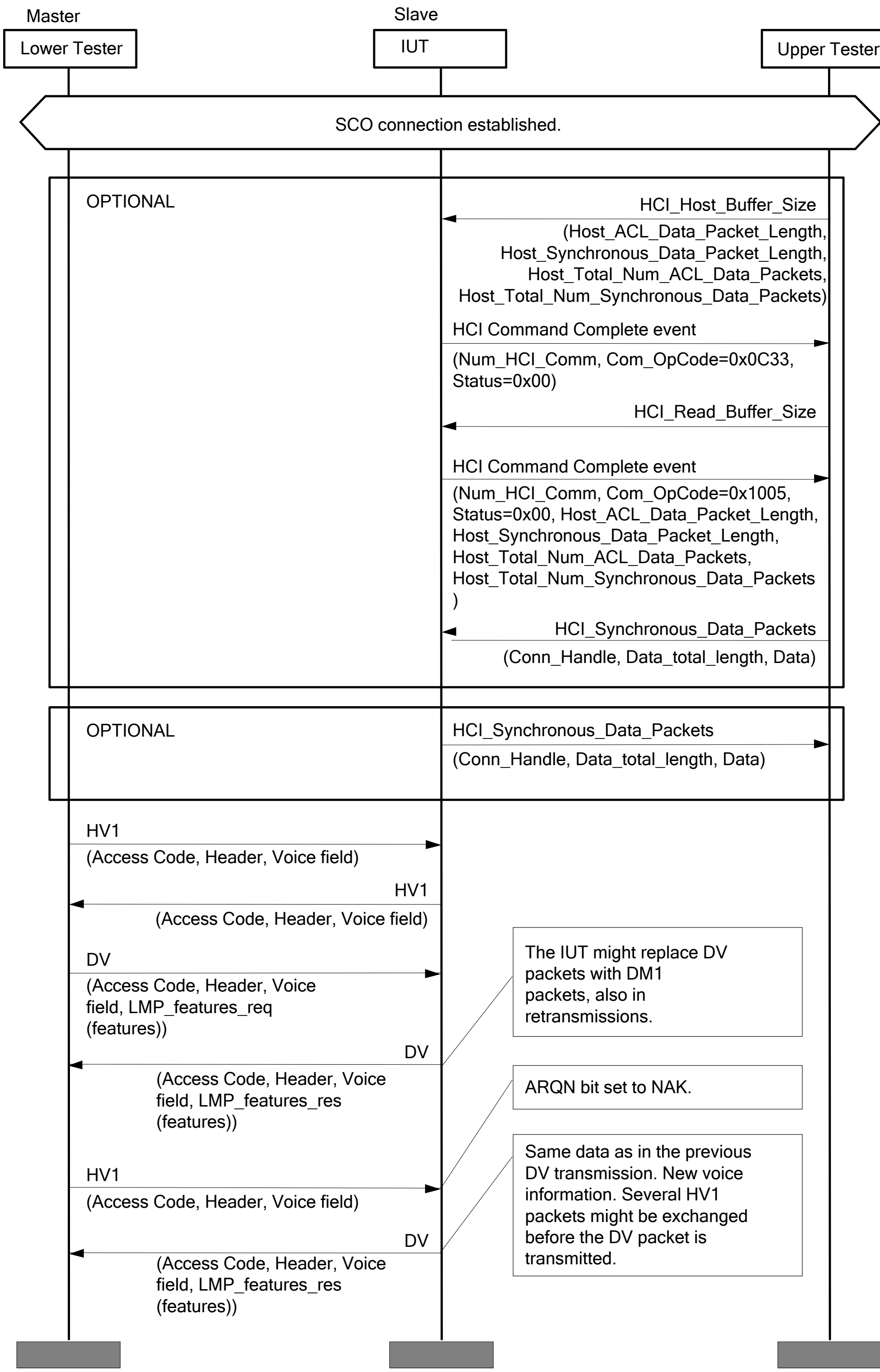

Figure 4.65: BB/PROT/ARQ/BV-25-C (Retransmission of DV packet)

The Lower Tester transmits a DV packet containing LMP_features_req to the IUT in order to force the IUT to transmit LMP_features_res.

The tester verifies that the IUT transmits a DV packet containing the LMP_features_res message.

The Lower Tester responds with an HV1 packet with the ARQN bit set to NAK.

The Lower Tester verifies that the IUT retransmits the DV packet containing the LMP_features_res message.

With IXIT [14] is selected if the IUT needs HCI Synchronous Data packets to transmit HV1/DV packets. If HCI Synchronous Data packets are used the Upper Tester fills them with a pseudo random bit pattern and the Lower Tester checks each HV1/DV packet has a new voice field.

- Expected Outcome

  Pass Verdict

  The IUT transmits a DV packet again containing the same data field.

  If HCI Synchronous Data packets are used the new DV packet contains a new voice field.

- Notes

  There is no possibility written in [1] to force the IUT to send a DV packet. For IUTs using DV packets it can be checked whether they are received. If no DV packet is returned the IUT must return a DM1 packet.

  An IXIT [14] statement is used to distinguish between IUTs requiring HCI interaction to transmit HV1/DV packets and IUTs transmitting the packets without HCI interaction. Optionally the IUT might send HCI Synchronous packets to the Upper Tester.

4.8.2.8 BB/PROT/ARQ/BV-26-C [Uncorrectable DV Packet]

- Test Purpose

  Verify that the IUT configured as Slave, upon reception of a DV packet with uncorrectable errors in the data payload, transmits a packet with the ARQN bit set to NAK.

- Reference

  [1] 6.5.2.4

- Initial Condition

  Lower Tester: Configured as Master.

  IUT: Configured as Slave.

  A SCO connection using HV1 packets is established.

- Test Procedure

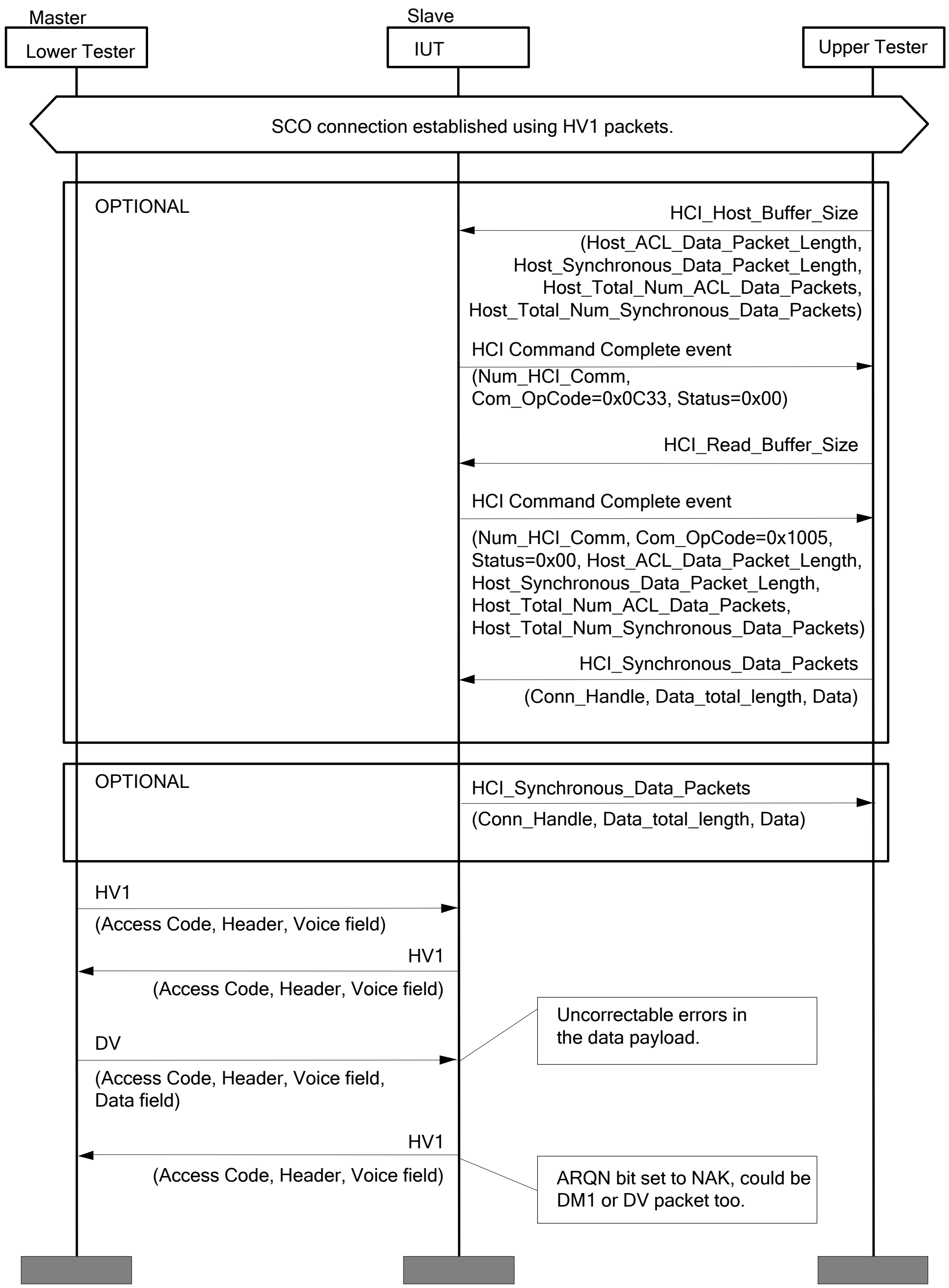

Figure 4.66: BB/PROT/ARQ/BV-26-C (Uncorrectable DV packet)

The Lower Tester transmits a DV packet with uncorrectable errors in the data payload.

The Lower Tester verifies that the IUT transmits a DM1, DV or HV1 packets with the ARQN bit set to NAK.

- Expected Outcome

  Pass Verdict

  The IUT transmits a DM1, DV or HV1 packet with the ARQN bit set to NAK.

- Notes

  An IXIT [14] statement is used to distinguish between IUTs requiring HCI interaction to transmit HV1/DV packets and IUTs transmitting the packets without HCI interaction. Optionally the IUT might send HCI Synchronous packets to the Upper Tester.

4.8.2.9 BB/PROT/ARQ/BV-29-C [Explicit NAK – eSCO Slave]

- Test Purpose

  Verify that the IUT when configured as Slave, upon reception of an eSCO packet with its ARQN bit set to NAK, transmits the packet again.

- Reference

  [1] 6.4.4, 7.6

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link).

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

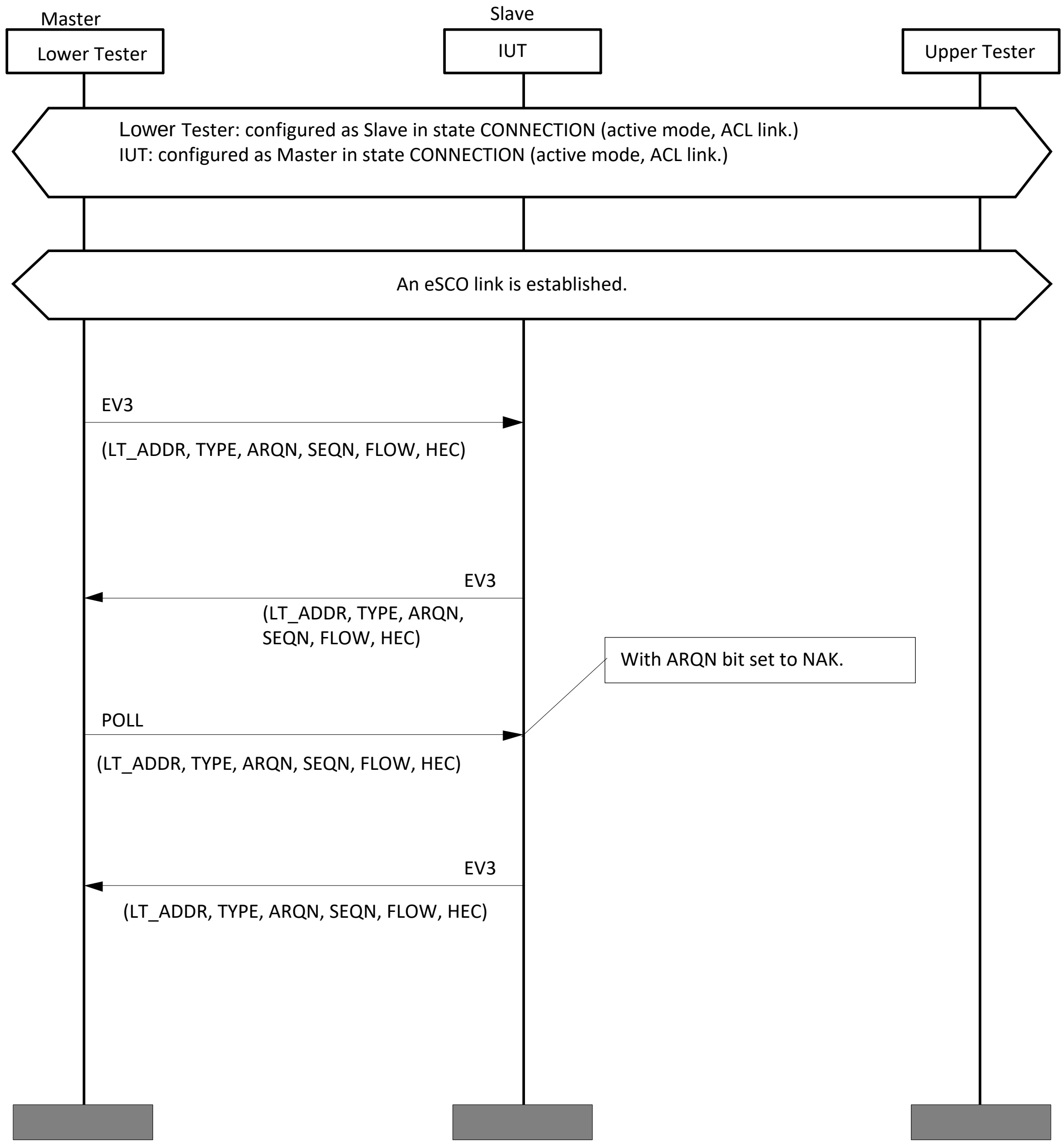

Figure 4.67: BB/PROT/ARQ/BV-29-C (Explicit NAK – eSCO Slave)

The Lower Tester sets up an eSCO link with the following parameters:

eSCO handle: Any valid number.

eSCO LT_ADDR: Any valid number.

Timing control flags: Derived from Lower Tester’s Master clock.

Desco: Any number in the range [0, Tesco-1].

Tesco: 6 slots.

Wesco: 2 slots.

Packet type M→S: EV3.

Packet type S→M: EV3.

Packet length M→S: 30 bytes.

Packet length S→M: 30 bytes.

Air mode: Any supported air mode.

Negotiation Flag: Initiate Negotiation.

The Lower Tester transmits an EV3 packet at the eSCO instant.

<u>EV3</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the eSCO link.

TYPE: ‘0111’B.

FLOW: ‘1’B.

ARQN: ‘0’B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial ‘647’O in respect to the UAP of the Master.

Payload Header:

N/A

Payload:

30 bytes PRBS plus 16 bit CRC.

The Lower Tester verifies that the IUT transmits an EV3 packet in the following slot.

The Lower Tester transmits a POLL packet in the following slot:

POLL

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the eSCO link.

TYPE: ‘0001’B.

FLOW: ‘1’B.

ARQN: ‘0’B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial ‘647’O in respect to the UAP of the Master.

The Lower Tester verifies that the IUT retransmits the EV3 packet in the following slot.

- Expected Outcome

  Pass Verdict

  The IUT retransmits the packet after receiving the EV3 packet with the ARQN bit set to NAK.

- Notes

  An IXIT [14] statement is used to distinguish between IUTs requiring HCI interaction to generate EV packets and IUTs transmitting the packets without HCI interaction. Optionally the IUT might send HCI eSCO packets to the Upper Tester.

4.8.2.10 BB/PROT/ARQ/BV-31-C [Uncorrectable Header Original Transmission – eSCO Slave]

- Test Purpose

  Verify that the IUT when configured as Slave, upon reception of a packet with uncorrectable errors in the packet header of an eSCO original transmission, will transmit the packet with the ARQN bit set to NAK.

- Reference

  [1] 6.4.4, 7.6

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link).

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

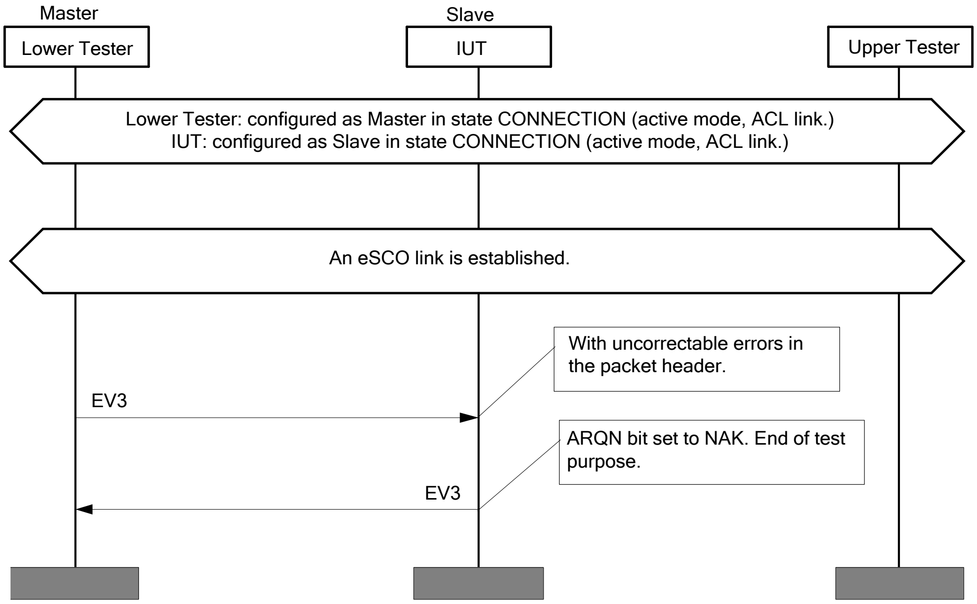

Figure 4.68: BB/PROT/ARQ/BV-31-C (Uncorrectable header original transmission – eSCO Slave)

The Lower Tester sets up an eSCO link with the following parameters:

eSCO handle: Any valid number.

eSCO LT_ADDR: Any valid number.

Timing control flags: Derived from Lower Tester’s Master clock.

Desco: Any number in the range [0, Tesco-1].

Tesco: 6 slots.

Wesco: 2 slots.

Packet type M→S: EV3.

Packet type S→M: EV3.

Packet length M→S: 30 bytes.

Packet length S→M: 30 bytes.

Air mode: Any supported air mode.

Negotiation Flag: Initiate Negotiation.

The Lower Tester transmits an EV3 packet at the eSCO instant.

EV3

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the eSCO link.

TYPE: ‘0111’B.

FLOW: ‘1’B.

ARQN: ‘1’B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial ‘647’O in respect to the UAP of the Master. The packet header is FEC 1/3 encoded. After the coding procedure the Lower Tester shall insert uncorrectable errors in the header in a random way.

Payload Header:

N/A

Payload:

30 bytes PRBS plus 16 bit CRC.

The Lower Tester verifies that the IUT transmits an EV3 packet in the next slot with the ARQN bit set to NAK.

The Test Procedure is repeated 100 times with randomly drawn uncorrectable error patterns.

- Expected Outcome

Pass Verdict

The IUT transmits the packet with the ARQN bit set to NAK for at least 99% of the repetitions excluding responses using the ACL LT_ADDR.

- Notes

The Lower Tester might POLL the IUT forcing the IUT to acknowledge the POLL rather than retransmit eSCO.

An IXIT [14] statement is used to distinguish between IUTs requiring HCI interaction to generate EV packets and IUTs transmitting the packets without HCI interaction. Optionally the IUT might send HCI eSCO packets to the Upper Tester.

4.8.2.11 BB/PROT/ARQ/BV-32-C [Uncorrectable Header Re-transmission – eSCO Slave]

- Test Purpose

  Verify that the IUT when configured as Slave, upon reception of a packet with uncorrectable errors in the packet header of an eSCO re-transmission, does not transmit.

- Reference

  [1] 6.4.4, 7.6

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link).

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

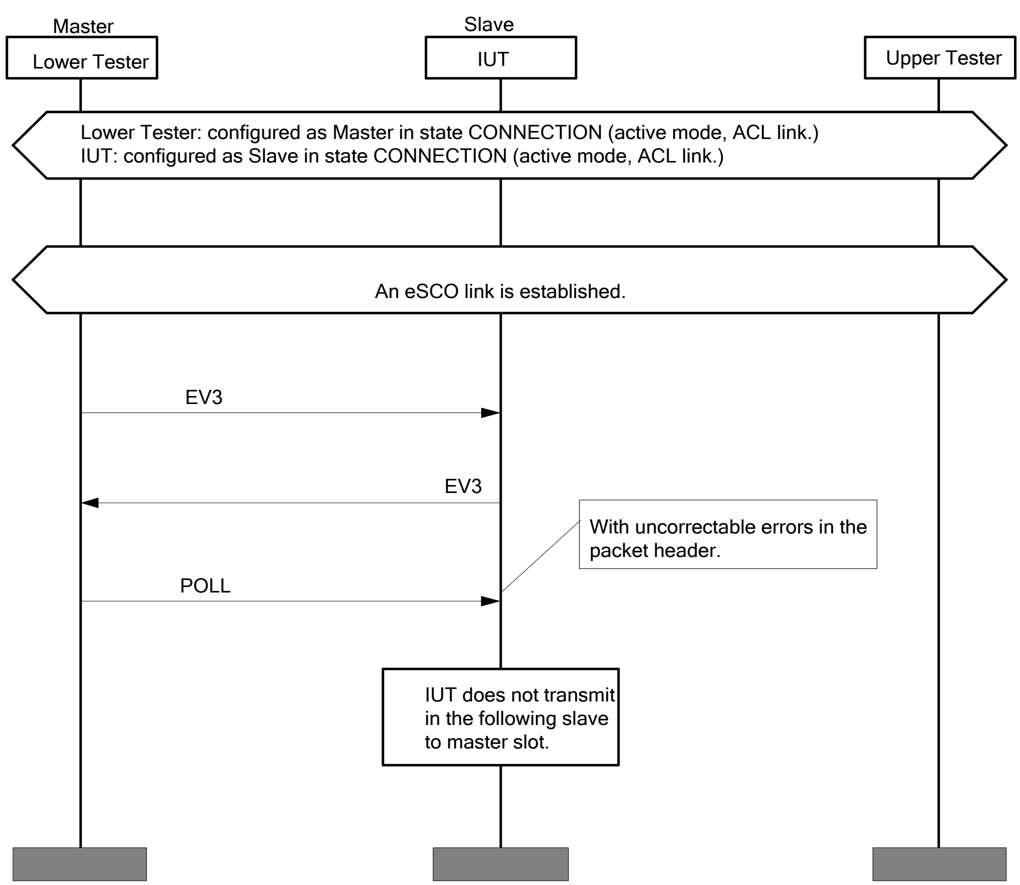

Figure 4.69: BB/PROT/ARQ/BV-32-C (Uncorrectable header re-transmission – eSCO Slave)

The Lower Tester sets up an eSCO link with the following parameters:

eSCO handle: Any valid number.

eSCO *LT_ADDR*: Any valid number.

Timing control flags: Derived from Lower Tester’s Master clock.

Desco: Any number in the range [0,Tesco-1].

Tesco: 6 slots.

Wesco: 2 slots.

Packet type M→S: EV3.

Packet type S→M: EV3.

Packet length M→S: 30 bytes.

Packet length S→M: 30 bytes.

Air mode: Any supported air mode.

Negotiation Flag: Initiate Negotiation.

The Lower Tester transmits an EV3 packet at the eSCO instant.

<u>EV3</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the eSCO link.

TYPE: ‘0111’B.

FLOW: ‘1’B.

ARQN: ‘0’B.

SEQN: Depends on the former transmission of the Lower Tester.

HEC: Generated by the polynomial ‘647’O in respect to the UAP of the Master.

Payload Header:

N/A

Payload:

30 bytes PRBS plus 16 bit CRC.

The Lower Tester verifies that the IUT transmits an EV3 packet in the next slot.

The Lower Tester transmits a POLL packet in the following slot:

POLL

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Logical Transport Address of the eSCO link.

TYPE: ‘0001’B.

FLOW: ‘1’B.

ARQN: ‘0’B.

SEQN: Depends on the former transmission of the Lower tester.

HEC: Generated by the polynomial ‘647’O in respect to the UAP of the Master.

The packet header is FEC 1/3 encoded. After the coding procedure the Lower Tester shall insert uncorrectable errors in the header in a random way.

The Lower Tester verifies that the IUT does not transmit again inside the retransmission window.

The Test Procedure is repeated 100 times with randomly drawn uncorrectable error patterns.

- Expected Outcome

  Pass Verdict

  The IUT does not transmit in response to the second packet from the Lower Tester, in at least 99% of the repetitions.

- Notes

  An IXIT [14] statement is used to distinguish between IUTs requiring HCI interaction to generate EV packets and IUTs transmitting the packets without HCI interaction. Optionally the IUT might send HCI eSCO packets to the Upper Tester.

4.8.2.12 BB/PROT/ARQ/BV-38-C [Invalid MIC as Slave]

- Test Purpose

  Verify that the IUT, configured as Slave, has the proper behavior in case of MIC failures:

  The IUT, upon reception of a DM1 packet with AES-CCM encryption, a valid CRC and an invalid MIC, transmits a packet with ARQN bit set to NAK or no packet at all in the next Slave to Master slot.

  No more than three authentication failures shall be permitted during the lifetime of an encryption key with a given IV.

  The third authentication failure shall initiate an encryption key refresh.

  If a fourth authentication failure occurs prior to the encryption key refresh procedure completing, the link shall be disconnected with reason code Connection Rejected Due to Security Reasons (0x0E).

- Reference

  [1] 7.6.1

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link) and AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link) and AES-CCM encryption enabled.

  No authentication failure has occurred since the encryption key has been created or refreshed.

- Test Procedure

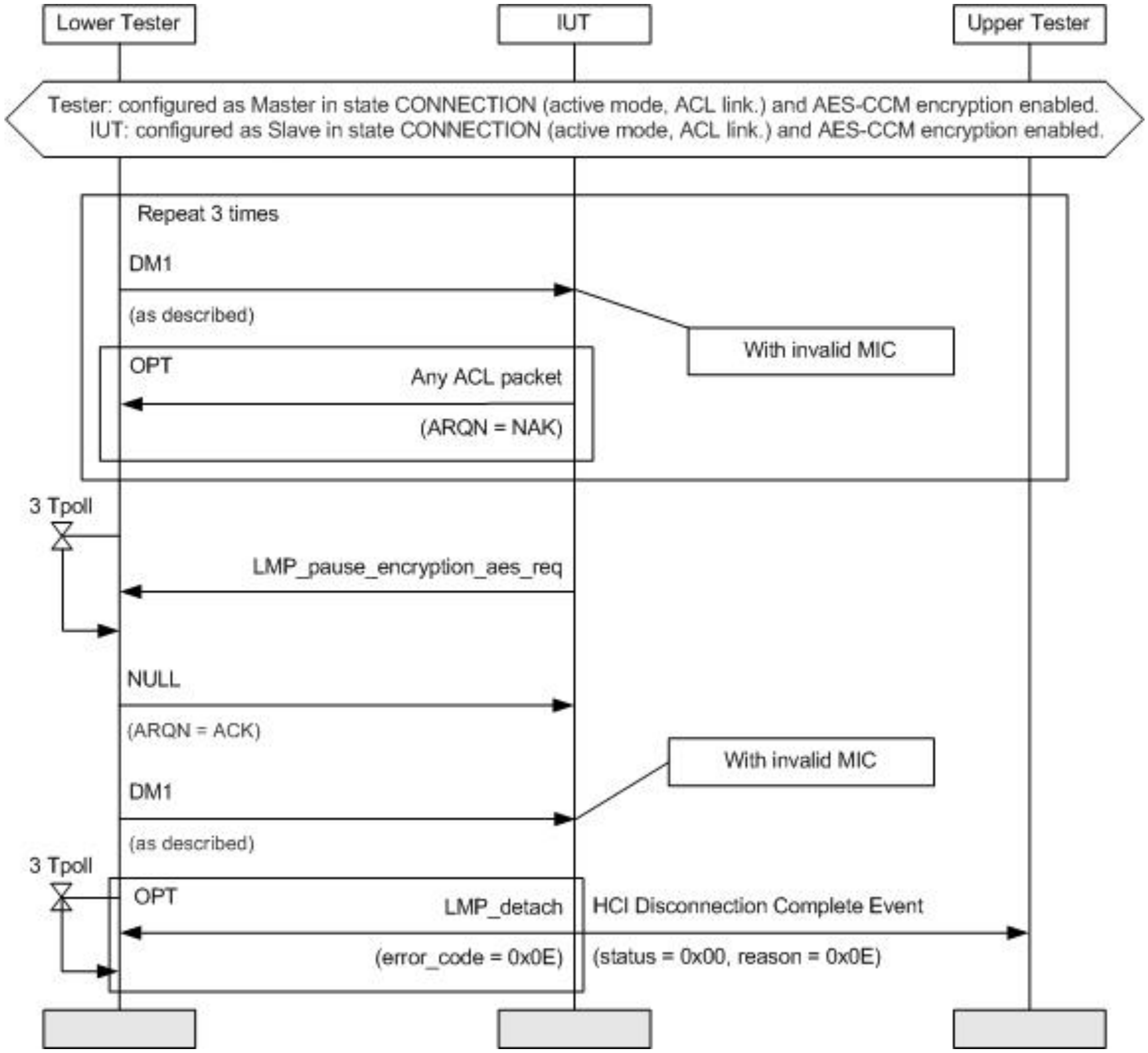

Figure 4.70: BB/PROT/ARQ/BV-38-C (invalid MIC)

a) The Lower Tester transmits a DM1 packet with an invalid MIC.

<u>DM1</u>

Access code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet header: per [13] Section 6.4

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the previous transmission from the Lower Tester and ACK or NAK from the IUT.

Payload header:

LLID: '11'B indicating LMP message.

FLOW: '1'B.

LENGTH: '10001'B = '17'D.

Payload body:

17 Bytes PRBS9 plus 4 bytes MIC (invalid) plus 2 bytes CRC.

This corresponds to 192 bits payload contents (1 Byte payload header, 17 Bytes payload body, 4 Bytes MIC and 2 Bytes CRC) before FEC 2/3 coding.

b) The Lower Tester verifies that the IUT transmits any ACL packet with the ARQN bit set to NAK or no packet at all in the next Slave to Master slot.
c) Steps a and b are repeated 2 times (in addition to the first time).
d) The Lower Tester verifies that the IUT initiates an encryption key refresh by sending an LMP_pause_encryption_aes_req PDU.
e) The Lower Tester sends a NULL packet with ARQN bit set to ACK.
f) The Lower Tester transmits a DM1 packet with an invalid MIC (repeat of step a).
g) The Upper Tester verifies that the IUT sends an HCI Disconnection Complete event with reason 0x0E (Connection Rejected Due to Security Reasons).

- Test Condition

The test is performed at normal conditions. Also, if additional valid packets are sent from the IUT, they need to be ACKed by the Lower Tester.

- Expected Outcome

Pass Verdict

For all the occurrences of step b, the IUT sends a packet with the ARQN bit set to NAK or no packet at all in the next Slave to Master slot.

Before step e, the IUT initiates an encryption key refresh by sending an LMP_pause_encryption_aes_req PDU.

After step f, the IUT notifies the disconnection by sending an HCI Disconnection Complete event with reason 0x0E (Connection Rejected Due to Security Reasons) within a three Tpoll time interval.

4.8.2.13 BB/PROT/ARQ/BV-39-C [Secure Connections and Uncorrectable payload as Slave]

- Test Purpose

Verify that the IUT configured as a Slave, upon receipt of a DM1 packet with AES-CCM encryption and uncorrectable errors in the payload transmits a packet with the ARQN bit set to NAK or no packet at all in the next Slave to Master slot.

- Reference

  [1] 7.6.1

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link) and AES-CCM encryption enabled.

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link) and AES-CCM encryption enabled.

- Test Procedure

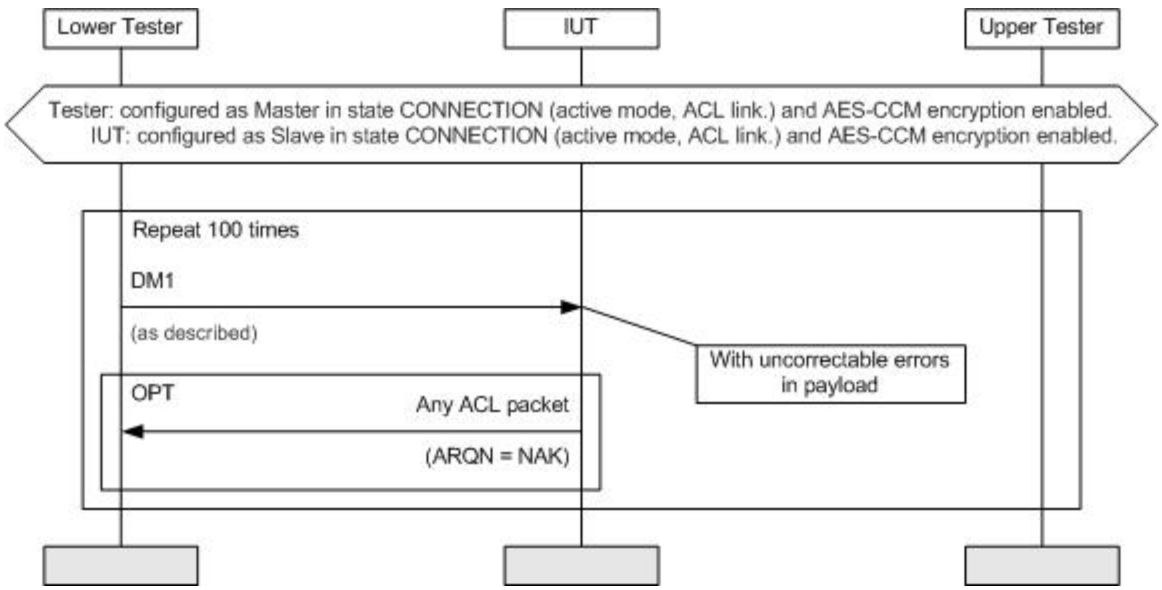

Figure 4.71: BB/PROT/ARQ/BV-39-C

a) The Lower Tester transmits a DM1 packet with uncorrectable errors in the payload.

<u>DM1</u>

Access code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Master (CAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet header: per [13] Section 6.6.2

LT_ADDR: Logical Transport Address of the Slave.

TYPE: '0011'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Depends on the previous transmission from the Lower Tester and ACK or NAK from the IUT.

Payload header:

LLID: '11'B indicating LMP message.

FLOW: '1'B.

LENGTH: '10001'B = '17'D.

Payload body: 17 Bytes PRBS9 plus 4 bytes MIC plus 2 bytes CRC.

This corresponds to 192 bits payload contents (1 Byte payload header 17 Bytes payload body, 4 Bytes MIC and 2 Bytes CRC) before FEC 2/3 coding. The maximum number of inserted errors depends on the Hamming distance provided by the CRC.

b) The Lower Tester verifies that the IUT transmits any ACL packet with the ARQN bit set to NAK.
c) This test procedure is repeated 100 times.

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions the IUT sends a packet with the ARQN bit set to NAK or no packet at all in the next Slave to Master slot.

  The IUT does not send an LMP_pause_encryption_aes_req PDU.

  The IUT does not disconnect the link.

4.8.2.14 BB/PROT/ARQ/BV-40-C [Retransmitting eSCO with AES as Slave]

- Test Purpose

  Verify that the IUT properly encrypts with AES the retransmitted eSCO packets as Slave.

- Reference

  [12] 9.1

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link) with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

- Test Procedure

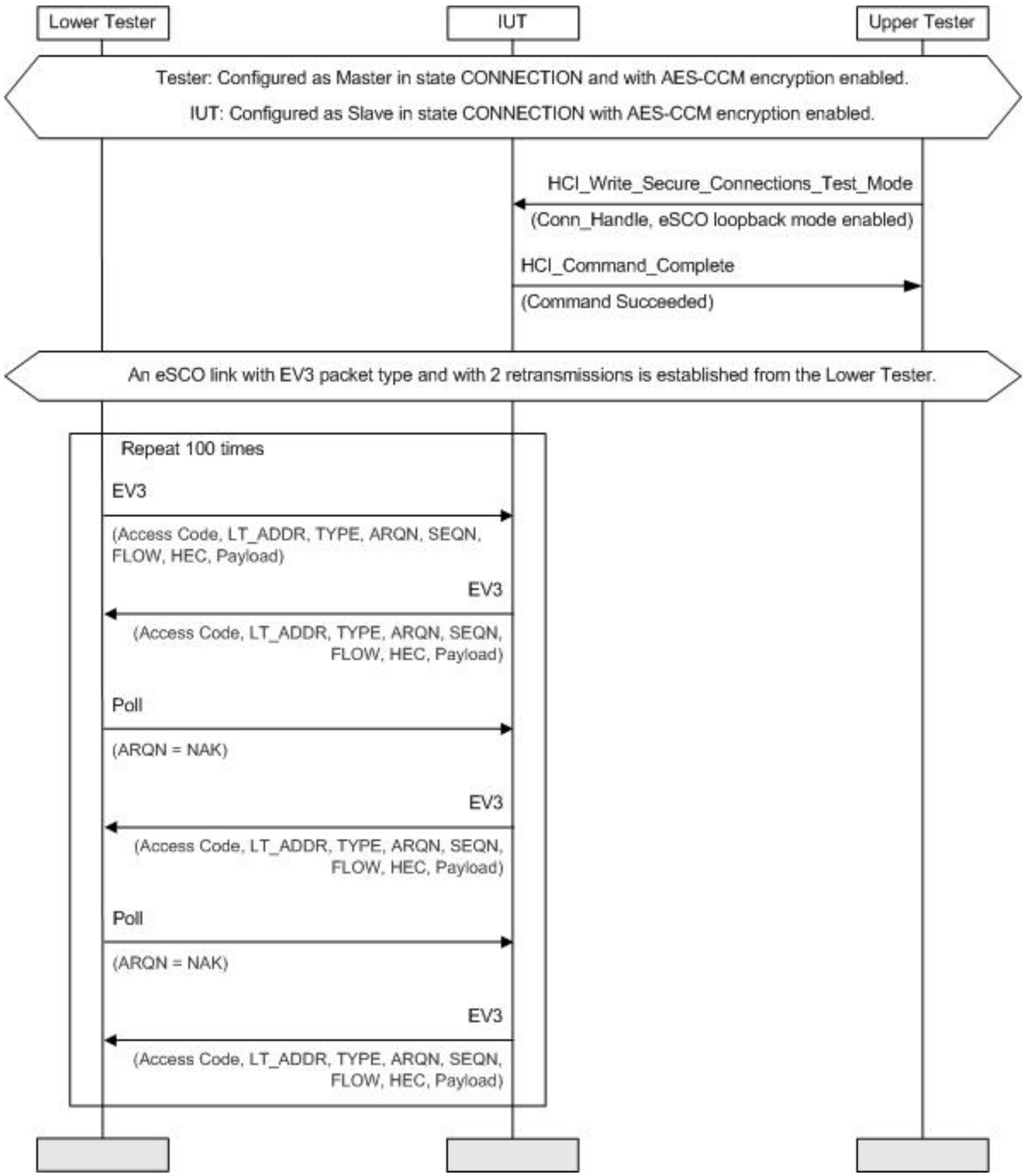

Figure 4.72: BB/PROT/ARQ/BV-40-C

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) The Lower Tester initiates an eSCO link using EV3 and with 2 retransmissions.
c) The Lower Tester sends an EV3 packet as follows:
d) Payload: 30 non deterministic random Bytes of payload plus 16 bit CRC.
e) The IUT replies with a packet of same description.
f) The Lower Tester verifies that the packet from IUT is properly encrypted and contains the same payload as transmitted by the Lower Tester.

g) The Lower Tester explicitly NAKs the packet from IUT using a Poll packet.
h) The IUT retransmits the EV3 packet with the same payload.
i) The Lower Tester verifies that the packet from IUT is properly encrypted and contains the same payload as the initial packet from the Lower Tester.
j) The Lower Tester explicitly NAKs the packet from IUT using a Poll packet.
k) The IUT retransmits the EV3 packet with the same payload.
l) The Lower Tester verifies that the packet from IUT is properly encrypted and contains the same payload as the initial packet from the Lower Tester.
m) Steps c)–k) are repeated 99 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 100 packets (plus their retransmissions) containing a looped back payload.

- Expected Outcome

  Pass Verdict

  At least 99 percent of the packets the IUT is supposed to send are received by the Lower Tester, are properly encrypted, and contain the same payload as the Lower Tester transmitted. The percentage applies to the first transmission and the 2 retransmissions all together.

- Notes

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.8.2.15 BB/PROT/ARQ/BV-41-C [Receiving eSCO retransmissions with AES as Slave]

- Test Purpose

  Verify that the IUT properly decrypts with AES the retransmitted eSCO packets as Slave.

- Reference

  [12] 9.1

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link) with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

- Test Procedure

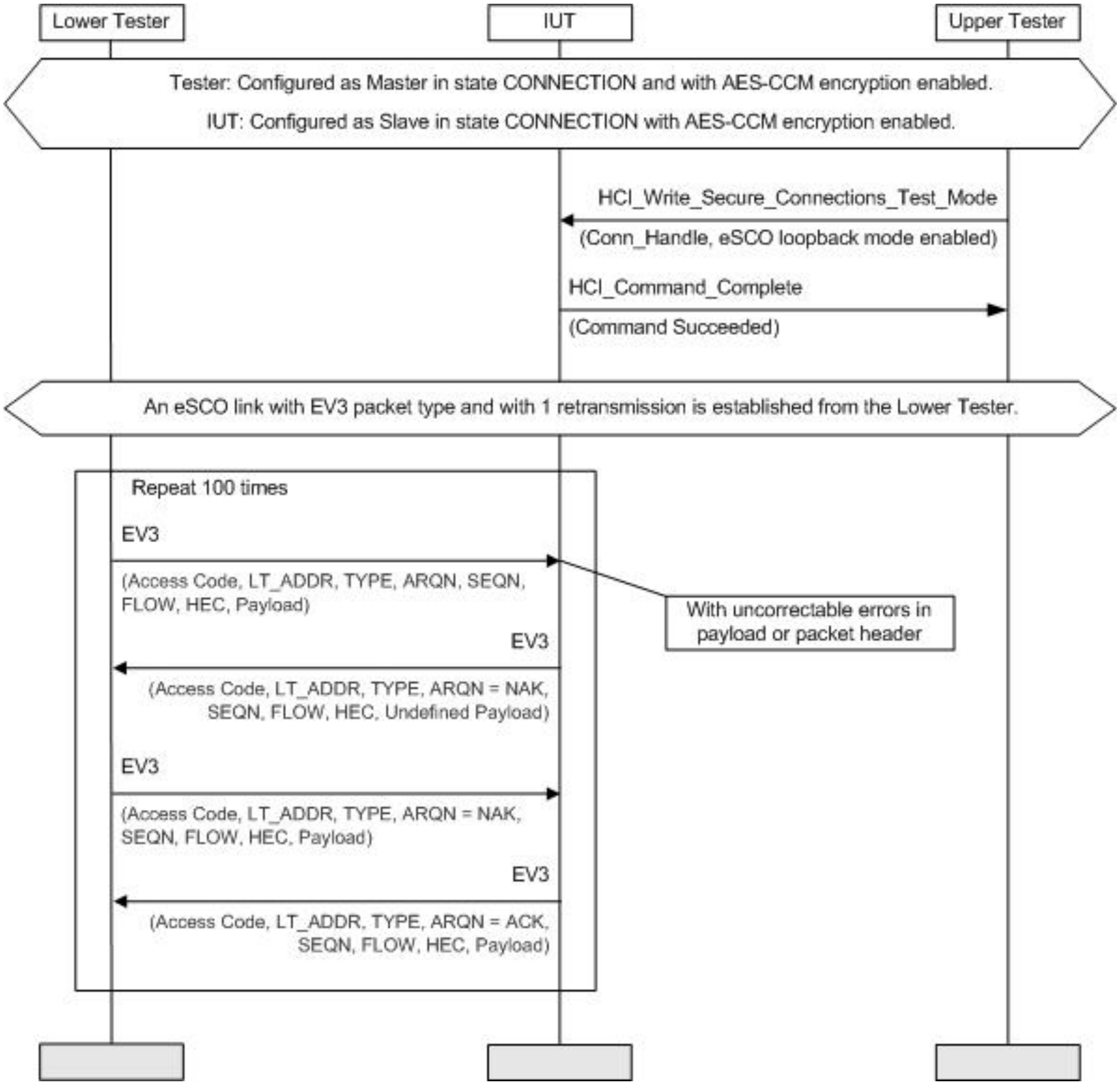

Figure 4.73: BB/PROT/ARQ/BV-41-C

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) The Lower Tester initiates an eSCO link using EV3 and with 1 retransmission.
c) The Lower Tester sends an EV3 packet as follows:

   Payload:

      30 non deterministic random Bytes of payload plus 16 bit CRC.

      The payload or packet header contains uncorrectable errors.

d) The IUT replies with an EV3 packet with ARQN bit set to NAK.
e) The Lower Tester ignores the payload contained in the packet with ARQN bit set to NAK.

f) The Lower Tester sends an EV3 packet as follows:

Payload:

30 non deterministic random Bytes of payload plus 16 bit CRC.

The CRC is valid (no errors in the payload) and the packet header is valid.

The ARQN bit set to NAK.

g) The IUT retransmits the EV3 packet with a valid payload and the ARQN bit set to ACK.
h) The Lower Tester verifies that the packet from IUT is properly encrypted and contains the same payload as transmitted by the Lower Tester.
i) Steps c)–h) are repeated 99 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 100 packets (plus their retransmissions) containing a looped back payload.

- Expected Outcome

  Pass Verdict

  In at least 99 percent of the repetitions, the packet sent by the IUT in step g is properly encrypted and contains the same payload as transmitted by the Lower Tester.

- Notes

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.8.2.16 BB/PROT/ARQ/BV-42-C [Receiving retransmitted ACL packets that were previously acked with AES]

- Test Purpose

  Verify that the IUT behaves properly when receiving retransmitted ACL packets that were previously ACKed.

- Reference

  [1] 7.6.1

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

- Test Procedure

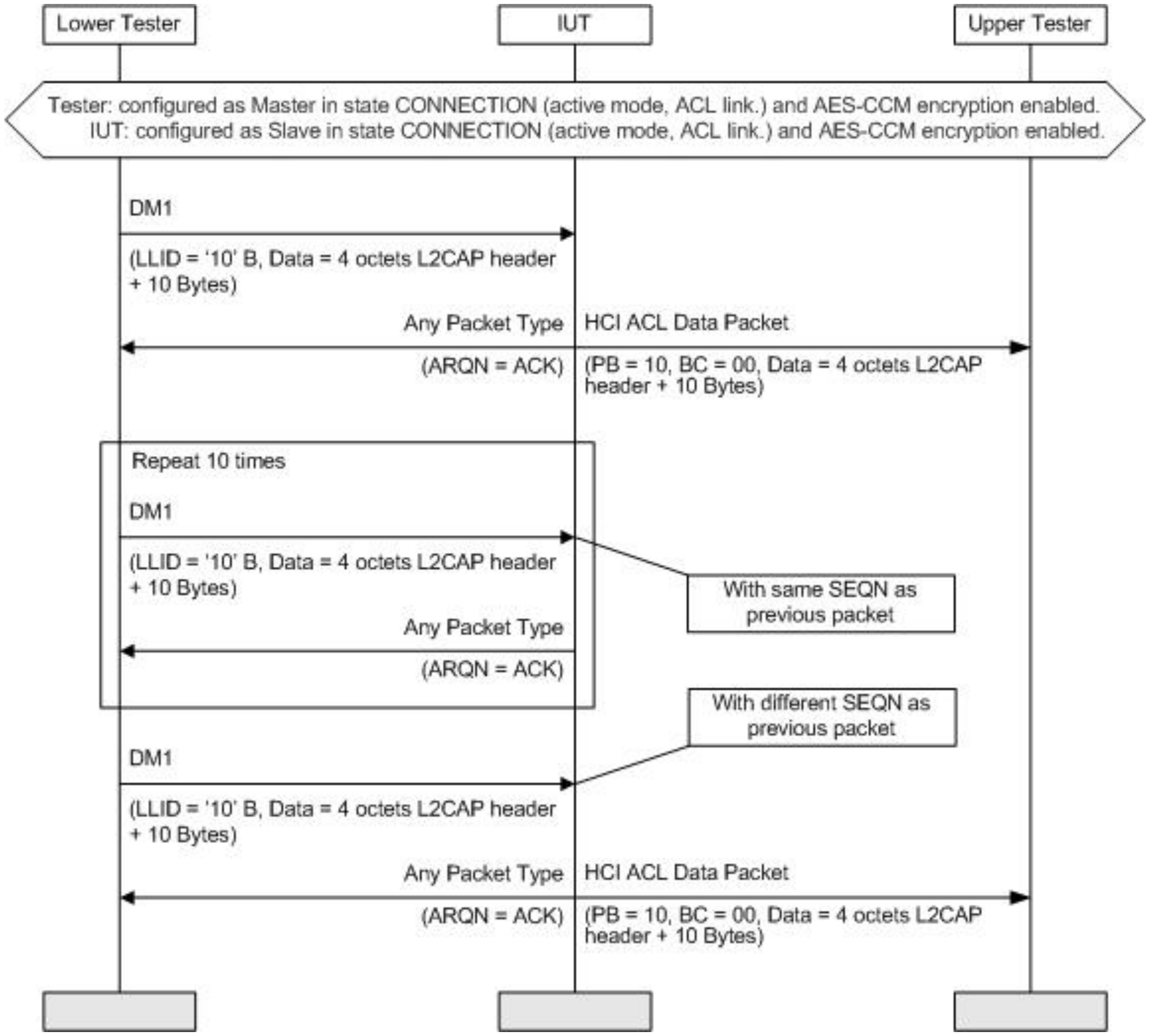

Figure 4.74: BB/PROT/ARQ/BV-42-C

a) The Lower Tester sends a DM1 packet as follows:

<u>DM1</u>

Packet Header: per [13] Section 6.4

Payload header:

LLID: '10'B.

FLOW: '1'B.

LENGTH: '1110'B = '14'D.

Payload body:

A valid 4-octet L2CAP header and 10 non deterministic random Bytes of payload plus 32 bits MIC plus 16 bit CRC.

b) The IUT replies with any ACL packet and ARQN bit set to ACK.
c) The Upper Tester verifies that the IUT sends the data correctly to the Upper Tester.

d) The Lower Tester retransmits the same DM1 packet, the payload and SEQN bit are the same as the previously sent packet.
e) The IUT replies with any ACL packet and ARQN bit set to ACK.
f) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
g) Steps d)–f) are repeated 9 times (in addition to the first time).
h) The Lower Tester sends a DM1 packet to the IUT. The payload and SEQN bit are different from the previously sent packet.
i) The IUT replies with any ACL packet and ARQN bit set to ACK.
j) The Lower Tester verifies that the IUT sends the data correctly to the Upper Tester.

- Expected Outcome

  Pass Verdict

  The IUT transmits the ACK packets correctly to the Lower Tester in all repetitions of e.

  The IUT sends the data correctly to the Upper Tester in j.

  The IUT does not send an LMP_pause_encryption_aes_req PDU.

  The IUT does not disconnect the link.

4.8.3 ARQ Procedures - Flush

Test subgroup objectives:

Verification that the flush scheme used by the device is correct.

4.8.3.1 BB/PROT/ARQ/BV-33-C [Flushable Packet is Flushed]

- Test Purpose

  Verify that the IUT correctly flushes a packet transmitted over the HCI interface when the packet boundary flag is set to '10'B on the first packet, an automatic flush timeout value has been set to a short value and the timer expires before the packet is sent.

- Reference

  [1] 7.6.3

  [11] 5.4.2

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link).

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link).

  The IUT has set a 100ms automatic flush timeout value on the ACL link to the Lower Tester.

- Test Procedure

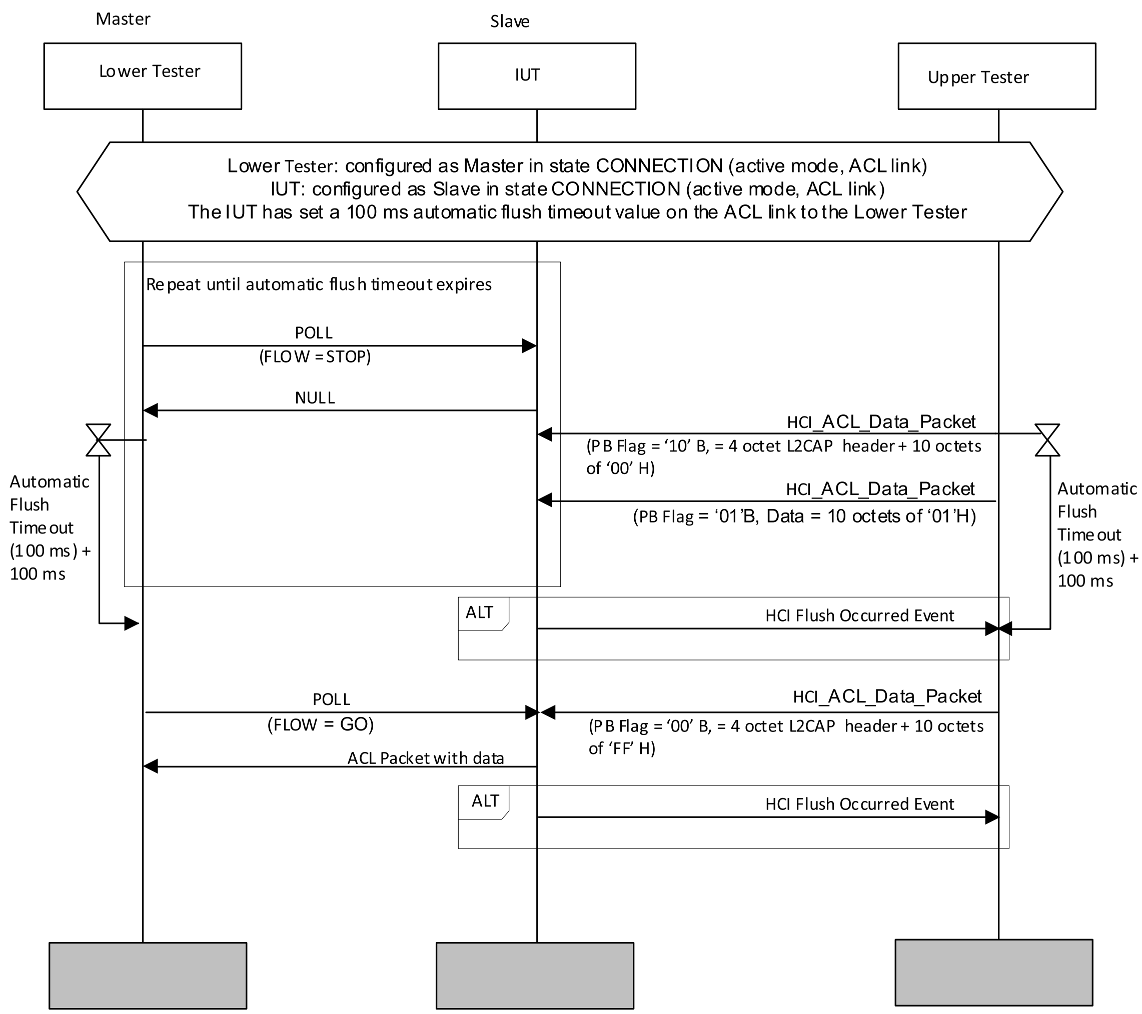

Figure 4.75: BB/PROT/ARQ/BV-33-C

1. Lower Tester stops IUT from sending packets by sending POLL packets with FLOW bit set to STOP.
2. The Upper Tester sends an HCI ACL Data packet with packet boundary flag set to '10'B (start flushable), a valid four-octet L2CAP header, and ten octets of data where each data octet has the value '00'H.
3. The Upper Tester sends an HCI ACL Data packet with packet boundary flag set to '01'B (continue) and ten octets of data where each octet has the value '01'H.
4. After the Automatic Flush Timeout (100 ms) + 100 ms, the Lower Tester allows IUT to transmit packets by sending POLL packets with the FLOW bit set to GO (may need to be repeated).
5. After the Automatic Flush Timeout (100 ms) + 100 ms, Upper Tester sends an HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable), a valid four-octet L2CAP header, and ten octets of data, where each data octet has the value 'FF'H. Note that it does not matter which of the POLL (FLOW = GO) or the third HCI_ACL_Data packet (data = 'FF'H) arrives first at the IUT, both occur at least 100ms (Automatic Flush Timeout) after the first HCI ACL Data packet. Note that the HCI Flush Occurred event may occur after the second or third HCI ACL Data packet.

- Expected Outcome

  Pass Verdict

  The IUT does not transmit the first two data packets containing ten data octets of '00'H and ten data octets of '01'H.

  The IUT transmits the third data packet containing ten data octets of 'FF'H.

  The IUT generates an HCI Flush Occurred event after the automatic flush timeout has expired.

- Notes

  The core specification states: “The Flush Timeout shall start when the First segment of the ACL-U packet is stored in the Controller buffer.”

  A tester may know when the data is given to an HCI Transport, but it cannot know when it was received by the controller’s buffers. Hence, it cannot determine when the Automatic Flush Timeout (100 ms) starts. Hence, an arbitrary delay of 100 ms is added to the test procedure to account for this HCI transport delay.

4.8.3.2 BB/PROT/ARQ/BV-34-C [Non-Flushable Packet is Not Flushed]

- Test Purpose

  Verify that the IUT does not flush a packet transmitted over the HCI interface when the packet boundary flag is set to 00 on the first packet, an automatic flush timeout value has been set to a short value and the timer expires before the packet is sent.

- Reference

  [1] 7.6.3

  [11] 5.4.2

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link).

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link).

  The IUT has set a 100ms automatic flush timeout value on the ACL link to the Lower Tester.

- Test Procedure

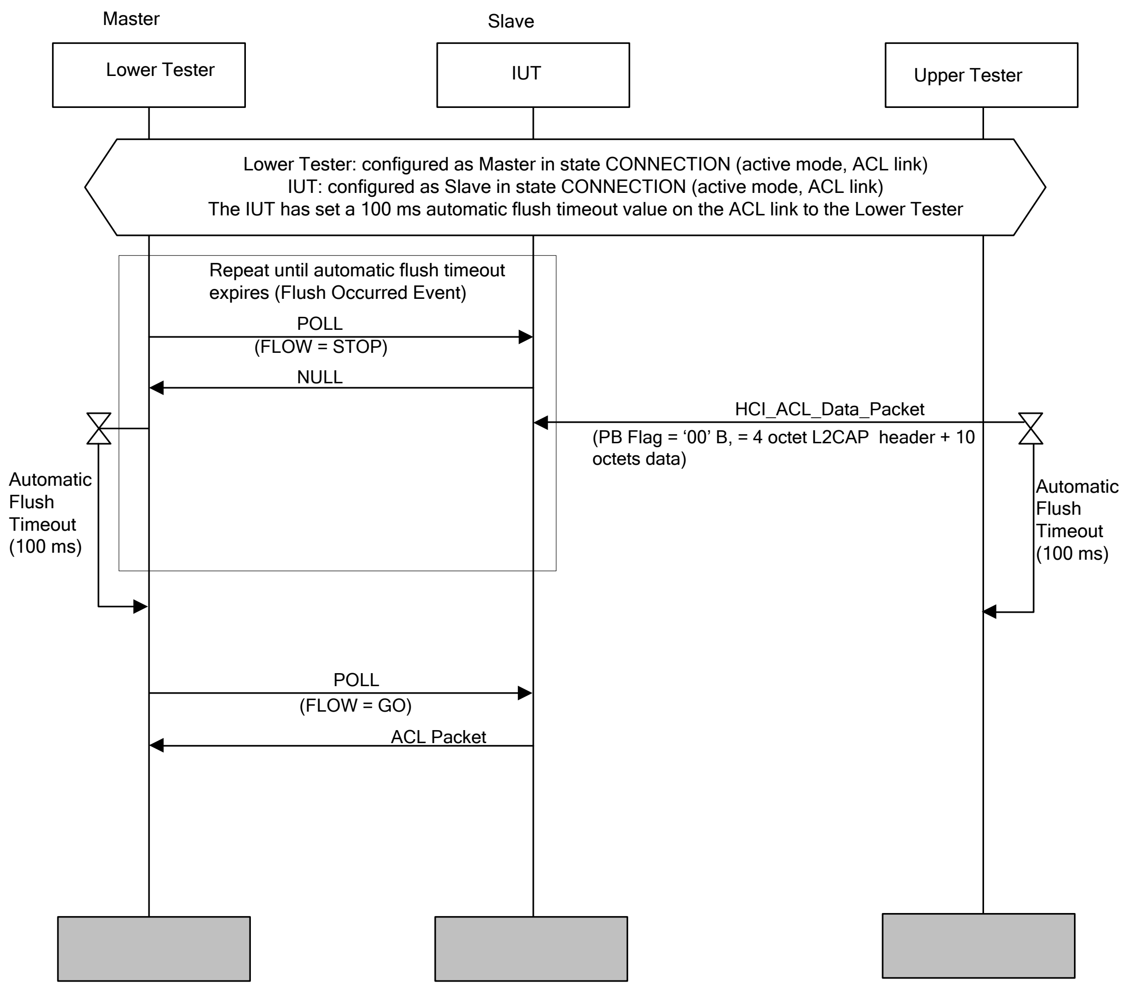

Figure 4.76: BB/PROT/ARQ/BV-34-C

a) Lower Tester stops IUT from sending packets by sending POLL packets with FLOW bit set to STOP.
b) The Upper Tester sends an HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable), valid 4-octet L2CAP header and 10 octets of data (any value).
c) After the IUT flush timeout has expired, Lower Tester allows IUT to transmit packets by sending a POLL packet with FLOW bit set to GO.

- Expected Outcome

<u>Pass Verdict</u>

The IUT transmits non-flushable data packet.

4.8.3.3 BB/PROT/ARQ/BV-35-C [Flushable L2CAP PDU with Multiple Fragments Flushed after First Fragment Sent]

- Test Purpose

  Verify that the IUT correctly flushes the remaining fragments of an L2CAP PDU transmitted over the HCI interface when the packet boundary flag is set to 10 on the first packet, an automatic flush timeout value has been set to a short value and the timer expires after the first fragment has been sent over the air, but the remaining fragments have not been sent.

- Reference

  [1] 7.6.3

  [11] 5.4.2

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL).

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link).

  The IUT has set a 100ms automatic flush timeout value on the ACL link to Lower Tester.

- Test Procedure

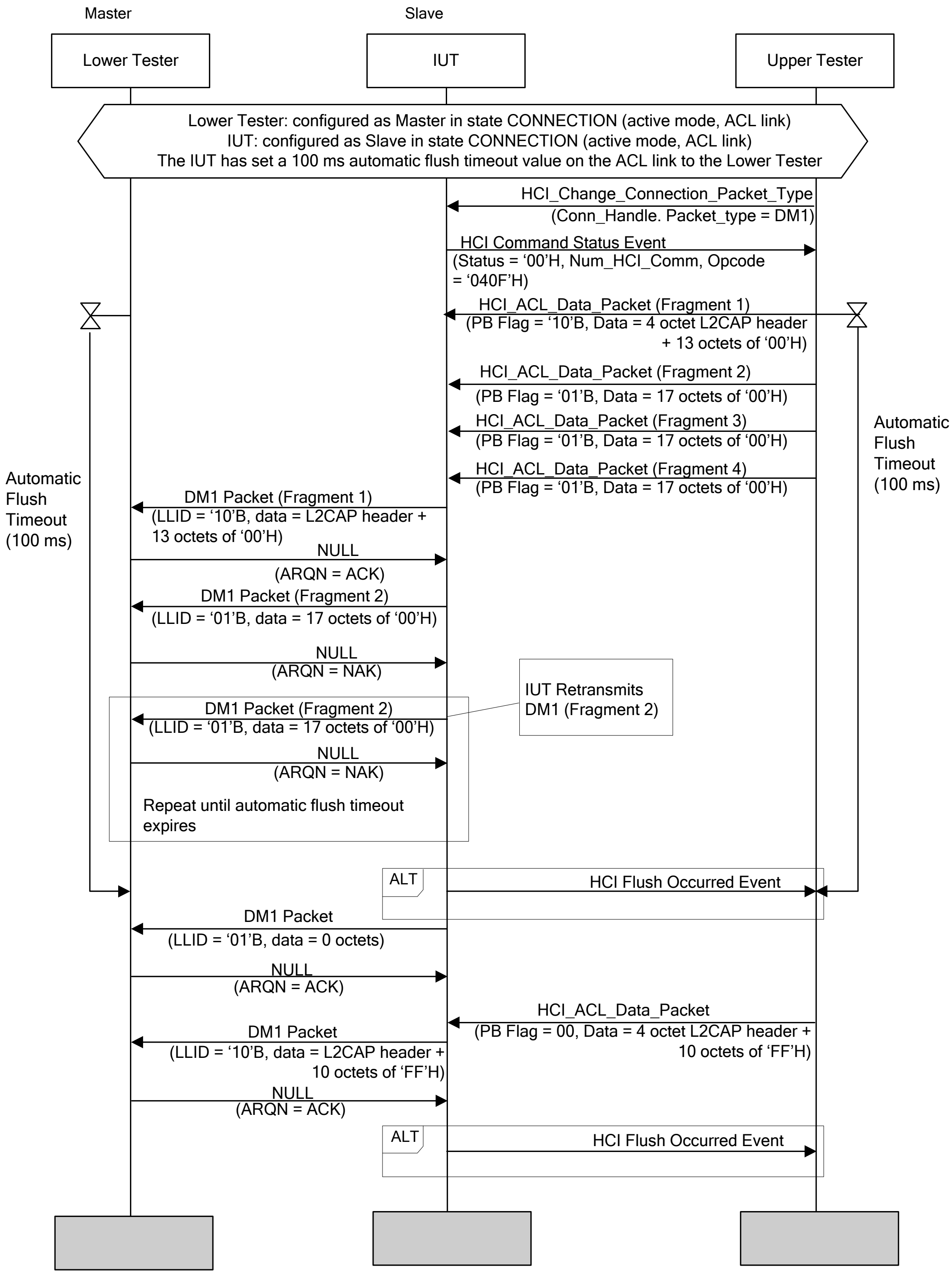

Figure 4.77: BB/PROT/ARQ/BV-35-C

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DM1.

b) The Upper Tester sends an L2CAP PDU containing a valid 4-octet L2CAP header plus 64 data octets of '00'H over the HCI interface in four fragments (HCI_ACL_Data packets) each fragment contains 17 octets of data. The first fragment has a packet boundary flag set to '10'B and the other fragments have a packet boundary flag set to '01'B.

c) Note: the PDU will be transmitted by the IUT in multiple DM1 packets (Packet_Type setting on ACL link is set so only DM1 packets can be used).
d) The Lower Tester allows the first DM1 packet to be transmitted then continually rejects (NAKs) the second DM1 packet until the flush timeout expires.
e) After the IUT's flush timeout has expired the Lower Tester allows the IUT to send packets (stops NAKing).
f) After the IUT flush timeout has expired, Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable) containing a valid 4-octet L2CAP header and10 octets of data where each data octet has the value 'FF'H. Note that the HCI Flush Occurred event may occur after the first fragment of the first PDU (first HCI ACL Data packet) or after the second PDU (fifth HCI ACL Data packet).

- Expected Outcome

Pass Verdict

The IUT does not transmit the last three fragments of the L2CAP PDU containing 64 data octets of '00'H.

The IUT transmits the second L2CAP PDU containing 10 data octets of 'FF'H.

The IUT generates an HCI Flush Occurred Event after the automatic flush timeout expires.

4.8.3.4 BB/PROT/ARQ/BV-36-C [Non-Flushable L2CAP PDU with Multiple Fragments is not Flushed after the First Fragment is Sent]

- Test Purpose

Verify that the IUT correctly sends the remaining fragments of an L2CAP PDU transmitted over the HCI interface when the packet boundary flag is set to 00 on the first packet, an automatic flush timeout value has been set to a short value and the timer expires after the first fragment has been sent over the air but the remaining fragments have not been sent.

- Reference

[1] 7.6.3

[11] 5.4.2

- Initial Condition

IUT is configured as Slave in state CONNECTION (active mode, ACL).

Lower Tester is configured as Master in state CONNECTION (active mode, ACL link).

The IUT has set a 100ms automatic flush timeout value on the ACL link to the Lower Tester.

- Test Procedure

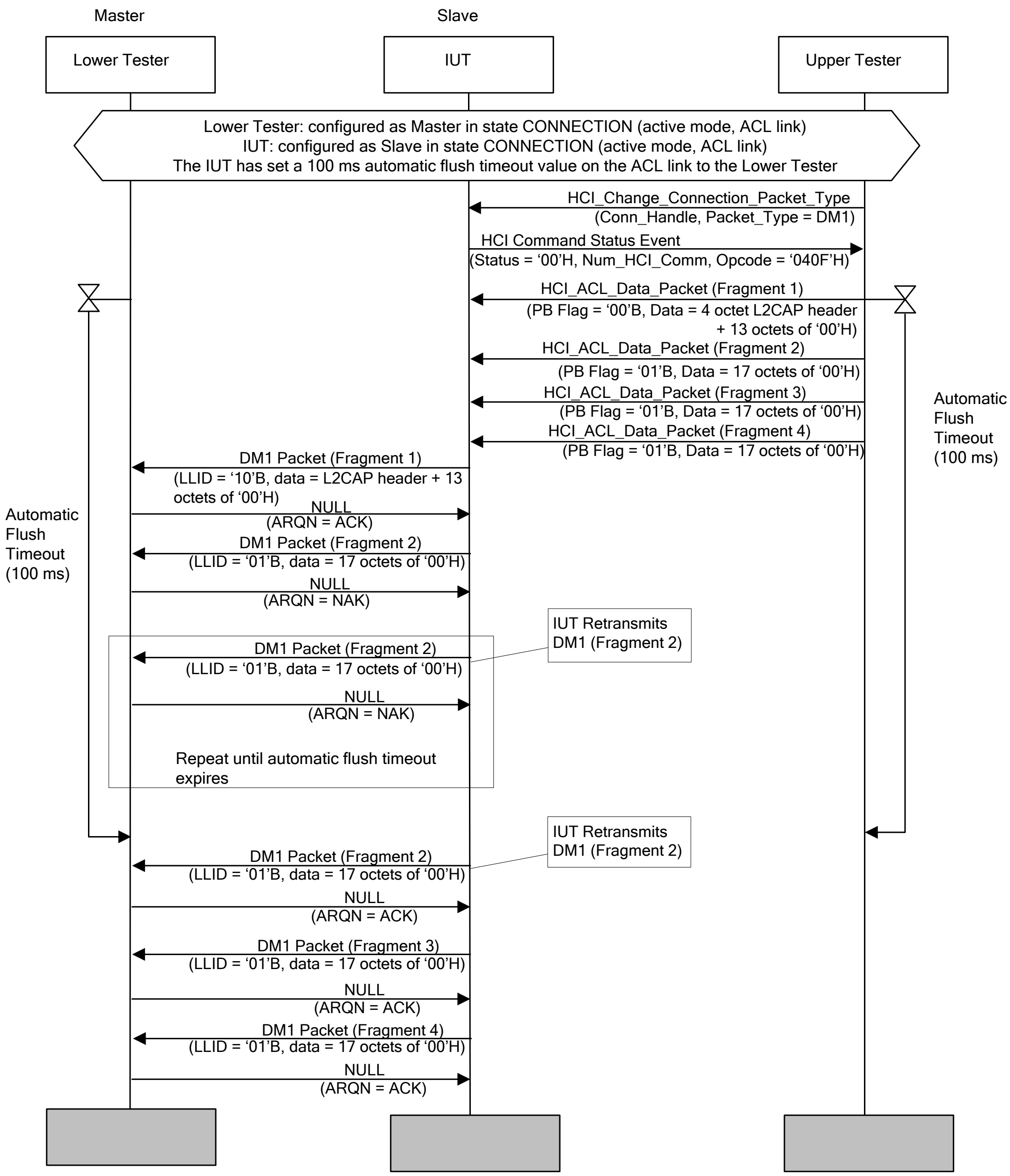

Figure 4.78: BB/PROT/ARQ/BV-36-C

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DM1.
b) The Upper Tester sends an L2CAP PDU containing a valid 4-octet L2CAP header plus 64 data octets of '00'H over the HCI interface in four fragments (HCI_ACL_Data packets) each fragment contains 17 bytes of data. The first fragment has a packet boundary flag set to '00'B and the other fragments have a packet boundary flag set to '01'B.
c) The Lower Tester allows the first DM1 packet to be transmitted then continually rejects (NAKs) the second DM1 packet until the flush timeout expires.
d) After the IUT's flush timeout has expired the Lower Tester allows the IUT to send packets (stops NAKing).

- Expected Outcome

  Pass Verdict

  The IUT transmits all four fragments of the L2CAP PDU.

4.8.3.5 BB/PROT/ARQ/BV-37-C [Flushable and Non-Flushable L2CAP PDUs]

- Test Purpose

  Verify that the IUT correctly flushes all flushable L2CAP PDUs and does not flush the non-flushable L2CAP PDUs when the HCI Enhanced Flush Command is called.

- Reference

  [1] 7.6.3

  [11] 5.4.2, 7.3.64

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link).

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link).

  The IUT has set a 1000ms automatic flush timeout value on the ACL link to the Lower Tester.

- Test Procedure

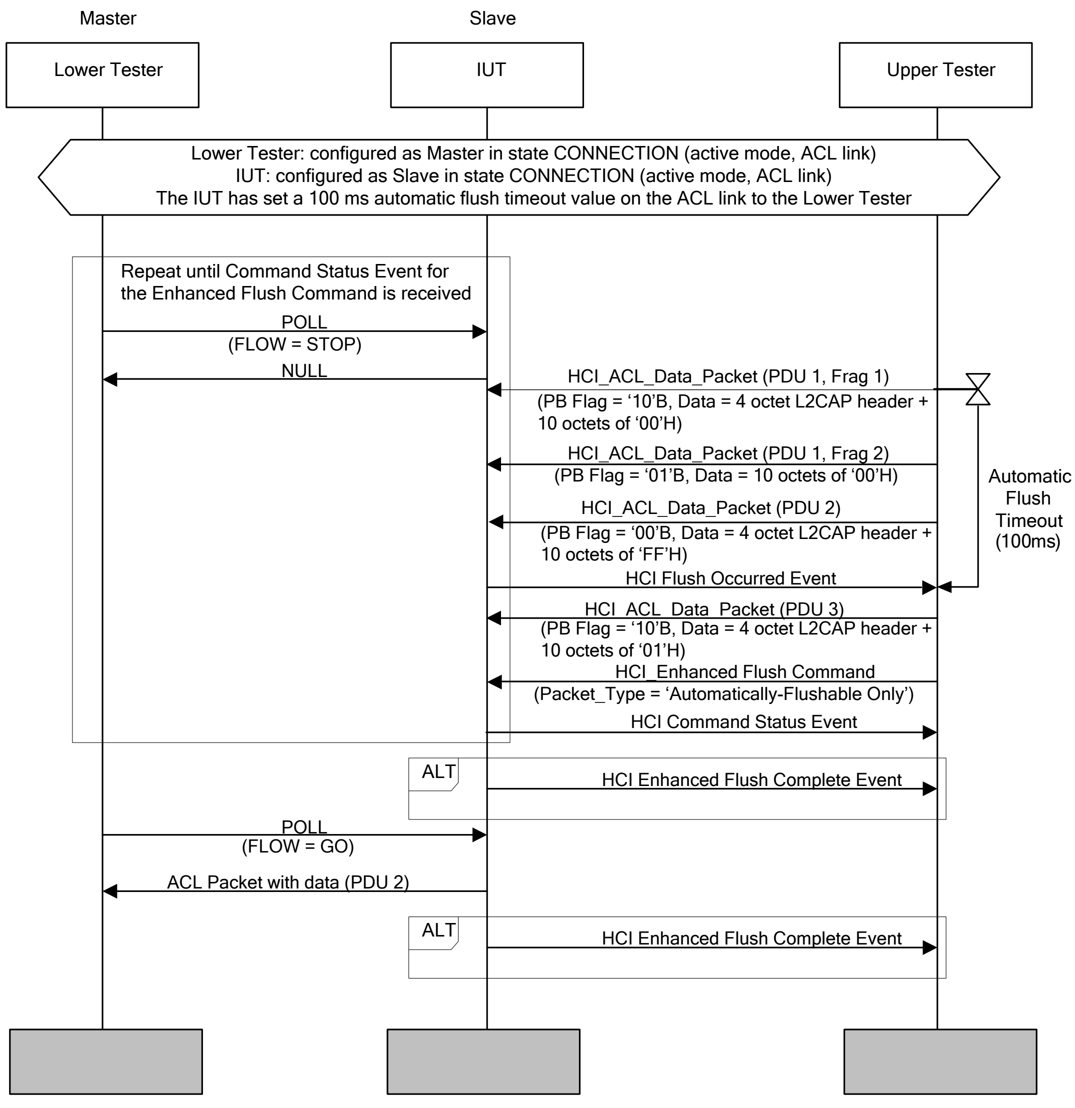

Figure 4.79: BB/PROT/ARQ/BV-37-C

a) Lower Tester stops the IUT from sending packets by sending POLL packets with FLOW bit set to STOP.

b) The Upper Tester sends two L2CAP PDUs over the HCI interface. The first PDU is sent in two fragments (HCI ACL Data packets) where the first fragment has a packet boundary flag set to 10 and the second fragment has a packet boundary flag set to '01'B. The first fragment contains a valid 4-octet L2CAP header plus 10 data octets of '00'H. The second fragment contain 10 data octets of '00'H. The second PDU is sent as one fragment with a packet boundary flag of '00'B, a valid 4-octet L2CAP header and 10 data octets of 'FF'H.

c) When the IUT's automatic flush timeout expires, the IUT sends a Flush Occurred Event to the Upper Tester. Upon receiving the Flush Occurred Event, the Upper Tester sends another L2CAP PDU. The PDU is sent as one fragment with a packet boundary flag of '10'B, a valid 4-octet L2CAP header and 10 data octets of '01'H. After that, the Upper Tester calls the HCI Enhanced Flush Command with the *Packet_Type* parameter set to "Automatically-Flushable Only".

d) When the Command Status Event for the Enhanced Flush Command is received by the Upper Tester, the Lower Tester stops rejecting packets sending POLL packets with the FLOW bit set to GO.
e) Note: The IUT may send Enhanced Flush Complete event to the Upper Tester either before or after transmitting the second PDU.

- Expected Outcome

  Pass Verdict

  The IUT does not transmit the first PDU containing 20 data octets of '00'H.

  The IUT transmits the second PDU containing 10 data octets of 'FF'H.

  The IUT does not transmit the third PDU containing 10 data octets of '01'H.

  The IUT generates a Flush Occurred Event.

  The IUT generates a Command Status event as a result of the Upper Tester invoking HCI Enhanced Flush Command.

  The IUT generates an Enhanced Flush Complete event after the Command Status event.

4.8.3.6 BB/PROT/ARQ/BV-43-C [Flushable Packet is flushed with AES encryption]

- Test Purpose

  Verify that the IUT correctly flushes a packet transmitted over the HCI interface when the packet boundary flag is set to '10'B on the first packet, an automatic flush timeout value has been set to a short value and the timer expires before the packet is sent, while AES-CCM encryption is in use.

- Reference

  [1] 7.6.3

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  The IUT has set a 100ms automatic flush timeout value on the ACL link to the Lower Tester.

- Test Procedure

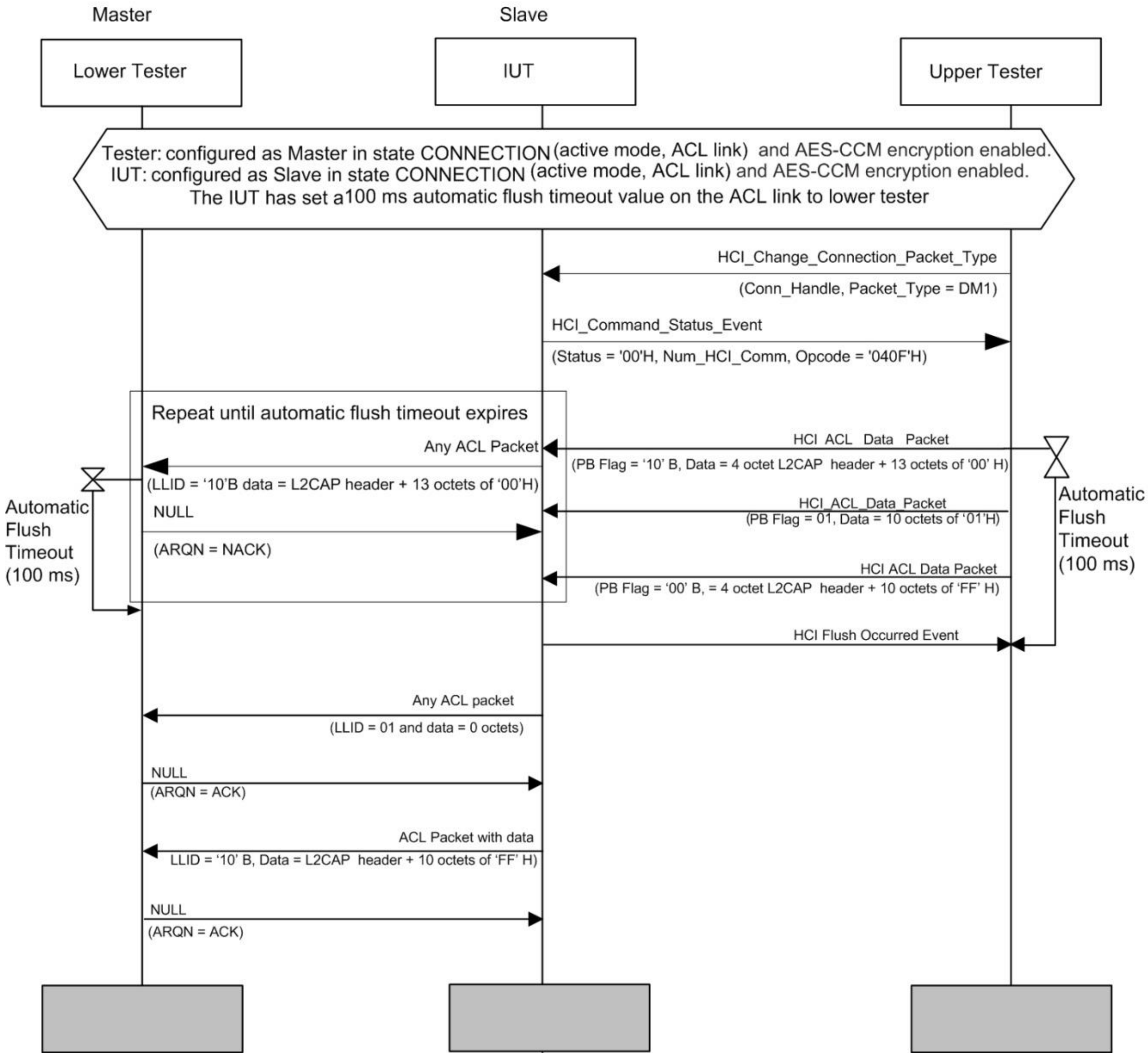

Figure 4.80: BB/PROT/ARQ/BV-43-C

a) The Lower Tester enters a state where it NAKs all ACL-U packets received from the IUT.
b) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DM1 only.
c) The Upper Tester sends an HCI ACL Data packet with packet boundary flag set to '10'B (start flushable), a valid four-octet L2CAP header, and 13 octets of data where each data octet has the value '00'H.
d) The Upper Tester sends an HCI ACL Data packet with packet boundary flag set to '01'B (continue) and ten octets of data where each octet has the value '01'H.
e) The Upper Tester sends an HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable), a valid four-octet L2CAP header, and ten octets of data, where each data octet has the value 'FF'H.
f) After the IUT flush timeout has expired, the Lower Tester stops NAKing all the ACL-U packets from the IUT.

- Expected Outcome

  Pass Verdict

  After the flush timeout, the IUT transmits a properly encrypted ACL-U continuation packet with the same sequence number as the first flushed data packet and length zero.

  The IUT transmits the third data packet containing ten data octets of 'FF'H properly encrypted.

  The IUT generates an HCI Flush Occurred event after the automatic flush timeout has expired.

- Notes

  Per [1]: for ACL-U continuation packet with length zero, the bit 4 in the AES-CCM encryption nonce4 byte is set to 1.

4.8.3.7 BB/PROT/ARQ/BV-44-C [Non-flushable Packet is not flushed with AES encryption]

- Test Purpose

  Verify that the IUT does not flush a packet transmitted over the HCI interface when the packet boundary flag is set to 00 on the first packet, an automatic flush timeout value has been set to a short value and an automatic timeout value and the timer expires before the packet is sent, while AES-CCM encryption is in use.

- Reference

  [1] 7.6.3

  [11] 5.4.2

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  The IUT has set a 100ms automatic flush timeout value on the ACL link to the Lower Tester.

- Test Procedure

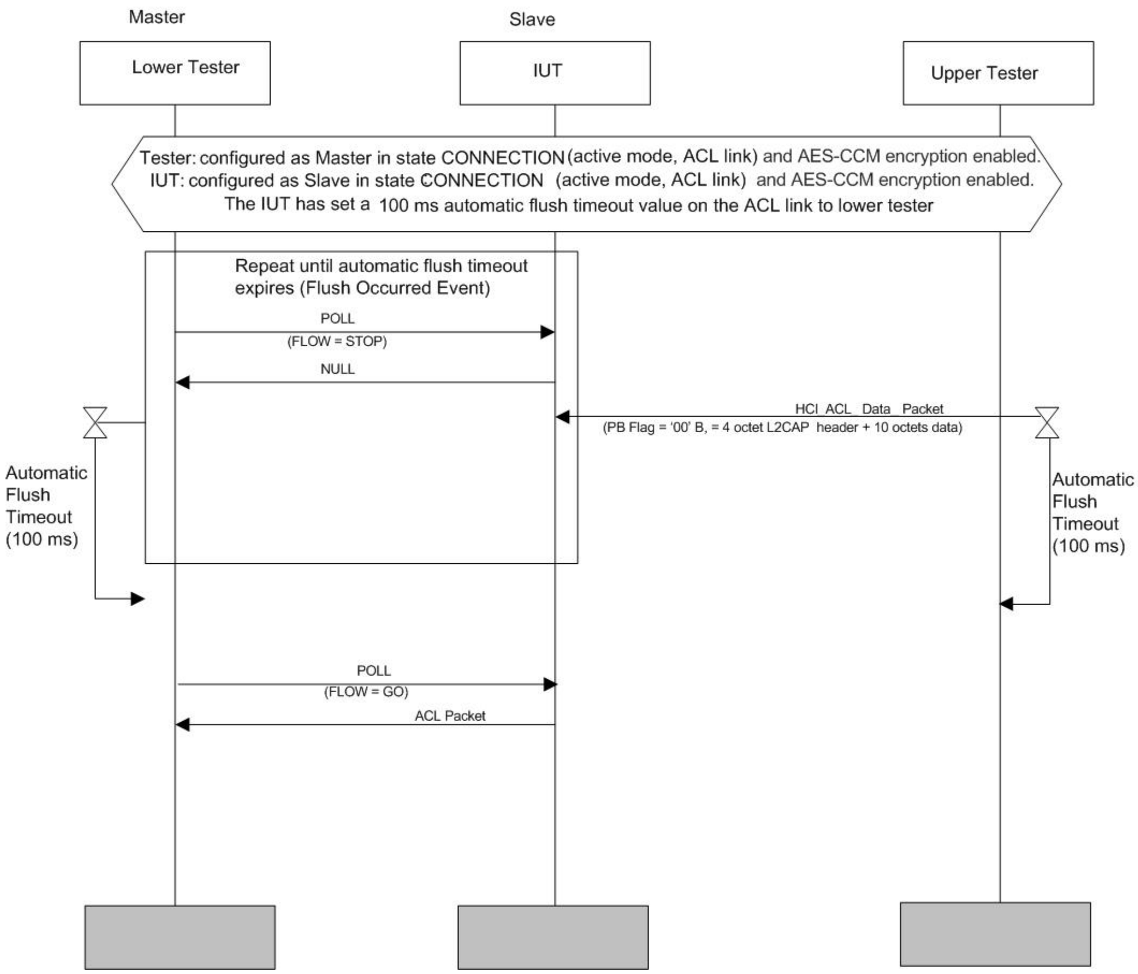

Figure 4.81: BB/PROT/ARQ/BV-44-C

a) Lower Tester stops IUT from sending packets by sending POLL packets with FLOW bit set to STOP.
b) The Upper Tester sends an HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable), valid 4-octet L2CAP header and 10 octets of data (any value).
c) After the IUT flush timeout has expired, Lower Tester allows IUT to transmit packets by sending a POLL packet with FLOW bit set to GO.

- Expected Outcome

<u>Pass Verdict</u>

The IUT transmits non-flushable data packet.

4.8.3.8 BB/PROT/ARQ/BV-45-C [Flushable L2CAP PDU with Multiple Fragments Flushed after First Packet Send, with AES encryption]

- Test Purpose

  Verify that the IUT correctly flushes the remaining packets of an L2CAP PDU transmitted over the HCI interface when the packet boundary flag is set to 10 on the first packet, an automatic flush timeout value has been set to a short value and the timer expires after the first packet has been sent over the air, but the remaining packets have not been sent, while AES-CCM encryption is in use.

- Reference

  [1] 7.6.3

  [11] 5.4.2

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL) and with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  The IUT has set a 100ms automatic flush timeout value on the ACL link to the Lower Tester.

- Test Procedure

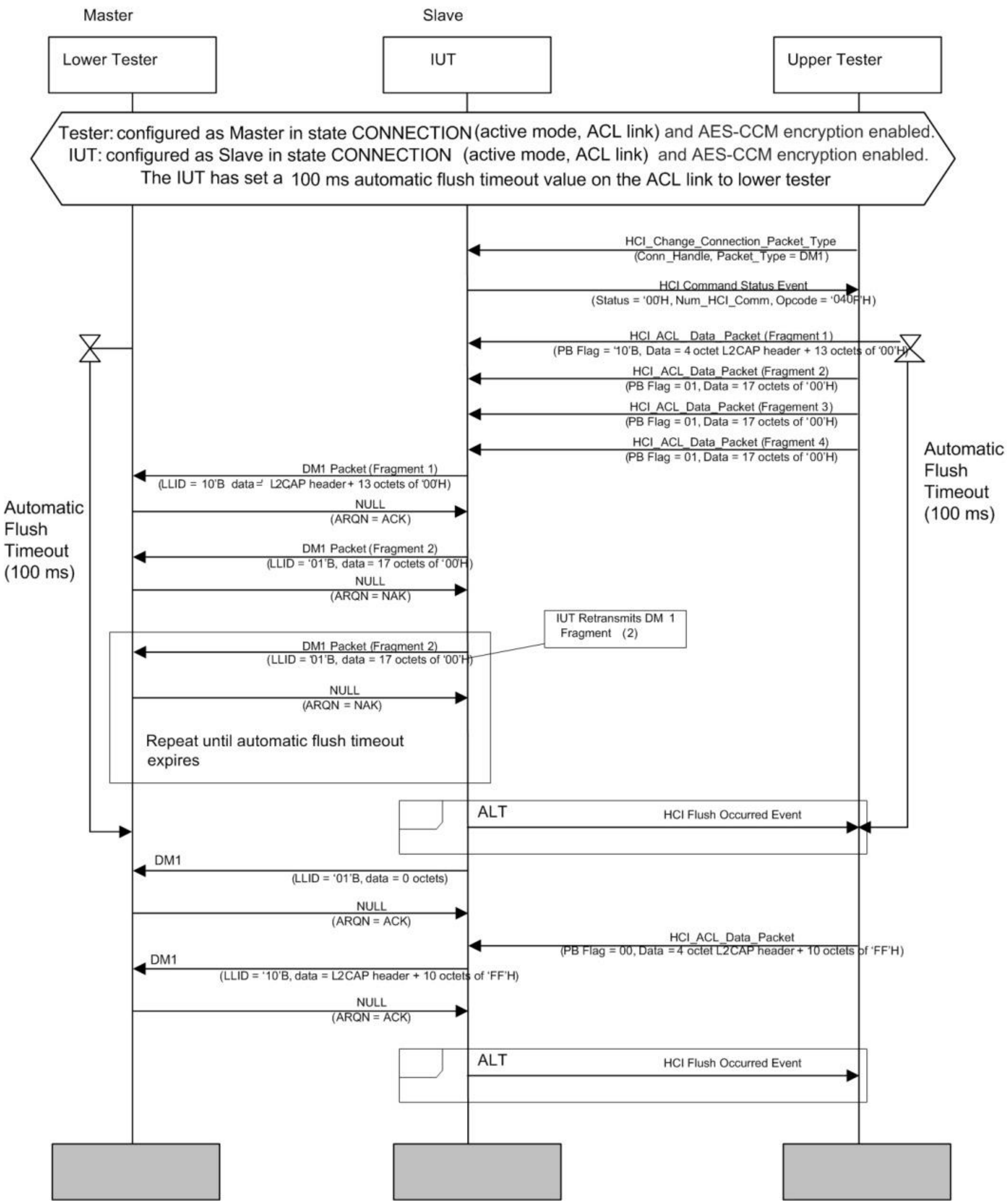

Figure 4.82: BB/PROT/ARQ/BV-45-C

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DM1.
b) The Upper Tester sends an L2CAP PDU containing a valid 4-octet L2CAP header plus 64 data octets of '00'H over the HCI interface in four fragments (HCI_ACL_Data packets) each fragment

contains 17 octets of data. The first fragment has a packet boundary flag set to '10'B and the other fragments have a packet boundary flag set to '01'B.

c) Note: the PDU will be transmitted by the IUT in multiple DM1 packets (Packet_Type setting on ACL link is set so only DM1 packets can be used).
d) The Lower Tester allows the first DM1 packet to be transmitted then continually rejects (NAKs) the second DM1 packet until the flush timeout expires.
e) After the IUT's flush timeout has expired the Lower Tester allows the IUT to send packets (stops NAKing).
f) After the IUT flush timeout has expired, Upper Tester sends a PDU as a single HCI ACL Data packet with packet boundary flag set to '00'B (start non-flushable) containing a valid 4-octet L2CAP header and10 octets of data where each data octet has the value 'FF'H.

- Expected Outcome

  Pass Verdict

  The IUT does not transmit the last three fragments of the L2CAP PDU containing 64 data octets of '00'H.

  The IUT transmits a properly encrypted ACL-U continuation packet with the same sequence number as the first flushed fragment and length zero.

  The IUT transmits the second L2CAP PDU containing 10 data octets of 'FF'H properly encrypted.

  The IUT generates an HCI Flush Occurred Event after the automatic flush timeout expires. Note that the HCI Flush Occurred event may occur before or after the HCI_ACL_Data_Packet with payload 'FF'H.

- Notes

  Per [1]: for ACL-U continuation packet with length zero, the bit 4 in the AES-CCM encryption nonce4 byte is set to 1.

4.8.3.9 BB/PROT/ARQ/BV-46-C [Non-flushable L2CAP PDU with Multiple Fragments is not flushed after the First Fragment is sent, with AES-CCM encryption]

- Test Purpose

  Verify that the IUT correctly sends the remaining fragments of an L2CAP PDU transmitted over the HCI interface when the packet boundary flag is set to 00 on the first packet, an automatic flush timeout value has been set to a short value and the timer expires after the first fragment has been sent over the air but the remaining fragments have not been sent, with AES-CCM encryption is in use.

- Reference

  [1] 7.6.3

  [11] 5.4.2

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL).

  The Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  The IUT has set a 100ms automatic flush timeout value on the ACL link to the Lower Tester and with AES-CCM encryption enabled.

- Test Procedure

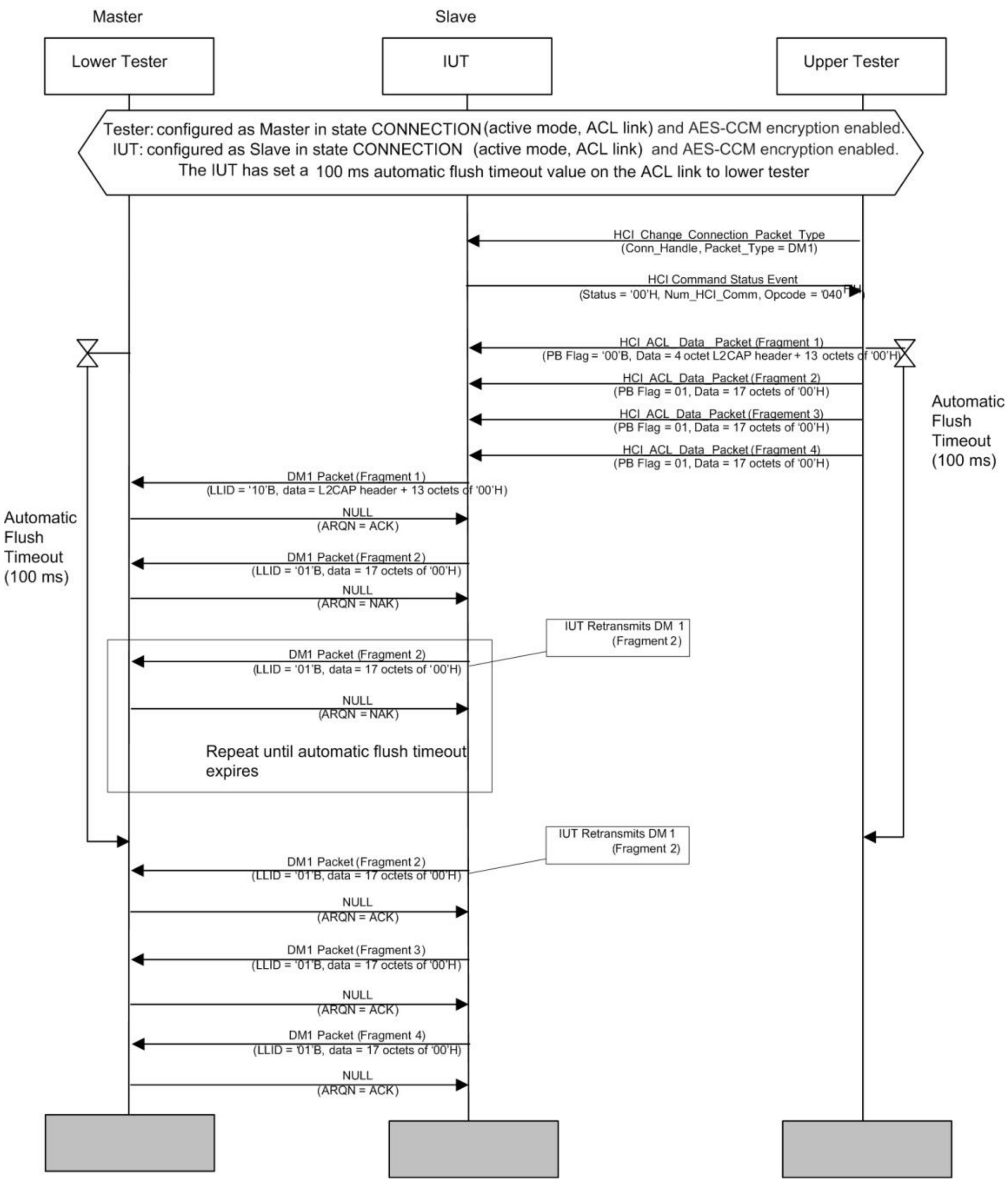

Figure 4.83: BB/PROT/ARQ/BV-46-C

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DM1.
b) The Upper Tester sends an L2CAP PDU containing a valid 4-octet L2CAP header plus 64 data octets of '00'H over the HCI interface in four fragments (HCI_ACL_Data packets) each fragment contains 17 bytes of data. The first fragment has a packet boundary flag set to '00'B and the other fragments have a packet boundary flag set to '01'B.
c) The Lower Tester allows the first DM1 packet to be transmitted then continually rejects (NAKs) the second DM1 packet until the flush timeout expires.
d) After the IUT's flush timeout has expired the Tester allows the IUT to send packets (stops NAKing).

- Expected Outcome

  Pass Verdict

  The IUT transmits all four fragments of the L2CAP PDU.

4.8.3.10 BB/PROT/ARQ/BV-47-C [Remote flushing with AES]

- Test Purpose

  Verify that the IUT behaves properly when remote flushes packets:

  Zero Length Continuation packets are properly ACKed.

  ACL-U packets received after flush are properly received.

- Reference

  [1] 7.6.3

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

- Test Procedure

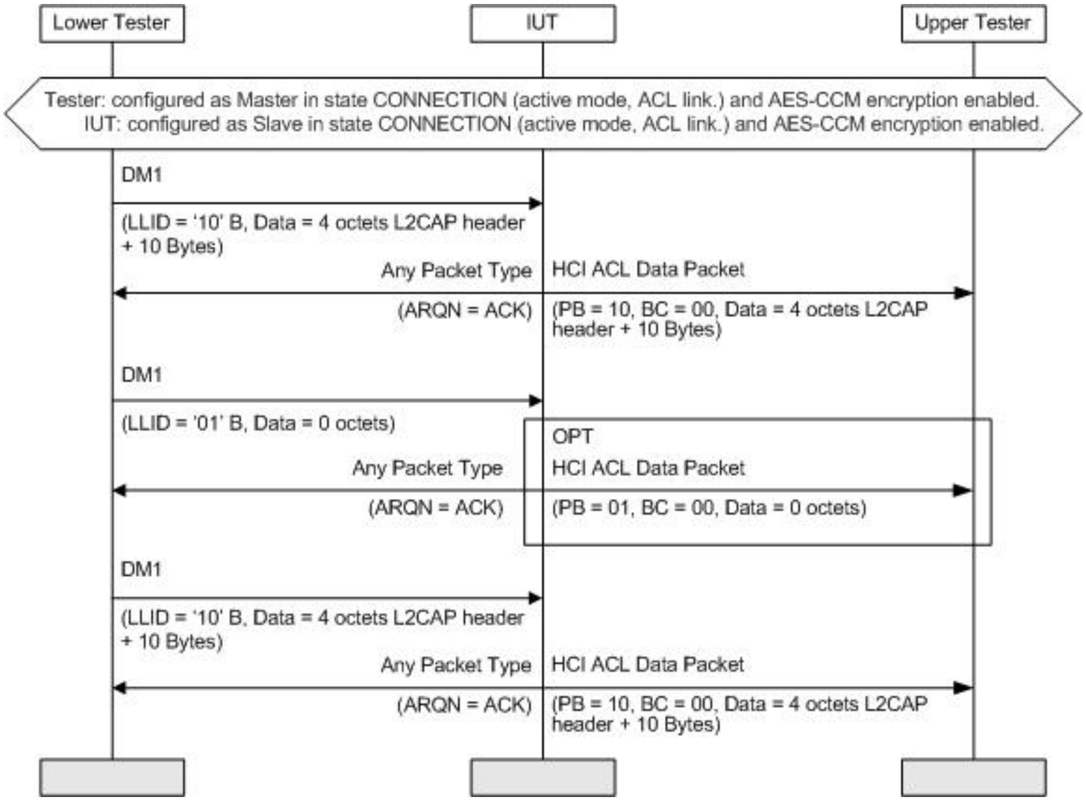

Figure 4.84: BB/PROT/ARQ/BV-47-C

a) The Lower Tester sends a DM1 packet as follows:

<u>DM1</u>

Packet header: per [13] Section 6.4

Payload header:

LLID: '10'B.

FLOW: '1'B.

LENGTH: '1110'B = '14'D.

Payload body:

A valid 4-octet L2CAP header and 10 non deterministic random Bytes of payload plus 32 bits MIC plus 16 bit CRC.

b) The IUT replies with any ACL packet and ARQN bit set to ACK.
c) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
d) The Lower Tester verifies that the IUT sends the data correctly to the Upper Tester.

e) The Lower Tester sends a DM1 packet as follows:

DM1

Packet header: per [13] Section 6.4

Payload header:

LLID: '01'B.

FLOW: '1'B.

LENGTH: '0000'B = '0'D.

Payload body:

A zero length payload plus 32 bits MIC plus 16 bit CRC.

f) The IUT replies with any ACL packet and ARQN bit set to ACK.
g) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
h) The Lower Tester sends a DM1 packet as follows:

DM1

Packet header: per [13] Section 6.4

Payload header:

LLID: '10'B.

FLOW: '1'B.

LENGTH: '1110'B = '14'D.

Payload body:

A valid 4-octet L2CAP header and 10 non deterministic random Bytes of payload plus 32 bits MIC plus 16 bit CRC.

i) The IUT replies with any ACL packet and ARQN bit set to ACK.
j) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
k) The Lower Tester verifies that the IUT sends the data correctly to the Upper Tester.

- Expected Outcome

  Pass verdict

  The IUT transmits the ACK packets correctly to the Lower Tester in c, g and j.

  The IUT sends the data correctly to the Upper Tester in d and k.

- Notes

  Per [1]: for ACL-U continuation packet with length zero, the bit 4 in the AES-CCM encryption nonce4 byte is set to 1.

4.9 Inquiry

Test group objectives:

To verify the Inquiry procedures.

4.9.1 Inquiry Procedures - Master

Test subgroup objectives:

To verify that the Inquiry procedures for the Master is correct.

4.9.1.1 BB/PHYS/INQ/BV-01-C [Inquiry Hop Sequence]

- Test Purpose

  Verify that the IUT as Master uses the correct inquiry hopping sequence when discovering which other Bluetooth devices are in range.

  Verify that:

  - The Master uses the general inquiry access code (GIAC) and its native clock CLKN to determine the inquiry hopping sequence.
  - The Master sequentially transmits on 2 different hop frequencies during each TX slot.
  - Two 10 ms inquiry trains A and B with 16 hops each are used.
  - The inquiry trains A and B are repeated at least Ninquiry = 256 times.
  - At least 4 trains are transmitted subsequently.
  - One inquiry instance is stopped latest when inquiryTO is reached.

- Reference

  [1] 8.4.2

- Initial Condition

  The Lower Tester has performed an inquiry procedure as Master before to get the clock CLK of the IUT.

  The IUT is configured as Master.

  Both IUT and Lower Tester are in standby mode.

- Test Procedure

  a) To verify the inquiry hopping sequence the Lower Tester must not follow the normal inquiry scan procedure. For the RX slots, the inquiry hopping sequence of the Master is used as well instead.
  b) In the *HCI_Inquiry* command the general inquiry LAP is used.
  c) The Lower Tester listens for inquiry packets from the IUT using an algorithm derived from its Bluetooth clock and enabling it to receive a packet within the IUT´s first repetition of the first A-Train. The Lower Tester´s correlator is matched to the inquiry access code.
  d) The Lower Tester monitors the train A during one train (16 frequencies). If no inquiry packet is received, the Lower Tester switches to scan train B during one train.
  e) Switching trains will continue until first ID packet is received by the Lower Tester.

f) After successfully receiving the first IAC packet, the Lower Tester adjusts its RX window and phase (clock bits 0-1) to get the remaining hops of train. The Lower Tester never responds to the inquiry.
g) The IUT repeats its first train for at least Ninquiry=256 times.
h) The Lower Tester records the first inquiry train for 255 times only because the first train is known to be incomplete.
i) The Lower Tester immediately starts listening on the other train frequencies.
j) The IUT sends the other inquiry train for Ninquiry times starting at an unknown point of time.
k) The Lower Tester records this inquiry train for 256 times.
l) Steps f) to j) are repeated until the inquiry instance is finished but with the difference that the Lower Tester always monitors 256 repetitions for each train from now on (also in step g).
m) One of the reserved LAPs for dedicated inquiry is randomly chosen and steps b) to k) are repeated.

- Expected Outcome

  Pass Verdict

  The Master using the general inquiry access code (GIAC) and its native clock CLKN to determine the inquiry hopping sequence) is checked in steps d), j) and l).

  The Master sequentially transmitting on two different hop frequencies during each TX slot is checked in steps d) and j).

  Two 10 ms inquiry trains A and B with 16 hops each were used is checked in steps d) and j).

  That inquiry trains A and B are repeated at least Ninquiry = 256 times is checked in steps f) and j).

  That at least four trains are transmitted subsequentially is checked in step k).

  That one inquiry instance is stopped latest when inquiryTO is reached is checked in step k).

  The tester records at least 95% of the expected ID packets.

- Notes

  As it is not possible to completely record all packets of the first most train after inquiry starts, violations of requirements cannot be checked on the first A train repetition. A cable connection is recommended to create an undisturbed RF path.

4.9.1.2 BB/PHYS/INQ/BV-03-C [Inquiry Proc]

- Test Purpose

  Verify that the IUT as Master uses the correct procedure when performing inquiry.

  Verify that:

  - The Master transmits the inquiry access code in the ID packet when starting the inquiry procedure.
  - That the Master continuously transmits inquiry messages after receiving a response (FHS packet).
  - The inquiry substate is left after a sufficient number of responses.

- Reference

  [1] 8.4.2, 8.4.3

- Initial Condition

  IUT must be configured as Master.

  The IUT is in STANDBY mode.

- Test Procedure

  a) The Upper Tester sends a HCI_Inquiry command to carry out Inquiry and sets the values for the LAP, and the Inquiry_Length and Num_Responses as follows:

     LAP: LAP for GIAC ‘9E8B33’H.

     Inquiry_Length: 0x30 = 61.44 sec.

     Num_Responses: 2.

  b) The Lower Tester verifies that the Master sends an ID packet containing the general inquiry access code (GIAC).
  c) The Lower Tester sends a FHS packet after receiving the first ID packet.
  d) The Lower Tester verifies that the Master sends continuously ID packets containing the general inquiry access code (GIAC).
  e) After a random number (between 0 and 1023) of time slots the tester sends one more FHS packet (different *BD_ADDR* from that sent the first time in step c)).
  f) The Lower Tester waits 30s and verifies that no more ID packet are sent by the IUT (i.e. the IUT has left inquiry substate).

- Expected Outcome

  <u>Pass Verdict</u>

  The Master transmits the inquiry access code in the ID packet when starting the inquiry procedure is checked after step b.

  The Master continuously transmitted inquiry messages after receiving a response (FHS packet) is checked after step d.

  The inquiry substate is left after a sufficient number of responses is checked after step f.

4.9.1.3 BB/PHYS/INQ/BV-19-C [Inquiry hop sequence with train nudge]

- Test Purpose

  Verify that the IUT as Master applies train nudging to the inquiry hopping sequence when discovering which other Bluetooth devices are in range in case the slots to receive the inquiry responses are periodically not available.

  Verify that:

  - The Master uses the general inquiry access code (GIAC) and its native clock CLKN to determine the inquiry hopping sequence.

- The Master sequentially transmits on 2 different hop frequencies during each TX slot.
- 2 10 ms inquiry trains A and B with 16 hops each are used.
- The inquiry trains A and B are repeated at least Ninquiry = 256 times.
- A k_{nudge} value of 0 is used during 1st 2 x Ninquiry repetitions.
- The Master uses an even value of k_{nudge} during all other repetitions. k_{nudge} value is not always equal to 0.
- At least 4 trains are transmitted subsequently.
- One inquiry instance is stopped latest when Extended_Inquiry_Length is reached.

• Reference

[1] 2.6.4.5

• Initial Condition

The Lower Tester has performed an inquiry procedure as Master before to get the clock CLK of the IUT.

The IUT is configured as Master.

Both IUT and Lower Tester are in standby mode.

• Test Procedure

To verify the inquiry hopping sequence, the Lower Tester must not follow the normal inquiry scan procedure. For the RX slots, the inquiry hopping sequence of the Master is used instead.

a) The IUT receives an HCI_ Set_External_Frame_Configuration as defined in Section 4.4.5.
b) In the HCI_Inquiry command the general inquiry LAP is used.
c) The Lower Tester listens for inquiry packets from the IUT using an algorithm derived from its Bluetooth clock and enabling it to receive a packet within the IUT´s first repetition of the first A-train. The Lower Tester´s correlator is matched to the inquiry access code.
d) The Lower Tester monitors the train A during one train (16 frequencies). If no inquiry packet is received, the Lower Tester switches to scan train B during one train.
e) Switching trains will continue until first ID packet is received by the Lower Tester
f) After successfully receiving the first IAC packet, the Lower Tester adjusts its RX window and phase (clock bits 0-1) to get the remaining hops of train. The Lower Tester never responds to the inquiry.
g) The IUT repeats its first train for at least Ninquiry=256 times.
h) The Lower Tester records the first inquiry train for 255 times only because the first train is known to be incomplete.
i) The Lower Tester immediately starts listening on the other train frequencies.
j) The IUT sends the other inquiry train for Ninquiry times starting at an unknown point of time.
k) The Lower Tester records this inquiry train for 256 times.
l) The Lower Tester then increments k_{nudge} by 2 mod 32.
m) The Lower Tester monitors the train during one train (16 frequencies). If no inquiry packet is received, the Lower Tester increments k_{nudge} by 2 mod 32.
n) Step m) is repeated until an inquiry packet is received.
o) The Lower Tester then checks if the value of k_{nudge} is 0 and records the train until no inquiry packets are received during one full train.

p) The Lower Tester checks that the trains have been repeated at least 256-(1+number of times step m was repeated) times.
q) Steps l)–p) are repeated until the inquiry instance is finished.
r) One of the reserved LAPs for dedicated inquiry is randomly chosen and steps c) to p) are repeated.

- Expected Outcome

  Pass Verdict

  - The IUT uses the general inquiry access code (GIAC) and the proper inquiry hopping sequence.
  - The IUT sequentially transmits on 2 different hop frequencies during each TX slot.
  - The IUT uses 2 10 ms inquiry trains A and B with 16 hops each.
  - The IUT repeats inquiry trains A and B at least Ninquiry = 256 times.
  - The IUT uses a value of k_{nudge} = 0 during the 1st 2 x Ninquiry repetitions.
  - The IUT uses an even value of k_{nudge} during all other repetitions. Also, k_{nudge} value is not always equal to 0.
  - The IUT transmits at least 4 trains subsequently.
  - One inquiry instance is stopped latest when Extended_Inquiry_Length is reached.
  - The Lower Tester records at least 95 percent of the expected ID packets.

- Notes

  As it is not possible to completely record all packets of the first most train after inquiry starts, violations of requirements cannot be checked on the first A-train repetition. A cable connection is recommended to create an undisturbed RF path.

4.10 Inquiry Procedures - Slave

Test subgroup objectives:

To verify that the Inquiry procedures for the Slave are correct.

4.10.1.1 BB/PHYS/INQ/BV-10-C [Inquiry Response]

- Test Purpose

  Verify that the IUT as Slave uses the correct inquiry response procedure.

  Verify that:

  - The IUT transmits the inquiry response (FHS packet) 625 µs after receiving the inquiry message.
  - The IUT transmits a FHS packet with the Slave's device address after receiving an inquiry message.
  - The IUT (if it does receive an inquiry message and returns a FHS packet) adds an offset of 1 to the phase in the inquiry hop sequence (the phase has a 1.28s resolution) and enters the inquiry scan substate again.

- Reference

  [1] 7.1, 8.4.3

- Initial Condition

  To ensure that the Lower Tester can follow the inquiry scan sequence of the Slave an inquiry procedure has been performed before to get the estimate CLKE of the Slave’s Bluetooth clock. The IUT uses default values for inquiry scan interval and inquiry scan window:

  Inquiry scan interval = 4096 slots.

  Inquiry scan window = 18 slots.

  Scan_Type = Normal Scan.

  The inquiry scan of the IUT is started before the Lower Tester starts inquiry.

- Test Procedure

  a) The Lower Tester starts inquiry using A trains, f(k) corresponding to the estimate of the IUT's scan frequency at the beginning of a 1.28 s phase (CLK 2-11 = 0). The Lower Tester sends ID packets continuously until the IUT responds with the FHS packet.
  b) After receiving the FHS packet from the IUT the Lower Tester increases its phase and sends ID packets again until the next FHS packet is received.
  c) Step b) will be repeated until 10 FHS packets have been received. The time distance between the FHS packets will be recorded and shall be randomly. After the 10^{th} FHS packet the Lower Tester shall stop sending the packets for at least 1023 slots.
  d) Step a)–c) are performed 10 times.

- Expected Outcome

  <u>Pass Verdict</u>

  In step d) of the Test Procedure, the tester receives at least 99 FHS packets from the IUT.

  That the IUT transmits the inquiry response (FHS packet) 625 µs after receiving the inquiry message is checked after step b).

  That the IUT transmits a FHS packet with the Slave’s device address after receiving the inquiry message is checked after step b).

  The IUT (if it does receive an inquiry message and returns a FHS packet) adds an offset of 1 to the phase in the inquiry hop sequence (the phase has a 1.28s resolution) and enters the inquiry scan substate again is checked in step d).

4.10.1.2 BB/PHYS/INQ/BV-14-C [Inquiry Scan Window and Interval]

- Test Purpose

  Verify that the IUT as Slave uses the correct inquiry scan window and interval.

To verify that:

- The receiver scans for the inquiry access code long enough to completely scan for 16 inquiry frequencies.
- The phase changes every 1.28 s.

- Reference

  [1] 8.4.1

- Initial Condition

  The Lower Tester uses the 79 hop scheme according to the IUT capabilities.

  The IUT is in STAND BY mode.

  HCI_Write_Scan_Enable = 01’H (Inquiry Scan enabled; Page Scan disabled).

  Default values are used for:

  InquiryScan_Interval = 4096 slots (2.56 s) and

  InquiryScan_Window = 18 slots

  Scan_Type = Normal Scan

- Test Procedure

  a) The Lower Tester continuously transmits inquiry messages until a response FHS packet is received.
  b) The Lower Tester waits for 1023 slots plus 18 slots.
  c) Steps a) and b) are performed 100 times.

- Expected Outcome

  Pass Verdict

  In step b) of the Test Procedure, the Lower Tester receives a response FHS packet within 5.12 s after starting to transmit inquiries for more than 95% of the inquiry procedures.

- Notes

  In Test Procedure step b) the additional 18 slots is required for the Lower Tester to avoid receiving FHS at the first inquiry scan after Test Procedure step a) even if the RAND is 1023 slots.

4.10.1.3 BB/PHYS/INQ/BV-15-C [Interlaced Inquiry Scan Window and Interval]

- Test Purpose

  Verify that the IUT as Slave uses the correct inquiry scan window and interval.

  To verify that:

  The receiver scans for the inquiry access code long enough to completely scan for 16 inquiry frequencies.

The phase changes every 1.28 s.

- Reference

  [1] 8.4.1

- Initial Condition

  The Lower Tester uses the 79 channel hop scheme.

  The IUT is in STAND BY mode.

  HCI_Write_Scan_Enable = ‘01’H (Inquiry Scan enabled; Page Scan disabled).

  Default values are used for:

  InquiryScan_Interval = 4096 slots (2.56 s) and

  InquiryScan_Window = 18 slots

  Scan_Type = Interlaced Scan

- Test Procedure

  a) The Lower Tester continuously transmits inquiry messages until a response FHS packet is received.
  b) The Lower Tester waits for 1023 slots plus 128 slots.
  c) Steps a) and b) are performed 100 times.

- Expected Outcome

  Pass Verdict

  In step b) of the Test Procedure, the Lower Tester receives a response FHS packet within 2.56 s after starting to transmit inquiry messages for more than 95% of the inquiry procedures.

- Notes

  In Test Procedure step b) since there may be some switching time between two back to back scans, the Lower Tester should wait for 1023 slots + 18 slots + (switching time) + 18 slots. It is assumed that no implementation would have the switching time larger than 128-18-18=92 slots.

4.10.1.4 BB/PHYS/INQ/BV-16-C [Reception of Extended Inquiry Response]

- Test Purpose

  Verify that the IUT as Master is able to receive Extended Inquiry Response.

- Reference

  [1] 8.4.2, 8.4.3

- Initial Condition

  The Extended Inquiry Result event has been enabled on the IUT with *HCI_Write_Inquiry_Mode*(Inquiry_Mode = 0x02).

The Lower Tester is configured to respond to Inquiry with an Extended Inquiry Response packet that is a full DM1 packet.

- Test Procedure

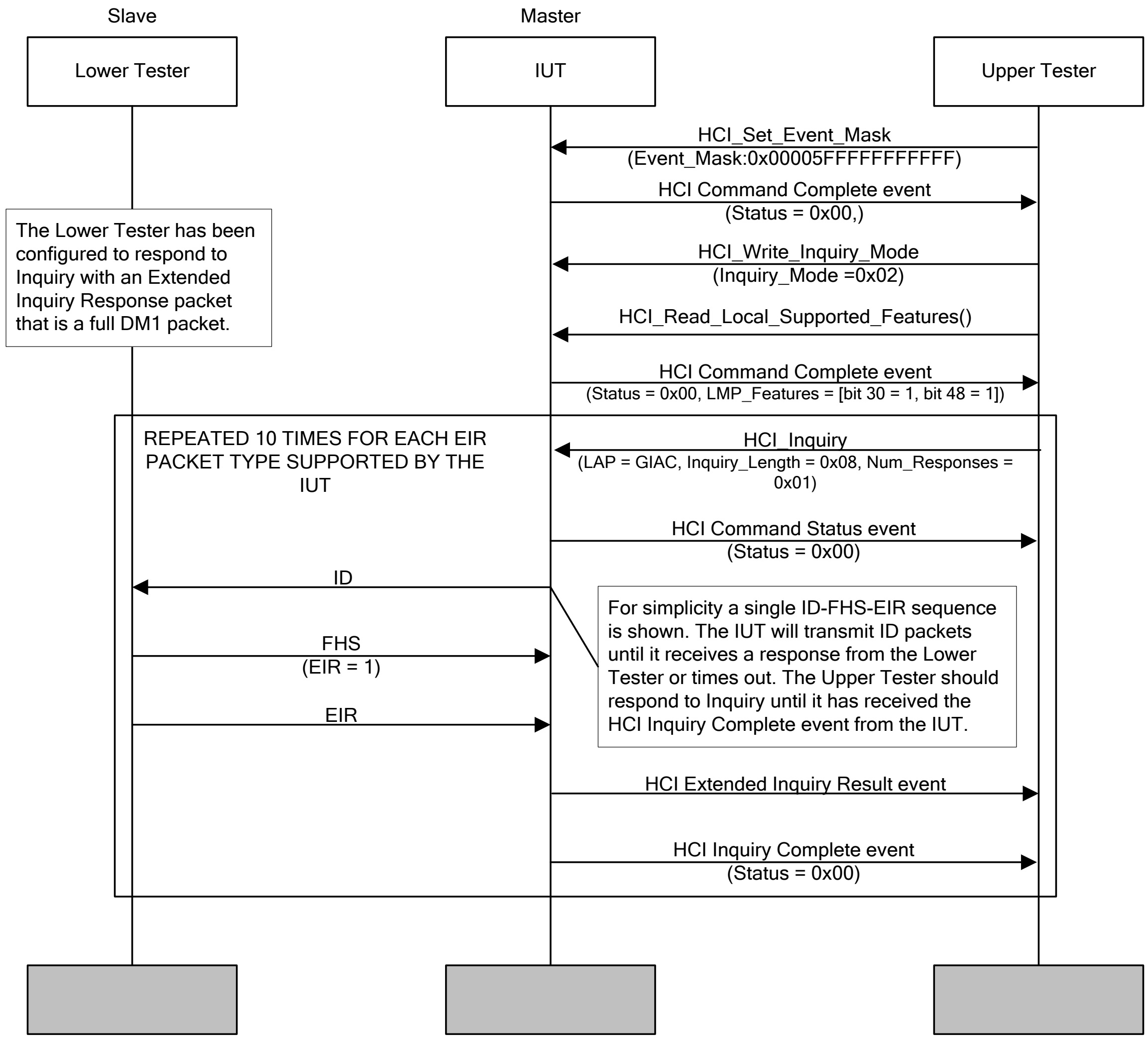

Figure 4.85: BB/PHYS/INQ/BV-16-C (Reception of Extended Inquiry Response)

1. The Upper Tester verifies that the LMP feature bits "Extended Inquiry Response" and "RSSI with Inquiry results" are set using HCI_Read_Local_Supported_Features.
2. The IUT does an Inquiry.
3. The Lower Tester responds with an FHS packet with the EIR bit set to one followed by an Extended Inquiry Response packet.
4. The IUT receives the FHS and the Extended Inquiry Response packet and generates an Extended Inquiry Result event.
5. Steps 2–4 are repeated 10 times.
6. Steps 2–5 are repeated with all additional Extended Inquiry Response packet types that are supported by the IUT with Extended Inquiry Responses that completely fill the respective packets. (If all packet types are supported by the IUT this means DH1, DM3, DH3, DM5, DH5.)

- Expected Outcome

  Pass Verdict

  In Test Procedure step 1, HCI_Read_Local_Supported_Features showed that the LMP feature bits "Extended Inquiry Response" and "RSSI with Inquiry Result" were set.

  In Test Procedure step 2, the IUT received the FHS and the EIR packet and generated a correct Extended Inquiry Result event in at least 90% of the repetitions for each of the supported packet types.

4.10.1.5 BB/PHYS/INQ/BV-17-C [Transmission of Extended Inquiry Response]

- Test Purpose

  Verify that the IUT as Slave is able to respond with Extended Inquiry Response.

- Reference

  [1] 8.4.2, 8.4.3

- Initial Condition

  Inquiry scan has been enabled on the IUT.

  An Extended Inquiry Response with significant octets that completely fill a DM1 packet has been written to the IUT with HCI_Write_Extended_Inquiry_Response.

- Test Procedure

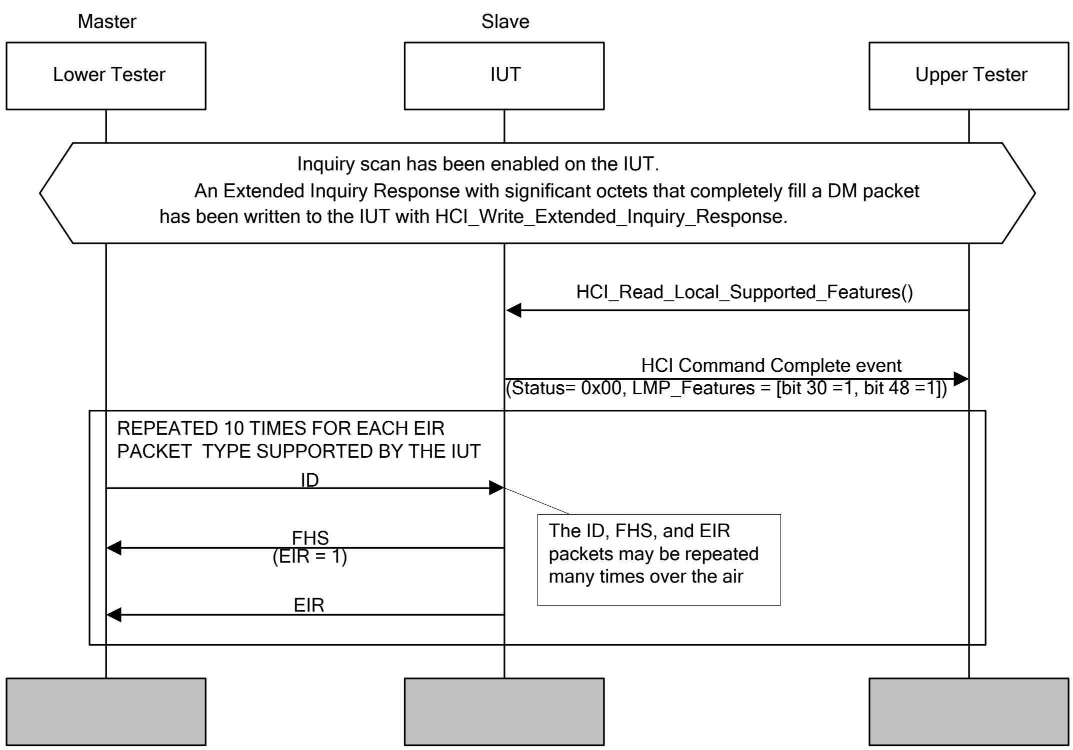

Figure 4.86: BB/PHYS/INQ/BV-17-C (Transmission of Extended Inquiry Response)

1. The Upper Tester verifies that the LMP feature bits "Extended Inquiry Response" and "RSSI with Inquiry results" are set using *HCI_Read_Local_Supported_Features*.
2. The Lower Tester does an Inquiry.
3. The IUT responds with an FHS packet with the EIR bit set to one followed by an Extended Inquiry Response packet.
4. The Lower Tester receives the FHS and the Extended Inquiry Response packet.
5. Steps 2–4 are repeated 10 times.
6. Steps 2–5 are repeated with all additional Extended Inquiry Response packet types that are supported by the IUT with Extended Inquiry Responses that completely fill the respective packets. (If all packet types are supported by the IUT this means DH1, DM3, DH3, DM5, DH5.)

- Expected Outcome

  Pass Verdict

  In Test Procedure step 1, HCI_Read_Local_Supported_Features showed that the LMP feature bits "Extended Inquiry Response" and "RSSI with Inquiry Result" were set.

  In Test Procedure step 4, the Lower Tester received the FHS and the correct EIR packet in at least 90% of the repetitions for each of the supported packet types. The ARQN and SEQN bits in all received EIR packets were set to zero.

4.10.1.6 BB/PHYS/INQ/BV-18-C [Inquiry Result Event Usage]

- Test Purpose

  Verify that the IUT as Master uses the correct Inquiry Result event format.

- Reference

  [1] 8.4.2, 8.4.3

- Initial Condition

  The Extended Inquiry Result event has been enabled on the IUT with HCI_Write_Inquiry_Mode(Inquiry_Mode = 0x02).

- Test Procedure

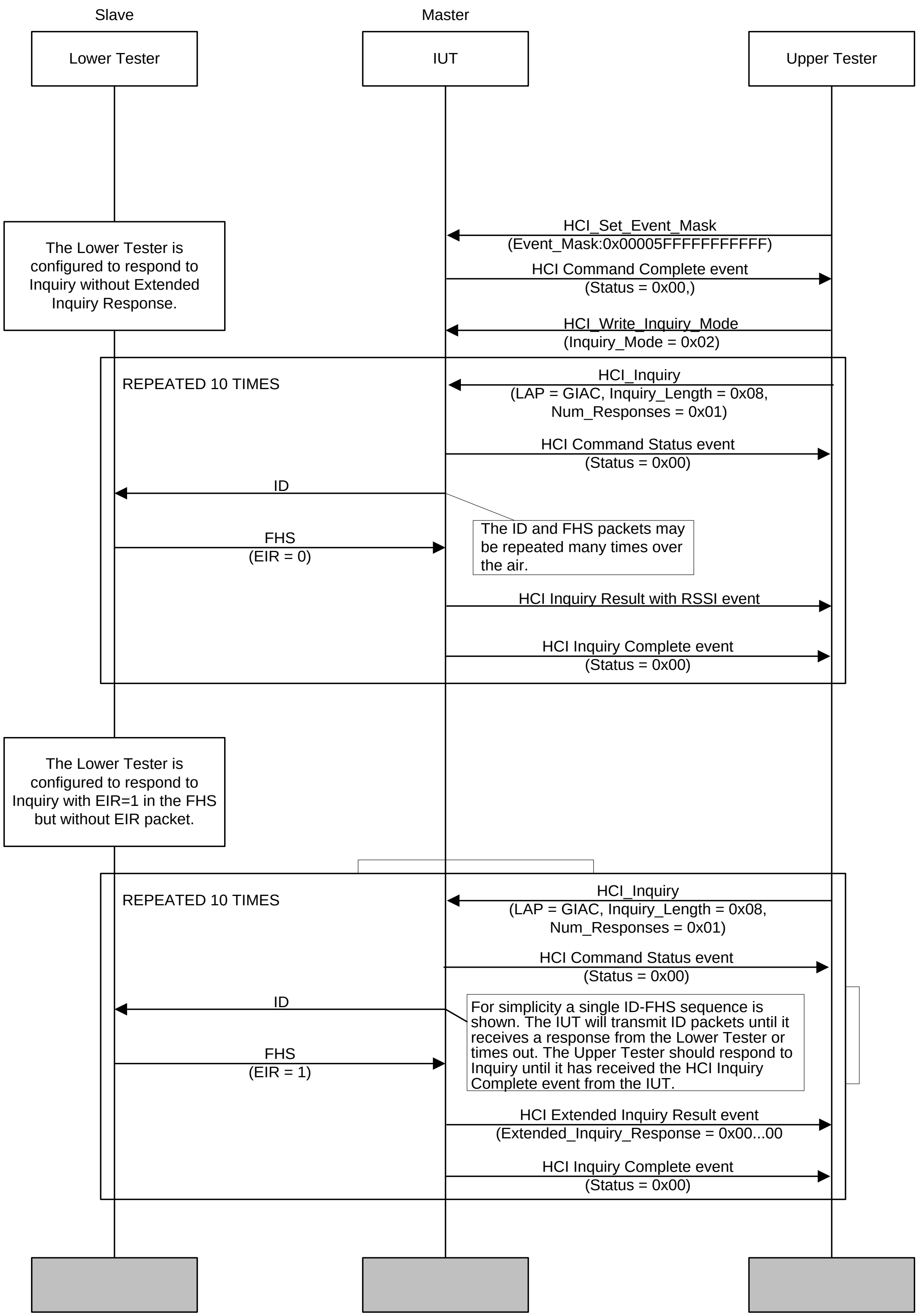

Figure 4.87: BB/PHYS/INQ/BV-18-C (Inquiry Result Event Usage)

1. The Lower Tester is configured to respond to Inquiry without an Extended Inquiry Response. The EIR bit in the FHS packet is set to zero.
2. The IUT does an Inquiry.
3. The Lower Tester responds with an FHS packet.
4. The IUT receives the FHS and generates an Inquiry Result with RSSI event.
5. Steps 2–4 are repeated 10 times.
6. The Lower Tester is configured to respond to Inquiry with the EIR bit in the FHS packet set to one but without any Extended Inquiry Response packet.
7. The IUT does an Inquiry.
8. The Lower Tester responds with an FHS packet with the EIR bit set to one.
9. The IUT receives the FHS and generates an Extended Inquiry Result event with Extended_Inquiry_Response set to all zeroes.
10. Steps 7–9 are repeated 10 times.

- Expected Outcome

  Pass Verdict

  In Test Procedure step 4, the IUT received the FHS and generated a correct Inquiry Result with RSSI event in at least 90 percent of the repetitions.

  In Test Procedure step 9, the IUT received the FHS and generated a correct Extended Inquiry Result event with Extended_Inquiry_Response set to all zeroes in more than 90 percent of the repetitions.

4.10.1.7 BB/PHYS/INQ/BV-20-C [Generalized Interlaced Inquiry scan]

- Test Purpose

  Verify that the IUT as Slave applies efficiently generalized interlaced scan to inquiry scan.

- Reference

  [1] 8.4.1

- Initial Condition

  The Lower Tester uses the 79 channel hop scheme.

  The IUT is in STAND BY mode.

  HCI_Write_Scan_Enable = ‘01’H (Inquiry Scan enabled; Page Scan disabled).

  Default values are used for:

  InquiryScan_Interval = 4096 slots (2.56 s) and

  InquiryScan_Window = 18 slots and

  Scan_Type = Interlaced Scan

  The IUT receives an HCI_ Set_External_Frame_Configuration as defined in Section 4.4.5.

- Test Procedure

  a) The Lower Tester transmits inquiry messages until a response FHS packet is received repeating the following pattern:

     i. Transmit inquiry messages during 1.928 ms.

     ii. Do not transmit inquiry messages during 3.069 ms.

Note that the inquiry sequence is not affected by the pattern, but the Lower Tester will just omit transmitting packets according to the pattern.

b) The Lower Tester waits for 1023 slots plus 18 slots.
c) Steps a) and b) are performed 100 times.

- Expected Outcome

  Pass Verdict

  In step b) of the test procedure, the Lower Tester receives a response FHS packet within 10.24 s after starting to transmit inquiry messages for more than 95% of the inquiry procedures.

- Notes

  In test procedure step b) since there may be some switching time between two back to back scans, the Lower Tester should wait for 1023 slots + 18 slots + (switching time) + 18 slots. It is assumed that no implementation would have the switching time larger than 128-18-18=92 slots.

4.11 Paging

Test group objectives:

To verify the Paging procedures.

4.11.1 Paging Procedures - Master

Test subgroup objectives:

To verify that the Paging procedures for the Master, i.e. the unit establishing the connection, is correct.

4.11.1.1 BB/PHYS/PAG/BV-01-C [Page Hop Seq]

- Test Purpose

  Verify that the IUT as Master uses the correct paging hopping sequence when paging the Slave (Lower Tester).

  Verify that:

  - The Master uses the Slave's device address to determine the page hopping sequence.
  - The Master sequentially transmits on 2 different hop frequencies during each TX slot.
  - The Master uses the estimate CLKE of the Slave's Bluetooth clock to build the page trains A and B (only applicable if IUT supports Inquiry).
  - The page trains A and B are repeated Npage times, depending on the scan interval R0/R1/R2.
  - The page is aborted after pageTO if no response is received.

- Reference

  [1] 8.3.2

- Initial Condition

  If the IUT supports inquiry:

  The IUT pages the Lower Tester to become the Master of the piconet. An inquiry procedure has been performed before to get back the clock offset between Master and Slave clock in the inquiry result event. The clock offset is used in the HCI_Create_Connection command to the IUT in step b) of the Test Procedure.

  If the IUT does not support Inquiry:

  The IUT pages the Lower Tester to become the Master of the piconet. The clock offset between Master and Slave clock is calculated in the Lower Tester. The clock offset is used in the HCI_Create_Connection command to the IUT in step b) of the Test Procedure.

  If Inquiry is supported SR mode R0 is used.

- Test Procedure

  a) The Upper Tester sends an HCI_Write_Page_Timeout command to the IUT with a parameter value 0x2800.
  b) If the IUT supports the HCI_Write_Extended_Page_Timeout command, the Upper Tester sends an HCI_Write_Extended_Page_Timeout command to the IUT with a parameter value of 0.
  c) To verify the page hopping sequence the Lower Tester must not follow the normal page scan procedure. For the RX slots, the page hopping sequence is used as well instead.
  d) The Lower Tester listens for paging packets from the IUT using an algorithm derived from its Bluetooth clock and enabling it to receive a packet within the IUT´s first repetition of the first A-Train. The Lower Tester´s correlator is matched to its device address.
  e) The IUT starts the page at some point not exactly known to the Lower Tester.
  f) After successfully receiving the first ID packet, the tester adjusts its RX window and phase (clock bits 0-1) to get the remaining hops of train A. The Lower Tester never responds to the page.
  g) The IUT repeats train A for at least Npage times.
  h) The Lower Tester records page train A for Npage-1 times only because the first train is known to be incomplete. As the number of repetitions is not known, only the minimum required number (i.e., 1, 128, or 256) is recorded to avoid missing the change to train B. If Npage is 1, to assure, that the first B train can be completely monitored, the Lower Tester shall switch to step i) after exactly one ID packet of train A was received.
  i) The Lower Tester immediately starts listening on train B frequencies.
  j) The IUT sends page train B for Npage times starting at an unknown point of time.
  k) The Lower Tester records page train B for Npage times. As the number of repetitions is not known, only the minimum required number (i.e., 1, 128, or 256) is recorded to avoid missing the change to train A.
  l) Steps f)–j) are repeated until the timeout page TO is reached but with the difference that the Lower Tester always monitors Npage repetitions for each train from now on.
  m) Steps c)–k) are repeated with SR mode R1 and R2.
  n) The Lower Tester changes its device address. A new inquiry procedure is performed to get the new DAC (if the IUT supports inquiry).
  o) Steps c)–k) are repeated.

- Expected Outcome

  Pass Verdict

  The Master using the Slave's device address to determine the page hoping sequence is checked in steps c), e), and l).

  The Master sequentially transmitting on two different hop frequencies during each TX slot is checked in steps c) and e).

  The Master uses the estimate CLKE of the Slave's Bluetooth clock to build the page trains A and B (only applicable if IUT supports Inquiry) is checked in steps c) and e).

  That the page trains A and B are repeated Npage times, depending on the scan interval R0/R1/R2 is checked in steps g) and j).

  The page is aborted after pageTO if no response is received is checked in step k).

  The tester records at least 95 percent of the expected ID packets.

- Notes

  Due to the limited resolution of the CLK value used for CLKE calculation the Lower Tester can miss hops of the first page train A.

4.11.1.2 BB/PHYS/PAG/BV-03-C [Page Response to 1st Message]

- Test Purpose

  Verify that the IUT as Master uses the correct page response procedure when paging the Slave (Lower Tester).

  The Slave responds to the **first** page message.

  Verify that:

  - The IUT (Master) enters the Master response routine, freezes the current clock input to the page hop selection scheme and transmits a FHS packet containing the Master's real time Bluetooth clock.
  - The IUT (Master) transmits the FHS packet 1250 μs after transmitting the first page packet if a response is received from the Slave (step 3).
  - The IUT (Master) updates the clock in each new FHS packet if no response is received.
  - The IUT (Master) changes to the Master parameter submitted in the FHS packet (step 3, channel access code and Master clock) after the FHS packet has been acknowledged by the Slave (step 5).
  - After a successful page attempt the IUT enters the CONNECTION state (step 5).
  - The IUT (Master) sends first a POLL packet within newconnectionTO number of slots after reception of the FHS packet acknowledgement (step 5).

- Reference

  [1] 8.3.3.2

- Initial Condition

  The IUT is in STANDBY mode.

  The Lower Tester knows the BD_ADDR of the IUT.

  A Page procedure is initiated by the IUT (Master, step 1).

- Test Procedure

  a) The Lower Tester (Slave) responds to the first page message.
  b) After receiving the first FHS packet (step 3) the Lower Tester records the CLK27-2 field in the FHS packet and does not send a response.
  c) After receiving the second FHS packet (step 3) the Lower Tester compares the clock value CLK27-2 field of the first FHS packet with that received in the second FHS packet (the CLK value is increased by 1) and sends a response.
  d) After receiving the first traffic packet (POLL packet) from the IUT, the Lower Tester checks that the first POLL packet was sent within newconnectionTO after the FHS packet acknowledgement.
  e) The Lower Tester checks that the IUT uses the Master channel access code, the Master clock and the rules for the 79 hopping system (Master BD_ADDR) to change from ‘Master response substate’ to CONNECTION state (step 5).

- Test Condition

  It must be possible to instruct the IUT to start the page procedure and also which unit to page, the DAC for the Slave (Lower Tester).

- Expected Outcome

  Pass Verdict

  The IUT (Master) enters the Master response routine, freezes the current clock input to the page hop selection scheme and transmits a FHS packet containing the Master’s real time Bluetooth clock is checked after step b.

  The IUT (Master) transmits the FHS packet 1250 µs after transmitting the first page packet if a response is received from the Slave (step 3) is checked after step b.

  The IUT (Master) updates the clock in each new FHS packet if no response is received is checked after step c.

  The IUT (Master) changes to the Master parameter submitted in the FHS packet (step 3, channel access code and Master clock) after the FHS packet has been acknowledged by the Slave (step 5) is checked after step d.

  After a successful page attempt the IUT enters the CONNECTION state (step 5) is checked after step e.

  The IUT (Master) sends first a POLL packet within newconnectionTO number of slots after reception of the FHS packet acknowledgement (step 5) is checked after step d.

4.11.1.3 BB/PHYS/PAG/BV-05-C [Page Response to 2nd Message]

- Test Purpose

  Verify that the IUT as master uses the correct page response procedure when paging the Slave (Lower Tester).

  The Slave responds to the **second** page message.

  Verify that:

  - The IUT (Master) enters the Master response routine, freeze the current clock input to the page hop selection scheme and transmits a FHS packet containing the Master's real time Bluetooth clock.
  - The IUT (Master) transmits the FHS packet 1250 µs after transmitting the first page packet if a response is received from the Slave (step 3).
  - The IUT (Master) updates the clock in each new FHS packet if no response is received.
  - The IUT (Master) changes to the Master parameter submitted in the FHS packet (step 3, channel access code and Master clock) after the FHS packet has been acknowledged by the Slave (step 5).
  - After a successful page attempt the IUT enters the CONNECTION state (step 5).
  - The IUT (Master) sends first a POLL packet within newconnectionTO number of slots after reception of the FHS packet acknowledgement (step 5).

- Reference

  [1] 8.3.3.2

- Initial Condition

  The IUT is in STANDBY mode.

  The Lower Tester knows the BD_ADDR of the IUT.

  A Page procedure is initiated by the IUT (Master, step 1).

- Test Procedure

  a) The Lower Tester (Slave) responds to the second page message.
  b) After receiving the first FHS packet (step 3) the tester records the CLK27-2 field in the FHS packet and does not send a response.
  c) After receiving the second FHS packet (step 3) the Lower Tester compares the clock value CLK27-2 field of the first FHS packet with that received in the second FHS packet and sends a response.
  d) After receiving the first traffic packet (POLL packet) from the IUT the Lower Tester checks that the first POLL packet was sent within newconnectionTO after the FHS packet acknowledgement.
  e) The Lower Tester checks that the IUT uses the Master channel access code, the Master clock and the rules for the 79 hopping system (Master BD_ADDR) to change from 'Master response substate' to CONNECTION state (step 5).

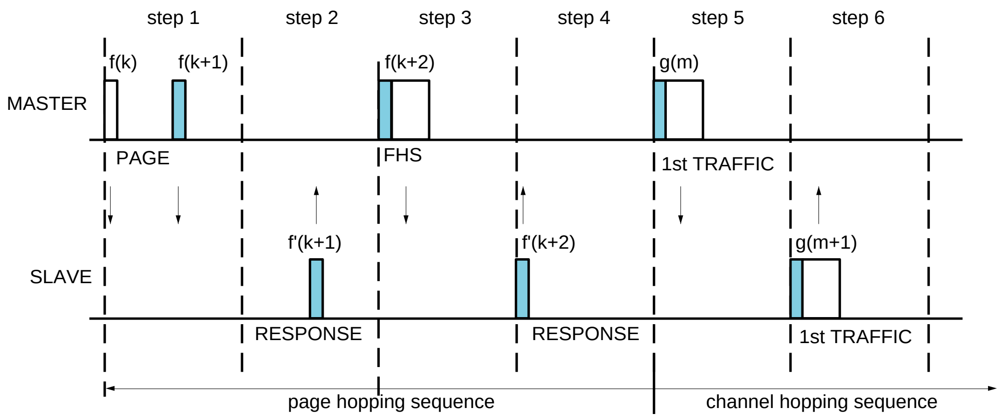

Figure 4.88: Messaging at initial connection when Slave responds to second page message.

- Expected Outcome

  <u>Pass Verdict</u>

  The IUT (Master) enters the Master response routine, freeze the current clock input to the page hop selection scheme and transmits a FHS packet containing the Master's real time Bluetooth clock is checked after step b.

  The IUT (Master) transmits the FHS packet 1250 µs after transmitting the first page packet if a response is received from the Slave (step 3) is checked after step b.

  That the IUT (Master) updates the clock in each new FHS packet if no response is received is checked after step c.

  The IUT (Master) changes to the Master parameter submitted in the FHS packet (step 3, channel access code and Master clock) after the FHS packet has been acknowledged by the Slave (step 5) is checked after step d.

  After successful page attempt the IUT enters the CONNECTION state (step 5) is checked after step e.

  The IUT (Master) sends first a POLL packet with the newconnectionTO number of slots after reception of the FHS packet acknowledgement (step 5) is checked after step d.

4.11.1.4 BB/PHYS/PAG/BV-20-C [Page hop sequence with train nudge]

- Test Purpose

  Verify that the IUT as Master applies train nudging to the page hopping sequence when paging the Slave (Lower Tester) in case the slots to receive the page responses are periodically not available.

  Verify that:

  - The Master uses the Slave's device address to determine the page hopping sequence.
  - The Master sequentially transmits on 2 different hop frequencies during each TX slot.
  - The Master uses the estimate CLKE of the Slave's Bluetooth clock to build the page trains A and B (only applicable if IUT supports Inquiry).

- The page trains A and B are repeated Npage times, depending on the scan interval R1/R2.
- A k_{nudge} value of 0 is used during 1st 2 x Npage repetitions.
- The Master uses an even value of k_{nudge} during all other repetitions. k_{nudge} value is not always equal to 0.
- The page is aborted no earlier than pageTO and no later than pageTO+extended_pageTO if no response is received.

- Reference

  [1] 2.6.4.5

- Initial Condition
  - If the IUT supports inquiry: The IUT pages the Lower Tester to become the Master of the piconet. An inquiry procedure has been performed before to get back the clock offset between Master and Slave clock in the inquiry result event. The clock offset is used in the HCI_Create_Connection command to the IUT in step b) of the test procedure.
  - If the IUT does not support Inquiry: The IUT pages the Lower Tester to become the Master of the piconet. The clock offset between Master and Slave clock is calculated in the Lower Tester. The clock offset is used in the HCI_Create_Connection command to the IUT in step b) of the test procedure.
  - SR mode R1 is used.

- Test Procedure

  To verify the page hopping sequence the Lower Tester must not follow the normal page scan procedure. For the RX slots, the page hopping sequence is used.

a) The Upper Tester sends an HCI_Write_Page_Timeout command to the IUT with a parameter value of 0x2800.
b) If the IUT supports the HCI_Write_Extended_Page_Timeout command, the Upper Tester sends an HCI_Write_Extended_Page_Timeout command to the IUT with a parameter value of 0x0800. Otherwise continue the test with extended_PageTO set to zero.
c) The IUT receives an HCI_ Set_External_Frame_Configuration as defined in Section 4.4.5
d) The Lower Tester listens for paging packets from the IUT using an algorithm derived from its Bluetooth clock and enabling it to receive a packet within the IUT´s first repetition of the first A-train. The Lower Tester´s correlator is matched to its device address.
e) The IUT starts the page at some point not exactly known to the Lower Tester.
f) After successfully receiving the first ID packet, the tester adjusts its RX window and phase (clock bits 0-1) to get the remaining hops of train A. The Lower Tester never responds to the page.
g) The IUT repeats train A for at least Npage times.
h) The Lower Tester records page train A for Npage-1 times only because the first train is known to be incomplete. As the number of repetitions is not known, only the minimum required number (i.e., 128 or 256) is recorded to avoid missing the change to train B.
i) The Lower Tester immediately starts listening on train B frequencies.
j) The IUT sends page train B for Npage times starting at an unknown point of time.
k) The Lower Tester records page train B until no page packet is received during one full train.
l) The Lower Tester then increments k_{nudge} by 2 mod 32.
m) The Lower Tester monitors the train during one train (16 frequencies). If no paging packet is received, the tester increments k_{nudge} by 2 mod 32.
n) Step m) is repeated until a paging packet is received.

o) The Lower Tester then checks if the value of k_{nudge} is 0 and records the train until no paging packets are received during one full train.
p) The Lower Tester checks that the trains have been repeated at least Npage-(1+number of times step l was repeated) times.
q) Steps k)–p) are repeated until the timeout pageTO+extended_pageTO is reached.
r) Steps c)–q) are repeated with SR mode R2.
s) The Lower Tester changes its device address. A new inquiry procedure is performed to get the new DAC (if the IUT supports inquiry).
t) Steps c)–r) are repeated.

- Expected Outcome

  Pass Verdict

  - The IUT uses the proper page hopping sequence based on the Slave's device address.
  - The IUT sequentially transmits on 2 different hop frequencies during each TX slot.
  - The IUT uses the estimate CLKE of the Slave's Bluetooth clock to build the page trains A and B (only applicable if IUT supports Inquiry).
  - The IUT repeats page trains A and B Npage times, depending on the scan interval R1/R2.
  - The IUT uses a value of k_{nudge}= 0 during 1st 2 x Npage repetitions.
  - The Master uses an even value of k_{nudge} during all other repetitions. Also, k_{nudge} value is not always equal to 0.
  - The page is aborted no earlier than pageTO and no later than pageTO+extended_pageTO if no response is received.
  - The Lower Tester records at least 95% of the expected ID packets.

- Notes

  Due to the limited resolution of the CLK value used for CLKE calculation the Lower Tester can miss hops of the first page train A.

4.11.2 Paging Procedures - Slave

Test subgroup objectives:

Verify that the Paging procedures for the Slave are correct.

4.11.2.1 BB/PHYS/PAG/BV-10-C [Page Response 1/1 Slot]

- Test Purpose

  Verify that the IUT as Slave uses the correct page response procedure when receiving the page message in the first half of the RX time slot.

  Verify that:

  - The Slave enters the Slave response routine and freezes the current clock input to the page and page response hop selection.
  - The Slave transmits a response message after receiving his own device access code with the Slave’s device access code 625 µs after the beginning of the received page message.

- The Slave uses the Slave response sequence for transmission during initial messaging.
- The IUT returns back to the page scan substate for one scan period if nothing was received after pagerespTO.
- The Slave returns to the state it was in prior to the first page scan if pagerespTO is exceeded and no page message is received during the additional scan period.
- The IUT returns to page scan substate when not receiving a POLL packet within newconnectionTO after acknowledging the FHS packet.
- The Slave changes to the Master parameter submitted in the FHS packet (BT address and Master clock) after the FHS packet has been acknowledged.
- The Slave enters the CONNECTION state after acknowledging the received FHS packet in the Slave response packet.

- Reference

  [1] 8.3.3

- Initial Condition

  The IUT is in STANDBY mode.

  Default values are used for:

  Page Scan_Window = 18 slots and

  Page Scan_Interval = 1.28 sec.

  Scan_Type = Normal Scan

- Test Procedure

  a) The Lower Tester pages the Slave in the first half of the TX time slot only by using the Slave's device access code.
  b) After receiving a response message consisting of the IUT's device access code the tester does not send a FHS packet.
  c) After the pagerespTO timer (in the Slave) has expired the Lower Tester does not page the IUT within the following scan period (11.25 ms). The Slave returns to the state it was in prior to the first page scan state (STAND BY mode).
  d) Step a) and b) shall be repeated.
  e) After the pagerespTO timer (in the Slave) has expired, the Lower Tester pages the IUT within the following scan period (11.25 ms).
  f) After receiving a response message consisting of the IUT's device access code the Lower Tester sends a FHS packet.
  g) After receiving the acknowledgement of the FHS packet the Lower Tester waits until the newconnectionTO timer has expired, the IUT returns to page scan substate.
  h) The Lower Tester pages the IUT.
  i) After receiving a response message the Lower Tester sends a FHS packet.
  j) After receiving the acknowledgement of the FHS packet the Lower Tester sends a POLL packet.
  k) The Lower Tester receives the confirmation from the Slave.

- Expected Outcome

  Pass Verdict

  The Slave enters the Slave response routine and freezes the current clock input to the page and page response hop selection is checked after step b.

  The Slave transmits a response message after receiving his own device access code with the Slave's device access code 625 µs after the beginning of the received page message is checked after step b.

  The Slave uses the Slave response sequence for transmission during initial messaging is checked after step g.

  That the IUT returns back to the page scan substate for one scan period if nothing was received after pagerespTO is checked after step e.

  The Slave returns to the state it was in prior to the first page scan if pagerespTO is exceeded and no page message is received during the additional scan period is checked after step c.

  The IUT returning to page scan substate when not receiving a POLL packet within newconnectionTO after acknowledging the FHS packet is checked after step i.

  The Slave changing to the Master parameter submitted in the FHS packet (BT address and Master clock) after the FHS packet has been acknowledged is checked after step k.

  That the Slave enters the CONNECTION state after acknowledging the received FHS packet in the Slave response packet is checked after step k.

- Notes

  The Lower Tester may need to transmit the FHS and POLL packets more than once within pagerespTO and newconnectionTO number of slots, respectively.

4.11.2.2 BB/PHYS/PAG/BV-12-C [Page Response 1/2 slot]

- Test Purpose

  Verify that the IUT as Slave uses the correct page response procedure when receiving the page message in the second half of the RX time slot.

  Verify that:

  - The Slave enters the Slave response routine and freezes the current clock input to the page and page response hop selection.
  - The Slave transmits a response message after receiving his own device access code within the Slave's device access code 625 µs after the beginning of the received page message.
  - The Slave uses the Slave response sequence for transmission during initial messaging.
  - The Slave returns back to the page scan substate for one scan period if nothing was received after pagerespTO.
  - The Slave return to the state it was in prior to the first page scan if pagerespTO is exceeded and no page message is received during the additional scan period.

- The IUT returns to page scan substate when not receiving a POLL packet within newconnectionTO after acknowledging the FHS packet.
- The Slave changes to the Master parameter submitted in the FHS packet (BT address and Master clock) after the FHS packet has been acknowledged.
- The Slave enters the CONNECTION state after acknowledging the received FHS packet in the Slave response packet.

- Reference

  [1] 8.3.3

- Initial Condition

  The IUT is in STANDBY mode.

- Test Procedure

  a) The Lower Tester pages the Slave 312.5 µs after the Master TX time slot has been started (second half of the TX time slot) by using the Slave's device access code.
  b) After receiving a response message consisting of the SLAVE's device access code the Lower Tester does not send a FHS packet.
  c) After the pagerespTO timer (in the Slave) has expired the tester do not pages the IUT within the following scan period (11.25 ms). The Slave returns to the state it was in prior to the first page scan state (STAND BY mode).
  d) Step a) and b) shall be repeated.
  e) After the pagerespTO timer (in the Slave) has expired the Lower Tester pages the IUT within the following scan period (11.25 ms).
  f) After receiving a response message consisting of the IUT's device access code the tester sends a FHS packet.
  g) After receiving the acknowledgement of the FHS packet the Lower Tester waits until the newconnectionTO timer has expired, the IUT returns to page scan substate.
  h) The Lower Tester pages the IUT.
  i) After receiving a response message the Lower Tester sends a FHS packet.
  j) After receiving the acknowledgement of the FHS packet the Lower Tester sends a POLL packet.
  k) The Lower Tester receives the confirmation from the Slave.

- Expected Outcome

  <u>Pass Verdict</u>

  The Slave entered the Slave response routine and froze the current clock input to the page and page response hop selection is checked after step b.

  The Slave transmitting a response message after receiving his own device access code within the Slave's device access code 625 µs after the beginning of the received page message is checked after step b.

  The Slave used the Slave response sequence for transmission during initial messaging is checked after step g.

  The Slave returned back to the page scan substate for one scan period if nothing was received after pagerespTO is checked after step e.

The Slave returned to the state it was in prior to the first page scan if pagerespTO is exceeded and no page message is received during the additional scan period is checked after step c.

The IUT returned to page scan substate when not receiving a POLL packet within newconnectionTO after acknowledging the FHS packet is checked after step i.

The Slave changed to the Master parameter submitted in the FHS packet (BT address and Master clock) after the FHS packet has been acknowledged is checked after step k.

The Slave entered the CONNECTION state after acknowledging the received FHS packet in the Slave response packet is checked after step k.

- Notes

The Lower Tester may need to transmit the FHS and POLL packets more than once within pagerespTO and newconnectionTO number of slots, respectively.

4.11.2.3 BB/PHYS/PAG/BV-14-C [Page Scan Interval R0]

- Test Purpose

Verify that the IUT as Slave uses the correct page scan interval for paging mode R0 (continuous).

- Reference

[1] 8.3.1, 8.3.2

- Initial Condition

The Lower Tester uses the 79 channel hop scheme.

The IUT is configured as Slave using page scan mode R0.

If the IUT supports inquiry:

> To ensure that the Lower Tester can follow the page scan sequence of the Slave a procedure has been performed before to get the estimate CLKE of the Slave's Bluetooth clock.

If the IUT does not support Inquiry:

> The Lower Tester is paged by the IUT. The clock offset between Master and Slave clock is calculated in the Lower Tester. The clock offset is used in step a) of the Test Procedure.

The IUT is in STAND BY mode. Periodic scan is enabled with *HCI_Write_Scan_Enable*.

- Test Procedure

a) The Lower Tester pages the IUT continuously until a response ID packet is received. The number of pages and the position in the page hop sequence are recorded.
b) The Lower Tester does not respond with a FHS packet but waits for one scan period (18 slots) + pagerespTO (8 slots) plus a randomly chosen number of slots between 0 and 1023.
c) Steps a) and b) are performed 100 times.

- Expected Outcome

  <u>Pass Verdict</u>

  In step a) of the Test Procedure, the tester receives a response ID packet on the first page train A in at least 95 percent of the page procedures.

4.11.2.4 BB/PHYS/PAG/BV-16-C [Page Scan Interval R1]

- Test Purpose

  Verify that the IUT as Slave uses the correct page scan interval for paging mode R1 (≤ 1.28s).

- Reference

  [1] 8.3.1, 8.3.2

- Initial Condition

  The Lower Tester uses the 79 channel hop scheme.

  The IUT is configured as Slave using page scan mode R1.

  If the IUT supports inquiry:

  > To ensure that the Lower Tester can follow the page scan sequence of the Slave a procedure has been performed before to get the estimate CLKE of the Slave's Bluetooth clock.

  If the IUT does not support Inquiry:

  > The Lower Tester is paged by the IUT. The clock offset between Master and Slave clock is calculated in the Lower Tester. The clock offset is used in step a) of the Test Procedure.

  The IUT is in STAND BY mode. Periodic scan is enabled with HCI_Write_Scan_Enable.

- Test Procedure

  a) The Lower Tester pages the IUT continuously until a response ID packet is received. The number of pages and the position in the page hop sequence are recorded.
  b) The Lower Tester does not respond with a FHS packet but waits for one scan period (18 slots), pagerespTO (8 slots) and a randomly chosen number of slots between 0 and 2048.
  c) Steps a) and b) are performed 1,000 times.

- Expected Outcome

  <u>Pass Verdict</u>

  In step a) of the Test Procedure, the Lower Tester receives a response ID packet within 1.28 s after the start of the page for more than 95 percent of the page procedures.

4.11.2.5 BB/PHYS/PAG/BV-17-C [Page Scan Interval R1 with Interlaced Scan]

- Test Purpose

  Verify that the IUT as Slave uses the correct page scan interval for paging mode R1 (≤ 1.28s) when interlaced scan is used during page scanning.

- Reference

  [1] 8.3.1, 8.3.2

- Initial Condition

  The Lower Tester uses the 79 channel hop scheme.

  The IUT is configured as Slave using page scan mode R1.

  Scan_type = Interlaced Scan

  The IUT is in STAND BY mode. Periodic scan is enabled with HCI_Write_Scan_Enable.

- Test Procedure

  a) The Lower Tester pages the IUT continuously until a response ID packet is received. The number of pages and the position in the page hop sequence are recorded.
  b) The Lower Tester does not respond with a FHS packet but waits for one scan period (128 slots), pagerespTO (8 slots) and a randomly chosen number of slots between 0 and 2048.
  c) Steps a) and b) are performed 1,000 times.

- Expected Outcome

  Pass Verdict

  In step a) of the Test Procedure, the Lower Tester receives a response ID packet within 1.28 s after the start of the page for more than 95 percent of the page procedures.

- Notes

  In Test Procedure step b) since there may be some switching time between two back to back scans, the Lower Tester should wait for scan period (18 slots + switching time + 18 slots), pagerespTO (8 slots) and a randomly chosen number of slots between 0 and 2048. It is assumed that no implementation would have the switching time larger than 128-18-18=92 slots.

4.11.2.6 BB/PHYS/PAG/BV-18-C [Page Scan Interval R2]

- Test Purpose

  Verify that the IUT as Slave uses the correct page scan interval for paging mode R2 ($\leq$ 2.56 s).

- Reference

  [1] 8.3.1, 8.3.2

- Initial Condition

  The Lower Tester uses the 79 channel hop scheme.

  The IUT is configured as Slave using page scan mode R2.

  If the IUT supports inquiry:

  > To ensure that the Lower Tester can follow the page scan sequence of the Slave a procedure has been performed before to get the estimate CLKE of the Slave’s Bluetooth clock.

If the IUT does not support Inquiry:

The Lower Tester is paged by the IUT. The clock offset between Master and Slave clock is calculated in the Lower Tester. The clock offset is used in step a) of the Test Procedure.

The IUT is in STAND BY mode. Periodic scan is enabled with HCI_Write_Scan_Enable.

- Test Procedure

a) The Lower Tester pages the IUT continuously until a response ID packet is received. The number of pages and the position in the page hop sequence are recorded.
b) The Lower Tester does not respond with a FHS packet but waits for one scan period (18 slots), pagerespTO (8 slots) and a randomly chosen number of slots between 0 and 4096.
c) Steps a) and b) are performed 1,000 times.

- Expected Outcome

Pass Verdict

In step a) of the Test Procedure, the Lower Tester receives a response ID packet within 2.56 s after the start of the page for more than 95 percent of the page procedures.

4.11.2.7 BB/PHYS/PAG/BV-19-C [Page Scan Interval R2 and Interlaced Scan]

- Test Purpose

Verify that the IUT as Slave uses the correct page scan interval for paging mode R2 (≤ 2.56 s) when interlaced scan is used during page scanning.

- Reference

[1] 8.3.1, 8.3.2

- Initial Condition

The Lower Tester uses the 79 channel hop scheme.

The IUT is configured as Slave using page scan mode R2.

Scan_type = Interlaced Scan.

The IUT is in STAND BY mode. Periodic scan is enabled with HCI_Write_Scan_Enable.

- Test Procedure

a) The Lower Tester pages the IUT continuously until a response ID packet is received. The number of pages and the position in the page hop sequence are recorded.
b) The Lower Tester does not respond with a FHS packet but waits for one scan period (128 slots), pagerespTO (8 slots) and a randomly chosen number of slots between 0 and 4096.
c) Steps a) and b) are performed 1,000 times.

- Expected Outcome

  Pass Verdict

  In step a) of the Test Procedure, the Lower Tester receives a response ID packet within 2.56 s after the start of the page for more than 95 percent of the page procedures.

- Notes

  In Test Procedure step b) since there may be some switching time between two back to back scans, the Lower Tester should wait for scan period (18 slots + switching time + 18 slots), pagerespTO (8 slots) and a randomly chosen number of slots between 0 and 2048. It is assumed that no implementation would have the switching time larger than 128-18-18=92 slots.

4.11.2.8 BB/PHYS/PAG/BV-21-C [Generalized Interlaced Page Scan]

- Test Purpose

  Verify that the IUT as Slave applies efficiently generalized interlaced scan to page scan.

- Reference

  [1] 8.4.1

- Initial Condition
  - The Lower Tester uses the 79 channel hop scheme.
  - The IUT is configured as Slave using page scan mode R1.
  - Scan_type = Interlaced Scan.
  - The IUT is in STAND BY mode. Periodic scan is enabled with HCI_Write_Scan_Enable.
  - The IUT receives an HCI_ Set_External_Frame_Configuration as defined in Section 4.4.5.

- Test Procedure

  a) The Lower Tester pages the IUT until a response ID packet is received repeating the following pattern:
  b) Transmit page messages during 1.928 ms.
  c) Do not transmit page messages during 3.066 ms.

  Note that the paging sequence is not affected by the pattern, but the Lower Tester will just omit transmitting packets according to the pattern.

  d) The number of pages and the position in the page hop sequence are recorded.
  e) The Lower Tester does not respond with a FHS packet but waits for one scan period (128 slots), pagerespTO (8 slots) and a randomly chosen number of slots between 0 and 2048.

  Steps a) and b) are performed 1,000 times.

- Expected Outcome

  Pass Verdict

  In step a) of the test procedure, the Lower Tester receives a response ID packet within 2.56 s after the start of the page for more than 95 percent of the page procedures.

4.12 Connection

Test group objectives:

Verify that the behavior in the connection state is correct.

4.12.1 Connection State - Master

Test subgroup objectives:

Verify that the Master works correctly in the connection state.

4.12.1.1 BB/PROT/CON/BV-01-C [POLL at Start Up]

- Test Purpose

  Verify that the IUT configured as Master sends a POLL packet at the start of a new connection and initializes the ARQN bit set to NAK.

  Further verify that the Master initializes the SEQN bit of the first CRC data packet to 1.

- Reference

  [1] 7.6.1, 7.6.2, 8.3.3.1, 8.5

- Initial Condition

  Lower Tester: Configured as Slave in state STANDBY.

  IUT: Configured as Master in state STANDBY.

- Test Procedure

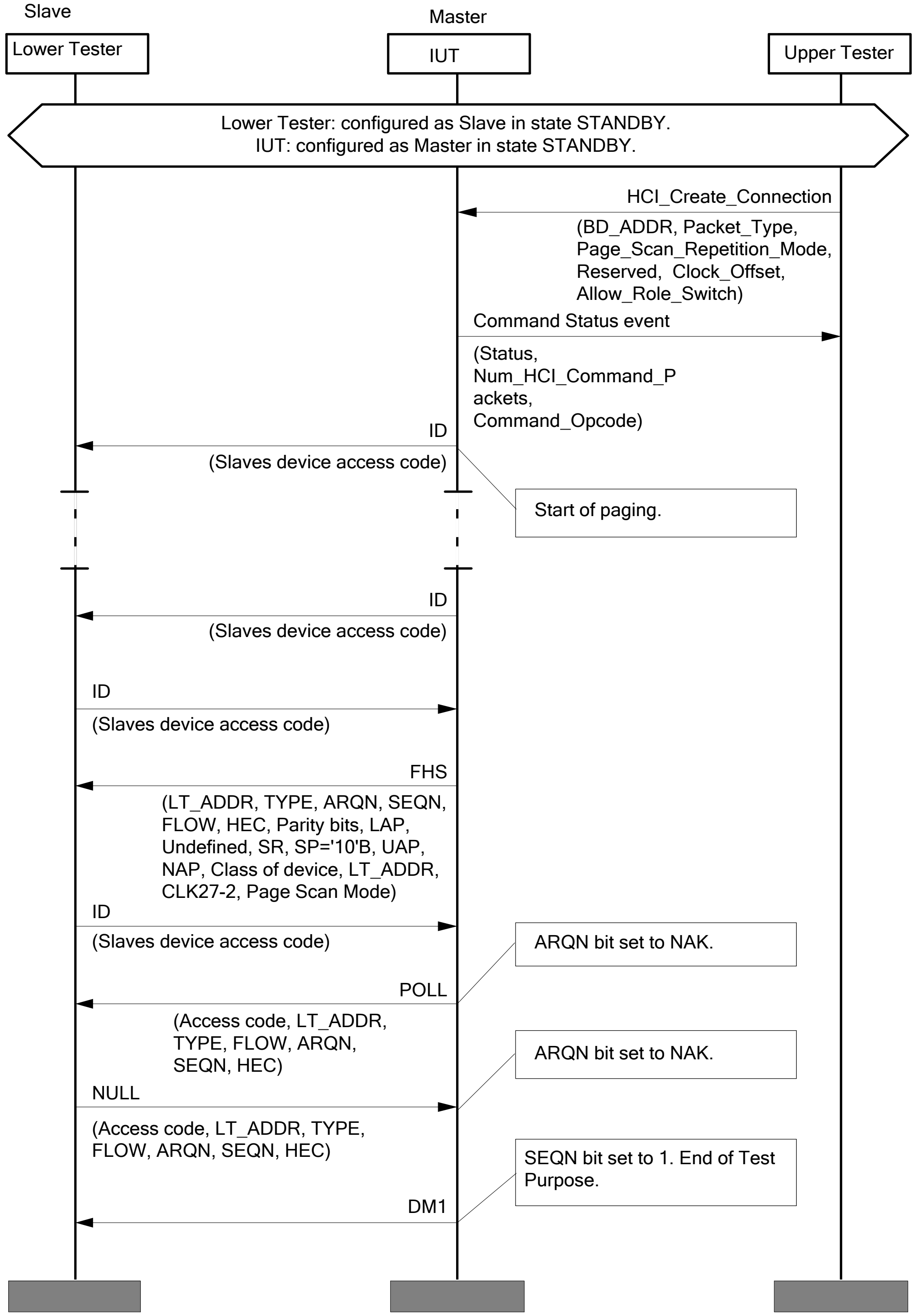

Figure 4.89: BB/PROT/CON/BV-01-C (POLL at start up)

The Lower Tester sends an HCI command via the Upper Tester to instruct the IUT to carry out page.

HCI_Create_Connection:

BD_ADDR: BD_ADDR of the tester.

Packet_Type: '330E'H.

Page_Scan_Repetition_Mode: '01'H.

Reserved: '00'H.

Clock_Offset: As required.

Allow_Role_Switch: As required by the IUT.

Then the Lower Tester verifies that the IUT sends an ID packet containing the Slave's device access code.

Upon reception of an ID packet the Lower Tester transmits an ID packet back also containing the Slave's device access code.

Then the Lower Tester verifies that the IUT transmits a FHS packet.

After having received the FHS packet from the IUT the Lower Tester transmits an ID packet (Slave's devices access code) again to indicate the reception from the former FHS packet.

The Lower Tester verifies that the IUT sends a POLL packet with the ARQN bit set to NAK.

The Lower Tester confirms the reception with a NULL packet.

The Lower Tester verifies that the IUT sends a DM1 packet with the SEQN bit set to 1.

- Expected Outcome

  Pass Verdict

  The IUT sends at the start of a new connection a POLL packet with the ARQN bit set to NAK.

  The IUT initializes the SEQN bit of the first CRC data packet to 1.

- Notes

  A FHS packet can already arrive 312.5 µs after the arrival of the page message, and not 625 µs as is usually the case in the RX/TX timing.

4.12.1.2 BB/PROT/CON/BV-02-C [Polling Slave]

- Test Purpose

  Verify that the IUT configured as Master transmits periodical to keep the Slave synchronized on the channel.

- Reference

  [1] 8.6

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

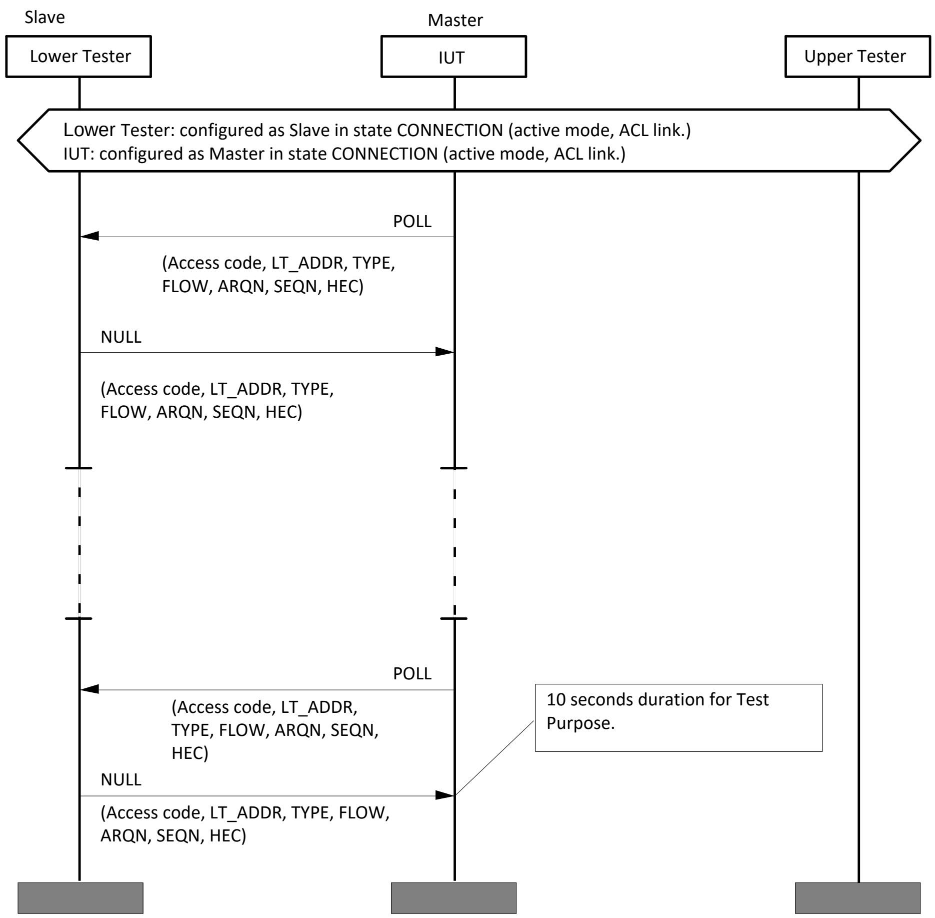

Figure 4.90: BB/PROT/CON/BV-02-C (Polling Slave)

The Lower Tester verifies that the IUT periodically transmits with an interval of maximum 40 slots (default value for POLL interval as stated in LMP Specification [10] in Table 5.5).

The test is carried out for a time of 10s.

- Expected Outcome

<u>Pass Verdict</u>

At least 95 percent of the master transmissions have an interval of at maximum 40 slots for a time of 10s.

4.12.1.3 BB/PROT/CON/BV-03-C [Wrong UAP]

- Test Purpose

Verify that the IUT configured as Master upon reception of a packet with the same access code - i.e., an access code of a device owning the same LAP but different UAP - passes the access code test, it will disregard the packet after HEC and CRC tests when the UAP do not match.

- Reference

  [1] 7.1

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  IUT: Configured as m in state CONNECTION (active mode, ACL link).

- Test Procedure

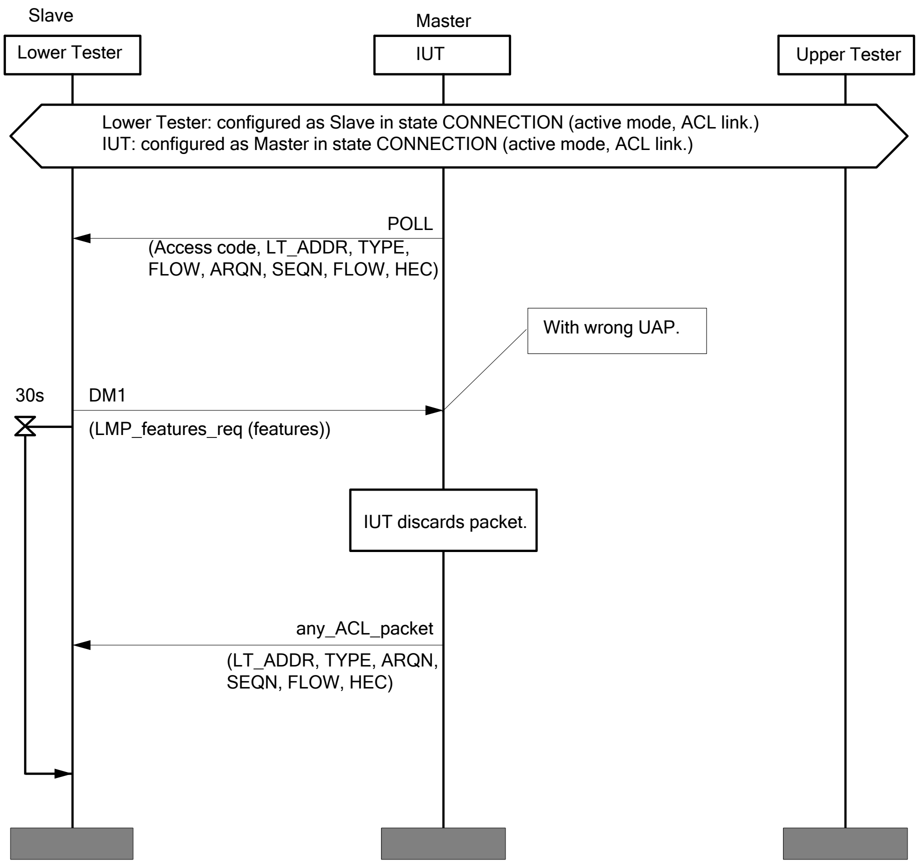

Figure 4.91: BB/PROT/CON/BV-03-C (Wrong UAP)

Upon reception of a POLL packet the tester sends a DM1 packet containing an LMP_features_req message with a wrong UAP.

The Lower Tester verifies that the IUT discards the packet and does not response to the LMP_features_req message for the next 30s.

- Expected Outcome

  Pass Verdict

  The IUT discards the packet and does not response to the LMP_features_req message.

4.12.1.4 BB/PROT/CON/BV-04-C [Change from DV to HV1]

- Test Purpose

  Verify that the IUT automatically change from DV packet type to HV1 packet type used before the mixed data/voice transmission when there is no data to be sent.

- Reference

  [1] 6.5.2.4

- Initial Condition

  Lower Tester: Configured as Slave.

  IUT: Configured as Master.

  An SCO link is established. The only features supported by the Lower Tester are SCO-link, μ-law, A-law, CVSD and transparent data.

- Test Procedure

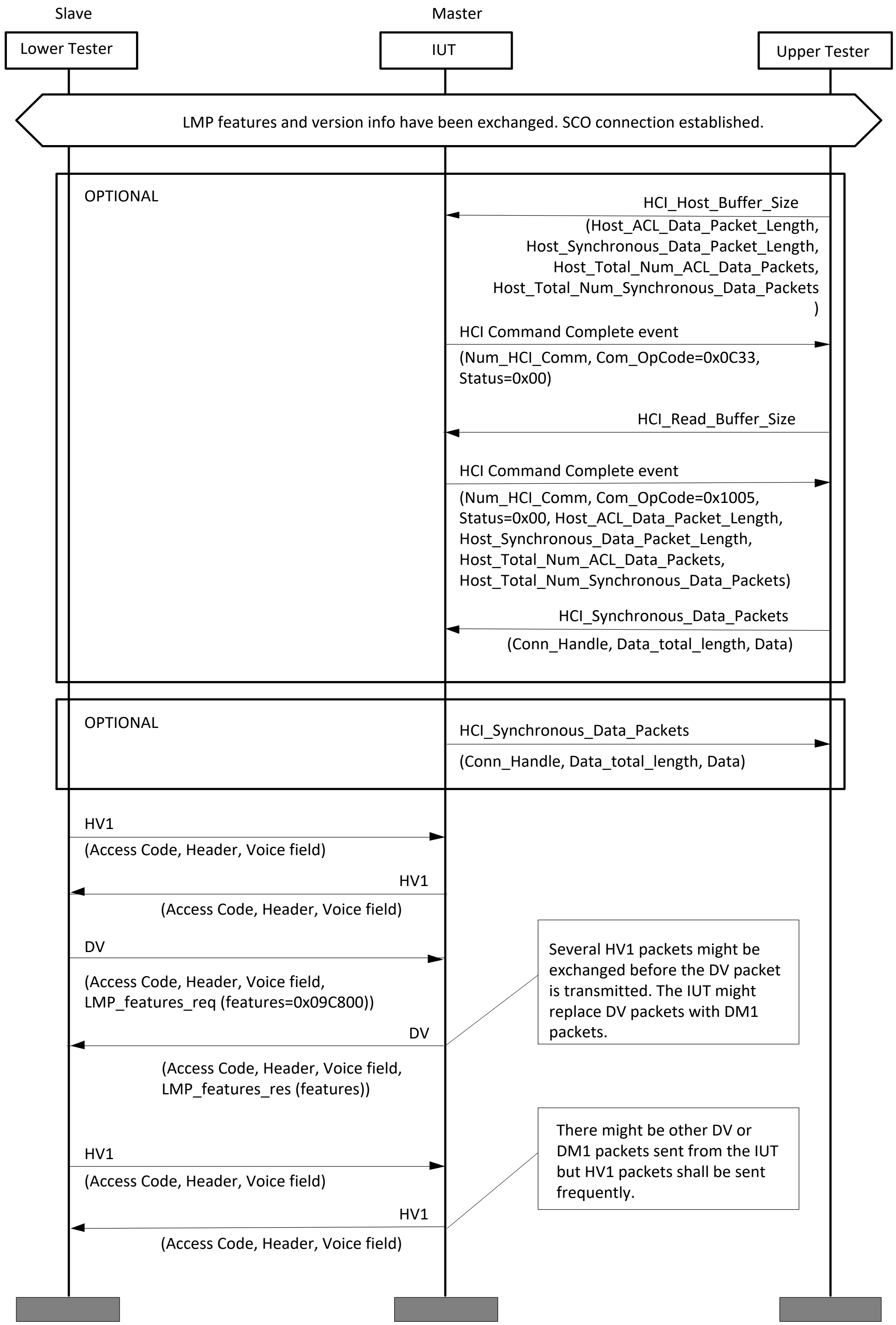

Figure 4.92: BB/PROT/CON/BV-04-C (Change from DV to HV1)

The Lower Tester verifies that the IUT transmits HV1 packets to the Lower Tester.

The Lower Tester responds with HV1 packets in the Slave to Master slots.

The Lower Tester transmits a DV packet containing LMP_features_req to the IUT in order to force the IUT to send a DV packet containing LMP_features_res.

Upon reception of a DV packet the tester responds with a HV1 packet.

The Lower Tester verifies that the IUT automatically changes from DV packet type to HV1 packet type.

- Expected Outcome

  Pass Verdict

  The IUT changes automatically from DV packet type to HV1 packet type.

- Notes

  There is no possibility written in the [1] to force the IUT to send a DV packet. For IUTs using DV packets it can be checked whether they are received. If no DV packet is returned the IUT must return a DM1 packet. The IUT might transmit unsolicited LMP signaling changing the intended Test Procedure. This risk is minimized by having the Lower Tester transmit LMP_features_req and LMP_version_req immediately after ACL connection establishment and only indicate support for the minimum number of features required to make the test case work.

  An IXIT [14] statement is used to distinguish between IUTs requiring HCI interaction to transmit HV1/DV packets and IUTs transmitting the packets without HCI interaction. Optionally the IUT might send HCI Synchronous packets to the Upper Tester.

4.12.2 Connection State - Slave

Test subgroup objectives:

Verify that the Slave works correctly in the connection state.

4.12.2.1 BB/PROT/CON/BV-05-C [POLL at Start Up]

- Test Purpose

  Verify that the IUT configured as Slave confirms the reception of the first POLL packet sent by the Master after startup of a new connection and initializes the ARQN bit set to NAK.

  Further verify that the IUT initializes the SEQN bit of the first CRC data packet set to 1.

- Reference

  [1] 6.5.1.3, 7.6.1, 7.6.2, 8.5

- Initial Condition

  Lower Tester: Configured as Master in state STANDBY. Inquiry is performed successfully.

  IUT: Configured as Slave in state STANDBY. Inquiry scan is performed successfully.

- Test Procedure

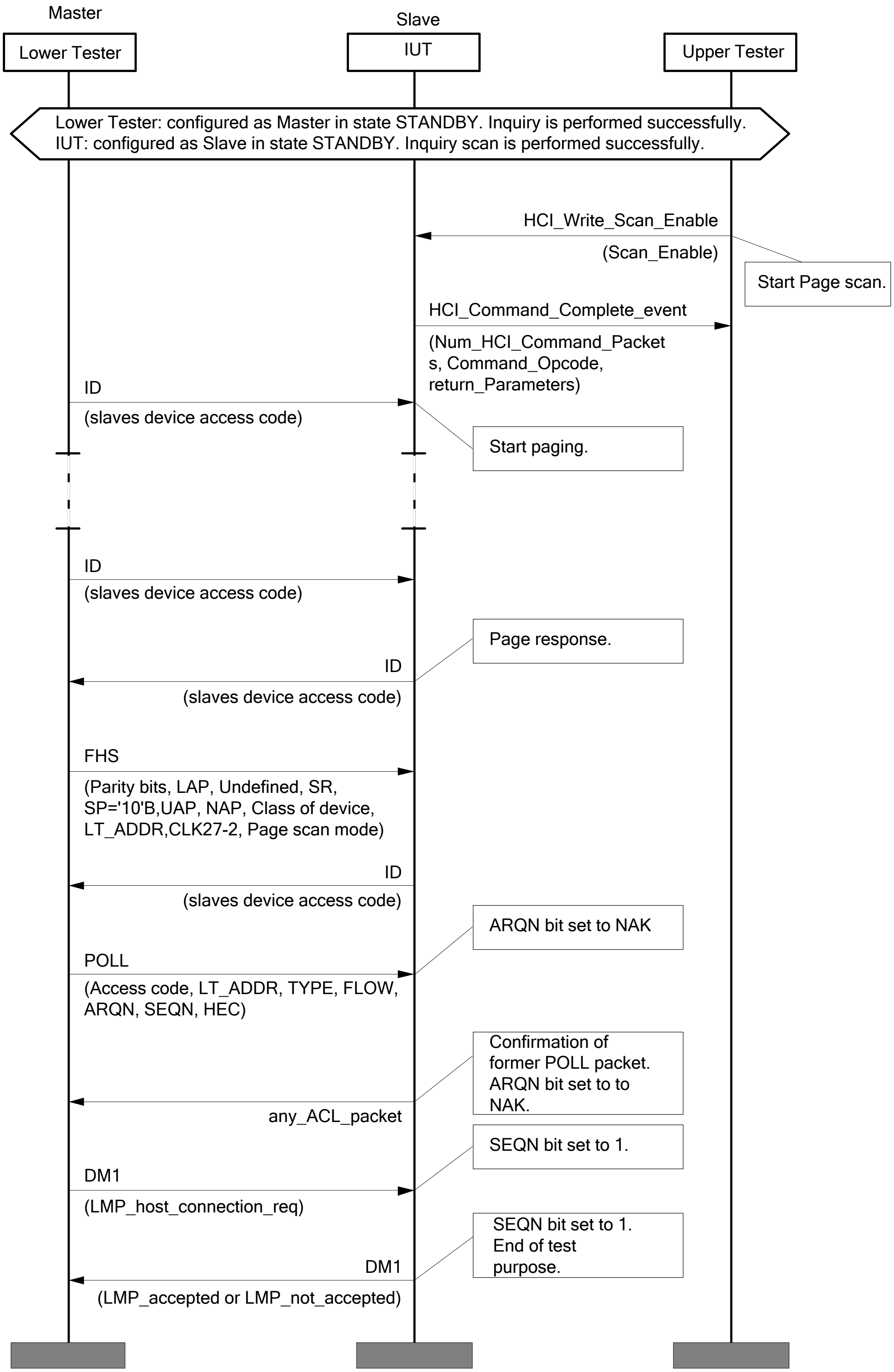

Figure 4.93: BB/PROT/CON/BV-05-C (POLL at start up)

The Upper Tester sends a HCI command to instruct the IUT to carry out page scan.

HCI_Write_Scan_Enable:

Scan_Enable: 0x02.

The Lower Tester repeatedly transmits an ID packet (Slave's device access code) in different hop channels to page the Slave.

Then the Lower Tester verifies that the IUT sends an ID packet containing the Slave's device access code.

Upon reception of the ID packet the Lower Tester transmits a FHS packet.

<u>FHS:</u>

Access Code:

Preamble: 1010 or 0101 sequence, depending on whether the LSB of the following sync word is 1 or 0, respectively.

Sync word: Derived from the 24 bit address (LAP) of the Slave (DAC).

Trailer: 1010 or 0101 sequence, depending on whether the MSB of the sync word is 1 or 0, respectively.

Packet Header:

LT_ADDR: Set to all-zero.

TYPE: '0010'B.

FLOW: '1'B.

ARQN: '1'B.

SEQN: Any value because contents of the SEQN bit in the FHS packet should not be checked.

HEC: Generated by the polynomial '647'O in respect to the UAP of the Master.

FHS Payload:

Parity bits: First 34-bit of the sync word of the access code.

LAP: LAP of the Lower Tester.

Undefined: Any value.

SR: '00'B.

SP: ‘10'B.

UAP: UAP of the Lower Tester.

NAP: NAP of the Lower Tester.

Class of device: Not defined yet; any value.

LT_ADDR: Logical Transport Address the IUT shall use.

CLK_{27-2}: Current value of the system clock of the Lower Tester.

Page Scan Mode: '000'B.

After having received the FHS packet of the Lower Tester the IUT transmits an ID packet (Slave's device access code only) again to indicate the reception of the former FHS packet.

The Lower Tester sends a POLL packet in the next Master to Slave slot.

POLL packet:

LT_ADDR: Logical Transport Address of the IUT.

TYPE: '0001'B.

FLOW: '1'B.

ARQN: Depends on the reception of the former packet.

SEQN: Any value.

HEC: UAP of the Master device address.

Then the Lower Tester verifies that the IUT confirms the reception of the former POLL packet with any ACL packet with the ARQN bit set to NAK.

The Lower Tester sends a DM1 packet containing an *LMP_host_connection_req* message with the SEQN bit set to 1.

The Lower Tester verifies that the IUT sends a DM1 packet with the SEQN bit set to 1.

- Expected Outcome

  Pass Verdict

  The IUT confirms the reception of the POLL packet after start up with the ARQN bit set to NAK.

  The IUT initializes the SEQN bit of the first CRC data packet to 1.

4.12.2.2 BB/PROT/CON/BV-08-C [Wrong UAP]

- Test Purpose

  Verify that when a packet with the same access code - i.e., an access code of a device owning the same LAP but different UAP - passes the access code test, it will disregard the packet after HEC and CRC tests when the UAP do not match.

- Reference

  [1] 7.1

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link).

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

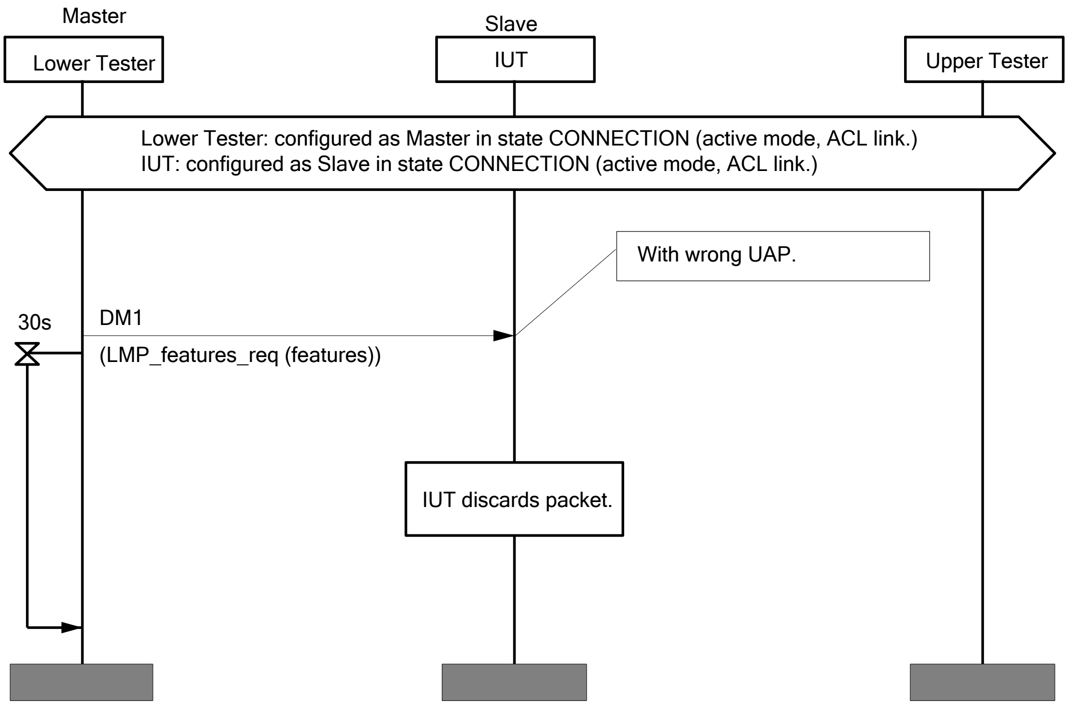

Figure 4.94 BB/PROT/CON/BV-08-C (Wrong UAP)

The Lower Tester sends a DM1 packet containing an LMP_features_req message with a wrong UAP to the IUT.

The Lower Tester verifies that the IUT discards the packet and verifies that the IUT does not response to the LMP_features_req message.

- Expected Outcome

<u>Pass Verdict</u>

The IUT discards the packet and does not response to the LMP_features_req message.

4.12.2.3 BB/PROT/CON/BV-09-C [Change from DV to HV1]

- Test Purpose

Verify that the IUT automatically changes from DV packet type to HV1 packet type used before the mixed data/voice transmission when there is no data to be sent.

- Reference

[1] 6.5.2.4

- Initial Condition

Lower Tester: Configured as Master.

IUT: Configured as Slave.

An SCO connection is established. The only features supported by the Lower Tester are SCO-link, µ-law, A-law, CVSD and transparent data.

- Test Procedure

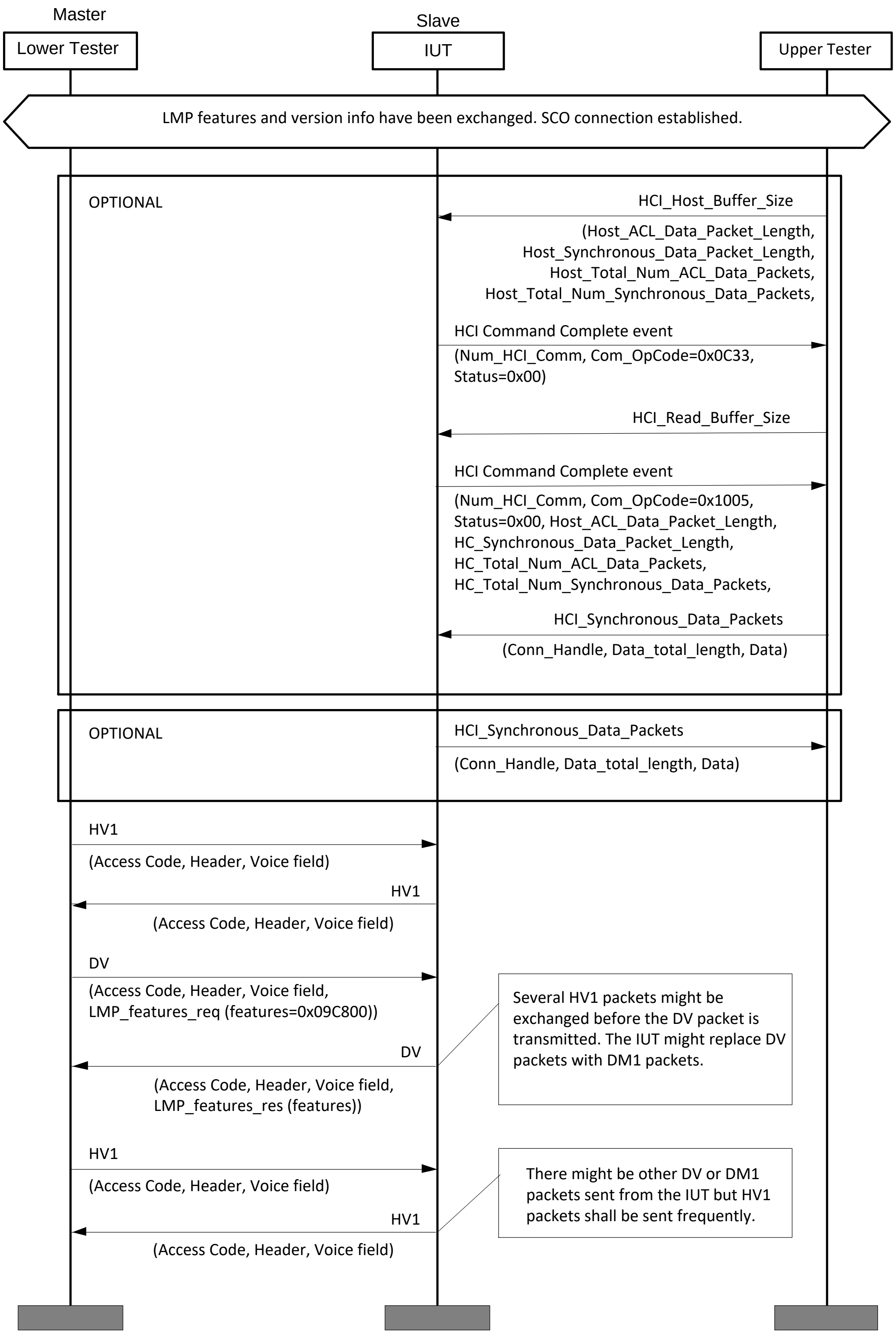

Figure 4.95: BB/PROT/CON/BV-09-C (Change from DV to HV1)

The Lower Tester transmits a HV1 packet to the IUT.

The Lower Tester verifies that the IUT responds with a HV1 packet in the following Slave to Master slot.

The Lower Tester sends transmits LMP_features_req to the IUT in order to force the IUT to transmit a DV packet containing LMP_Features_res.

The Lower Tester verifies that the IUT transmits a DV packet.

The Lower Tester verifies that the IUT automatically changes from DV packet type to HV1 packet type.

- Expected Outcome

  Pass Verdict

  The IUT changes automatically from DV packet type to HV1 packet type.

- Notes

  There is no possibility written in the [1] to force the IUT to send a DV packet. For IUTs using DV packets it can be checked whether they are received. If no DV packet is returned the IUT must return a DM1 packet. The IUT might transmit unsolicited LMP signaling changing the intended Test Procedure. This risk is minimized by having the tester transmit LMP_features_req and LMP_version_req immediately after ACL connection establishment and only indicate support for the minimum number of features required to make the test case work.

  An IXIT [14] statement is used to distinguish between IUTs requiring HCI interaction to transmit HV1/DV packets and IUTs transmitting the packets without HCI interaction. Optionally the IUT might send HCI Synchronous packets to the Upper Tester.

4.12.2.4 BB/PROT/CON/BV-10-C [AES DayCounter Initialization to 1 as Slave]

- Test Purpose

  Verify that the IUT correctly initializes the AES DayCounter in the specific case where it is initialized to 1.

- Reference

  [12] 9.1

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link) with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  The CLK has been chosen so that clock wrap-around will happen in the near future.

- Test Procedure

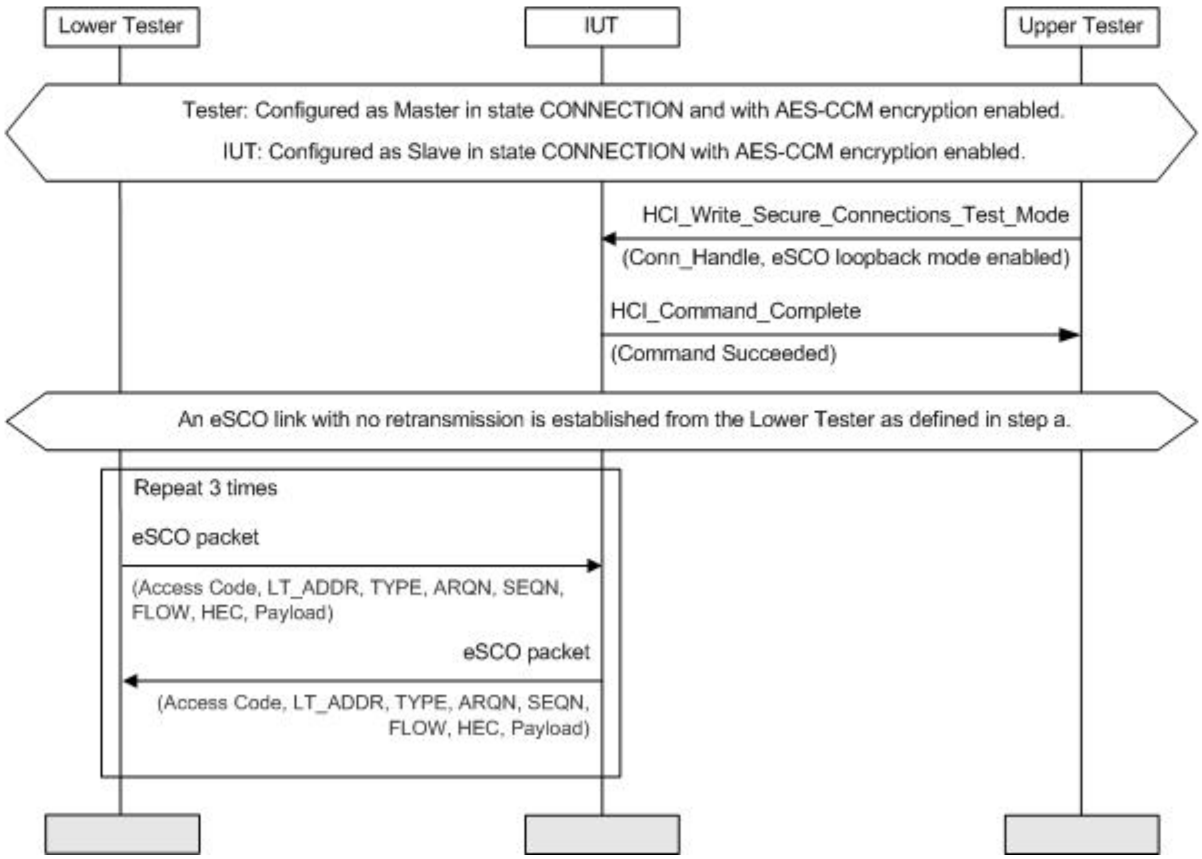

Figure 4.96: BB/PROT/CON/BV-10-C

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) The Lower Tester initiates an eSCO link at a precise time so that initialization 2 is used for setting up eSCO AND the MSB of the Master clock (CLK27) is 0 at the first eSCO packet from the Master. eSCO link is set with no retransmission.
c) The Lower Tester sends an eSCO packet as follows:

   Payload: 30 non deterministic random Bytes of payload plus 16 bit CRC.

d) The IUT replies with a packet of same description.
e) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
f) Steps c)–e) are repeated 2 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 3 packets containing a looped back payload.

- Expected Outcome

<u>Pass Verdict</u>

The Lower Tester receives the three eSCO packets properly encrypted and containing the same payload as it transmitted.

- Notes

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  Per [1], in this specific test, the DayCounter is initialized to 1 due to the specific timing at eSCO link establishment.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.12.2.5 BB/PROT/CON/BV-11-C [AES DayCounter increment at clock wrap-around as Slave]

- Test Purpose

  Verify that the IUT correctly increments the AES DayCounter at clock wrap-around.

- Reference

  [12] 9.1

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link) with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  The CLK has been chosen so that clock wrap-around will happen in a reasonably close future (there is no restriction but around a second or a couple seconds would be reasonable). The only restriction is that eSCO packets have to be exchanged before and after clock wrap-around.

- Test Procedure

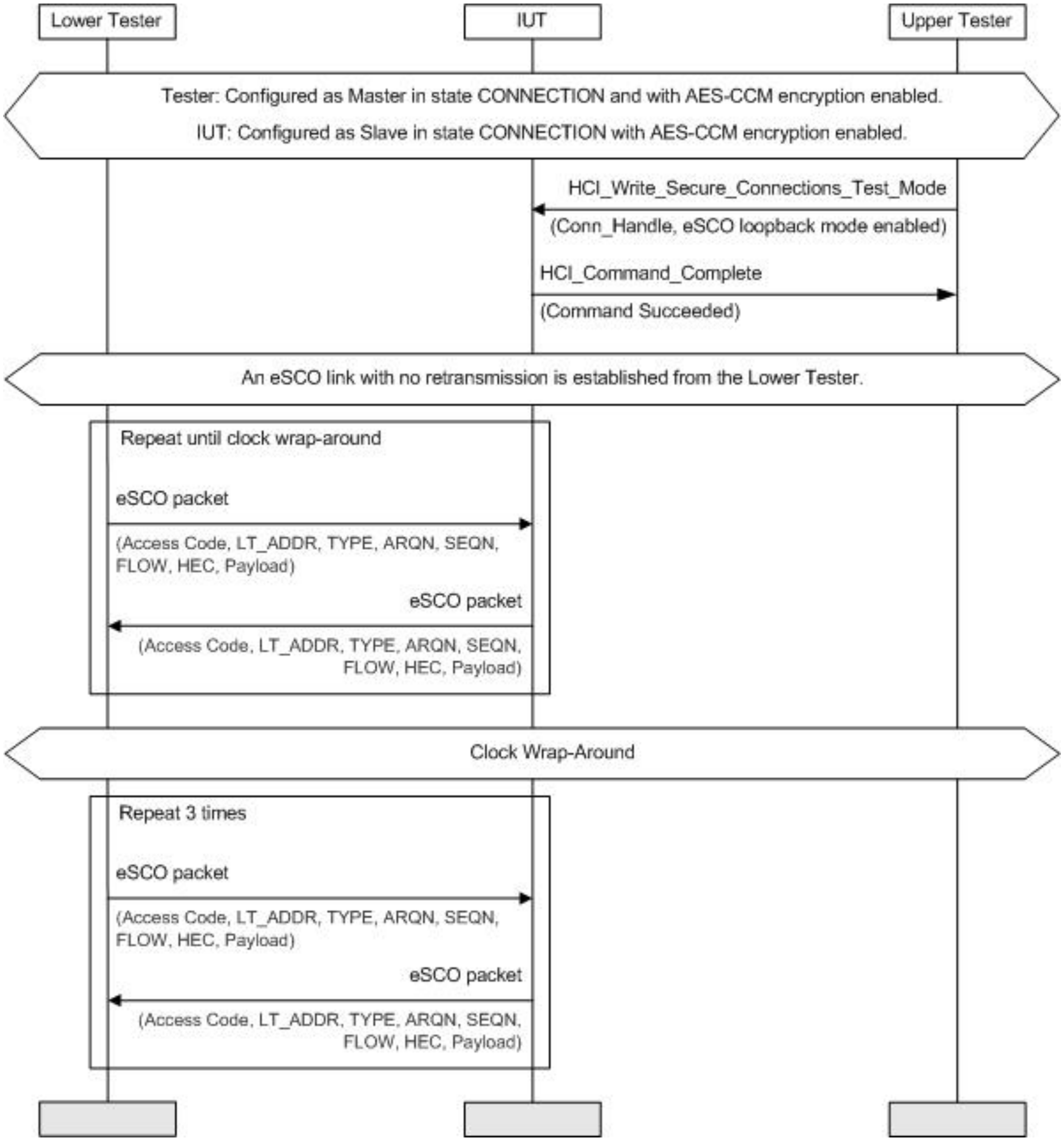

Figure 4.97: BB/PROT/CON/BV-11-C

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) Lower Tester initiates an eSCO link at a reasonable time before clock wrap-around. eSCO link is set with no retransmission.
c) The Lower Tester sends an eSCO packet as follows:
d) Payload: 30 non deterministic random Bytes of payload plus 16 bit CRC.
e) The IUT replies with a packet of same description.
f) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
g) Steps c)–e) are repeated till clock wrap-around. A minimum of 3 packets containing a looped back payload have to be sent from the IUT.

h) After clock wrap-around, steps b)–d) are repeated 3 times.

- Expected Outcome

  Pass Verdict

  Before clock wrap around, at least 99 percent of eSCO packets sent by the Lower Tester get a response packet properly encrypted and containing the same payload as transmitted.

  After clock wrap-around, the Lower Tester receives the three packets properly encrypted and containing the same payload as it transmitted.

- Notes

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.12.2.6 BB/PROT/CON/BV-12-C [AES DayCounter not initialized after an eSCO reconnection as Slave]

- Test Purpose

  Verify that the IUT does not initialize the AES DayCounter after an eSCO reconnection.

- Reference

  [12] 9.1

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link) with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  The CLK has been chosen so that clock wrap-around will happen in a reasonably close future (there is no restriction but around a second or a couple seconds would be reasonable). The only restriction is that 3 eSCO packets have to be exchanged before the clock wrap-around.

- Test Procedure

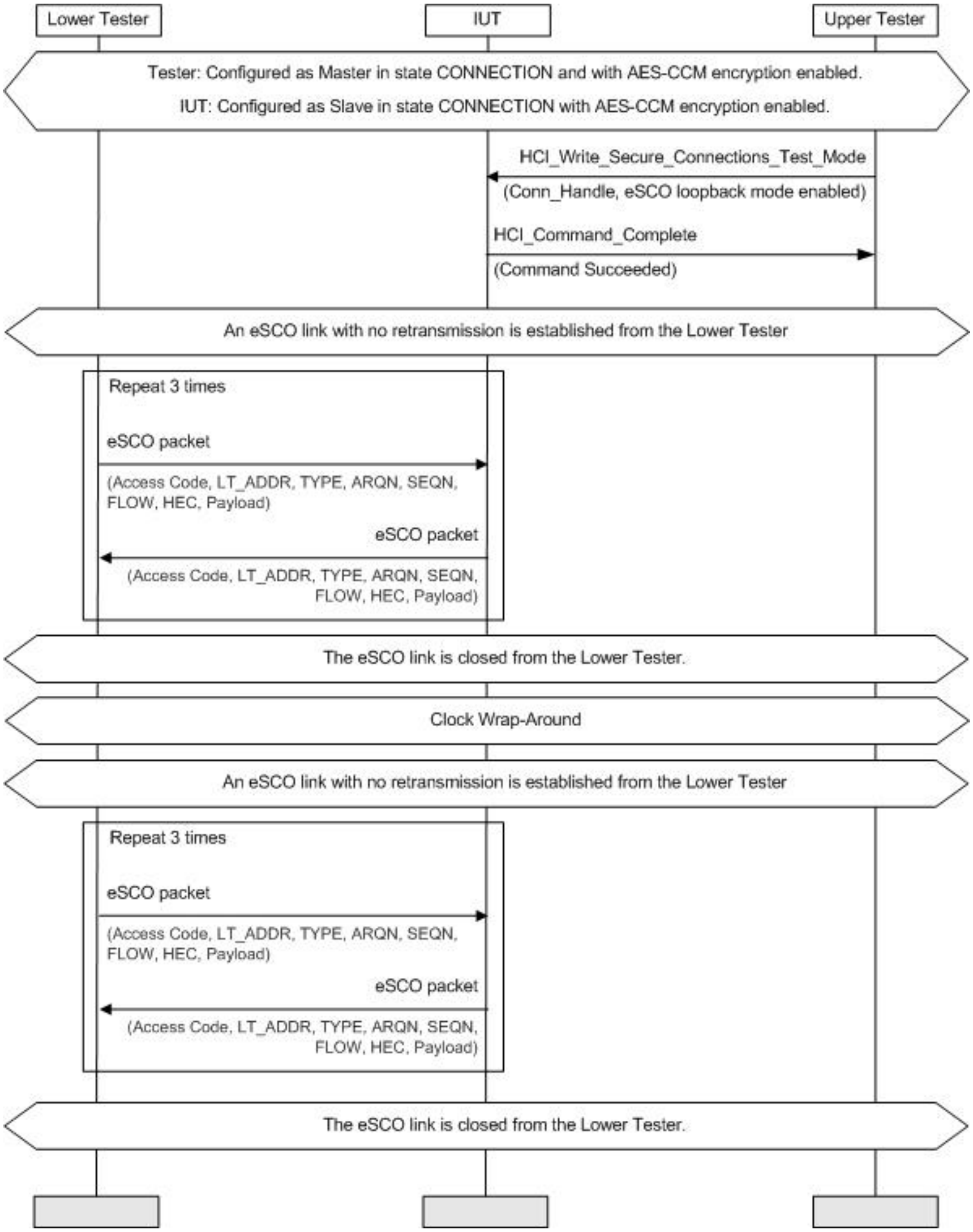

Figure 4.98: BB/PROT/CON/BV-12-C

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) Lower Tester initiates an eSCO link at a reasonable time before clock wrap-around. eSCO link is set with no retransmission.
c) The Lower Tester sends an eSCO packet as follows:
d) Payload: 30 non deterministic random Bytes of payload plus 16 bit CRC.
e) The IUT replies with a packet of same description.
f) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.

g) Steps c)–e) are repeated 2 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 3 packets containing a looped back payload.
h) The Lower Tester closes the eSCO link before Clock wrap-around.
i) After Clock wrap around, the Lower Tester initiates an eSCO link with no retransmission.
j) Steps c)–e) are repeated 3 times plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 3 packets containing a looped back payload.
k) The Lower Tester closes the eSCO link.

- Expected Outcome

  Pass Verdict

  Before clock wrap around, the Lower Tester receives the three packets properly encrypted and containing the same payload as it transmitted.

  After clock wrap-around, the Lower Tester receives the three packets properly encrypted and containing the same payload as it transmitted.

- Notes

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.12.2.7 BB/PROT/CON/BV-13-C [AES DayCounter initialization after a role switch as Slave]

- Test Purpose

  Verify that the IUT correctly initializes the AES DayCounter after a role switch.

- Reference

  [12] 9.1

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link) with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  The CLK has been chosen so that clock wrap-around will happen in a reasonably close future (there is no restriction but around a second or a couple seconds would be reasonable). The only restriction is that 3 eSCO packets have to be exchanged before the clock wrap-around.

- Test Procedure

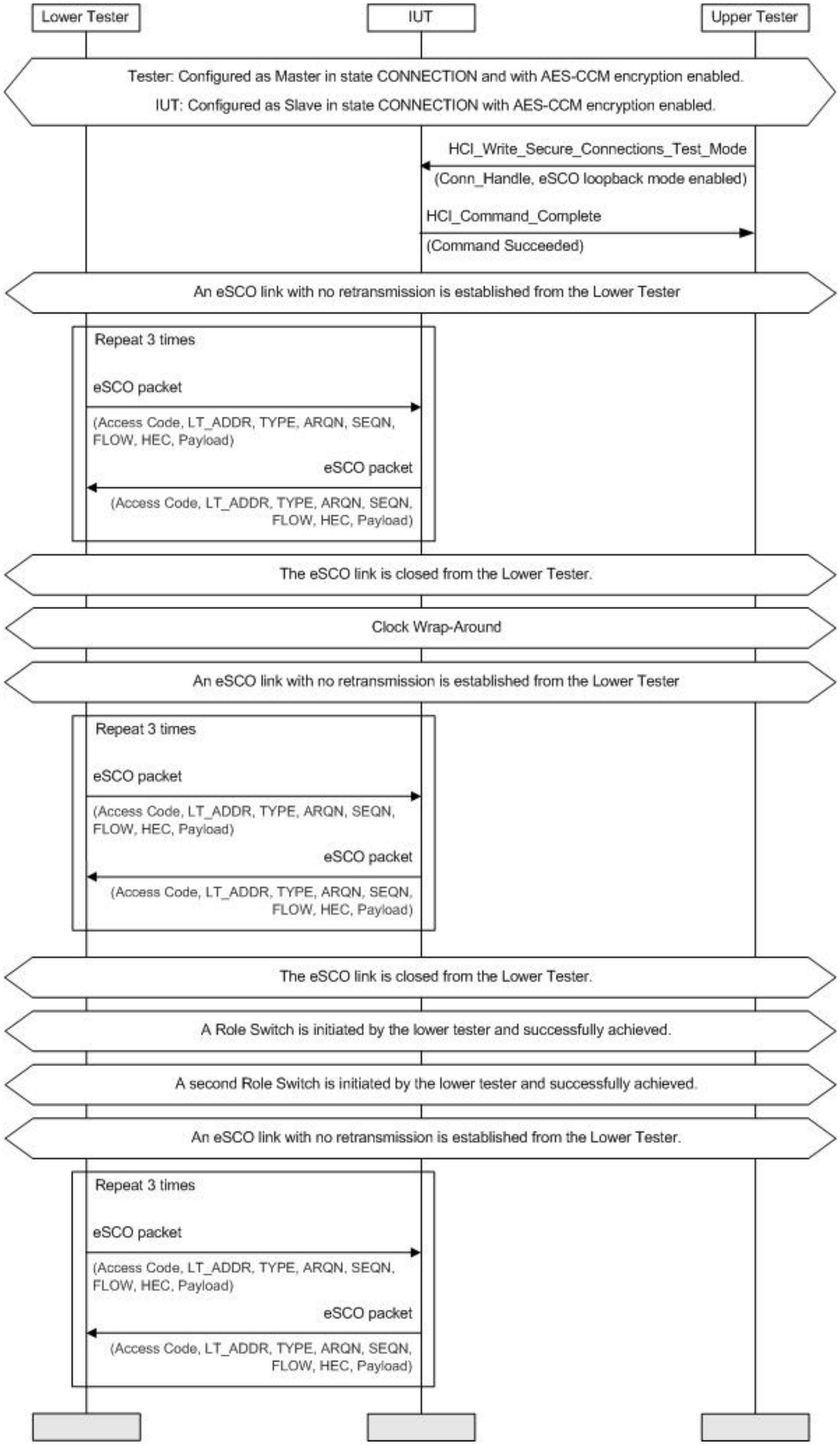

Figure 4.99: BB/PROT/CON/BV-13-C

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) Lower Tester initiates an eSCO link at a reasonable time before clock wrap-around. eSCO link is set with no retransmission.
c) The Lower Tester sends an eSCO packet as follows:

   Payload: 30 non deterministic random Bytes of payload plus 16 bit CRC.

d) The IUT replies with a packet of same description.
e) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
f) Steps c)–e) are repeated 2 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 3 packets containing a looped back payload.
g) The Lower Tester closes the eSCO link before Clock wrap-around.
h) After Clock wrap around, the Lower Tester initiates an eSCO link with no retransmission.
i) Steps c)–e) are repeated 3 times plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 3 packets containing a looped back payload.
j) The Lower Tester closes the eSCO link.
k) The Lower Tester initiates a Role Switch, Role Switch is successful.
l) The Lower Tester initiates a second Role Switch, Role Switch is successful.
m) The Lower Tester initiates an eSCO link with no retransmission.
n) Steps c)–e) are repeated 3 times plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 3 packets containing a looped back payload.

- Expected Outcome

  Pass Verdict

  Before clock wrap around, the Lower Tester receives the three packets properly encrypted and containing the same payload as it transmitted.

  After clock wrap-around, the Lower Tester receives the three packets properly encrypted and containing the same payload as it transmitted.

  After the 2 Role Switch operations, the Lower Tester receives the three packets properly encrypted and containing the same payload as it transmitted.

- Notes

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.12.2.8 BB/PROT/CON/BV-14-C [AES DayCounter not initialized after an Encryption Pause and Resume]

- Test Purpose

  Verify that the IUT does not initialize the AES DayCounter after an Encryption Pause and Resume.

- Reference

  [12] 9.1

- Initial Condition

  IUT is configured as Slave in state CONNECTION (active mode, ACL link) with AES-CCM encryption enabled.

  Lower Tester is configured as Master in state CONNECTION (active mode, ACL link) and with AES-CCM encryption enabled.

  The CLK has been chosen so that clock wrap-around will happen in a reasonably close future (there is no restriction but around a second or a couple seconds would be reasonable). The only restriction is that 3 eSCO packets have to be exchanged before the clock wrap-around.

- Test Procedure

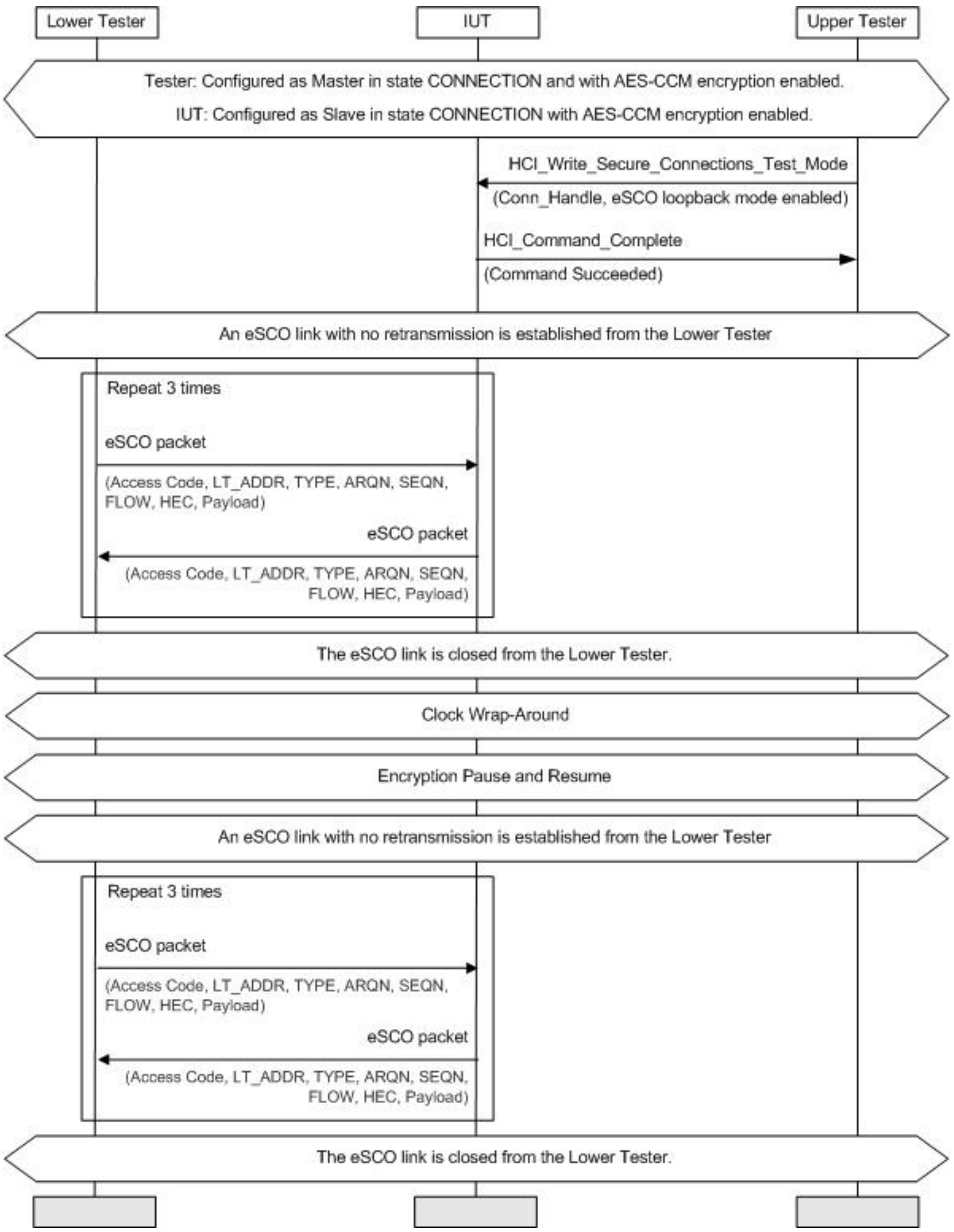

Figure 4.100: BB/PROT/CON/BV-14-C

a) The Upper Tester sends HCI Write Secure Connections Test Mode to enable the eSCO loopback mode.
b) The Lower Tester initiates an eSCO link at a reasonable time before clock wrap-around. eSCO link is set with no retransmission.
c) The Lower Tester sends an eSCO packet as follows:

   Payload: 30 non deterministic random Bytes of payload plus 16 bit CRC.

d) The IUT replies with a packet of same description.
e) The Lower Tester verifies that the IUT transmits the packet correctly to the Lower Tester.
f) Steps c)–e) are repeated 2 times (in addition to the first time) plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 3 packets containing a looped back payload.
g) The Lower Tester closes the eSCO link before Clock wrap-around.
h) After Clock wrap around, the Lower Tester initiates an Encryption Pause and Resume.
i) The Lower Tester initiates an eSCO link with no retransmission.
j) Steps c)–e) are repeated 3 times plus a few times equal to the eSCO loopback delay value, so that the IUT sends a minimum of 3 packets containing a looped back payload.
k) The Lower Tester closes the eSCO link.

- Expected Outcome

  Pass Verdict

  Before clock wrap around, the Lower Tester receives the three packets properly encrypted and containing the same payload as it transmitted.

  After clock wrap-around, the Lower Tester receives the three packets properly encrypted and containing the same payload as it transmitted.

- Notes

  The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.

  According to the Secure Connections eSCO Loopback Delay value (provided in the IXIT [14]), the payload contained in the first packets from the IUT is discarded and does not impact the verdict.

4.13 Piconet

Test group objectives:

Verify the behavior in a piconet.

4.13.1 Piconet - Master

Test subgroup objectives:

Verify that the Master works correctly in the piconet.

4.13.1.1 BB/PROT/PIC/BV-03-C [Broadcast Packets]

- Test Purpose

  Verify that broadcast packets are repeated a fixed number of times.

Verify that broadcast packets carrying L2CAP start packets use the indication LLID = 0b10. Verify that broadcast packets have a separate sequence numbering.

- Reference

  [1] 7.6.5

- Initial Condition

  The IUT is Master and the Lower Tester is Slave. An ACL connection is established using only 1-slot packets. The Host Controller data buffers have been checked. The number of retransmissions (N_{BC}) shall be declared as IXIT [14].

  The Lower Tester does not support any features (features= 0x0000000000000000).

- Test Procedure

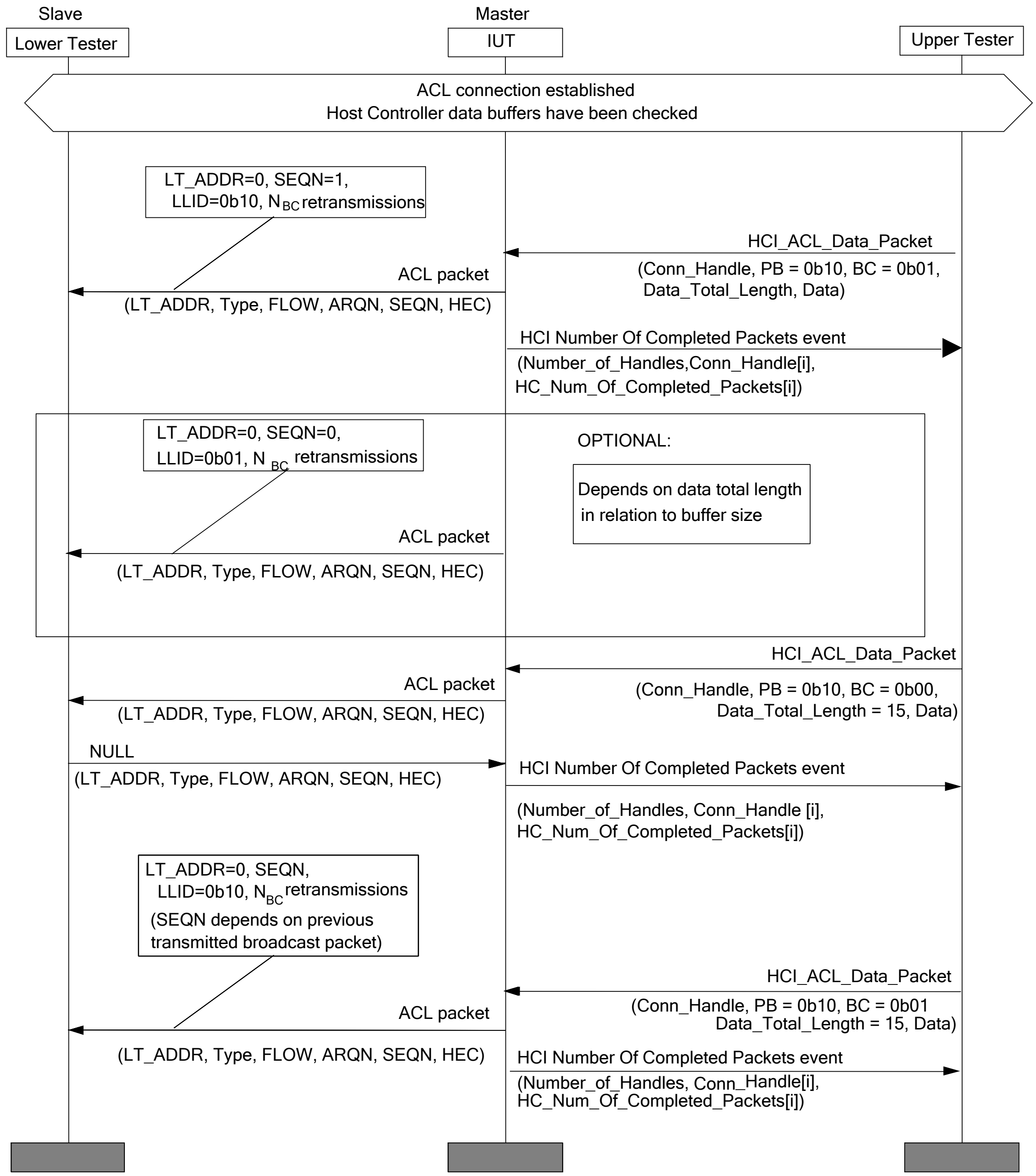

Figure 4.101: BB/PROT/PIC/BV-03-C (Broadcast packets)

The Upper Tester sends HCI_ACL_Data packets alternating broadcast and point-to-point. The Upper Tester sends the first broadcast HCI ACL Data packet with payload length 28 bytes to force the IUT to split the data over at least 2 BB packets. The remaining packets are sent with payload size 15 bytes. If the IUT buffer size is less than 28 bytes the Upper Tester uses the longest possible data payload that fits for the first packet and the IUT might not split the data over several BB packets. After each HCI_ACL_Data packet the Upper Tester waits for the HCI Number Of Completed Packets Event before sending the next HCI_ACL_Data packet.

	ACL SEQN	Broad-cast SEQN	ACL SEQN	Broad-cast SEQN	ACL SEQN	Broad-cast SEQN	ACL SEQN	Broad-cast SEQN
Last ACL SEQN	0		0		1		1	
First broadcast		1		1 0		1		1 0
ACL data	1		1		0		0	
Broadcast		0		1		0		1

Table 4.2: Sequence Numbers

- Expected Outcome

  Pass Verdict

  The Lower Tester receives the broadcast packets repeated maximum NBC times as specified in IXIT [14].

  Broadcast packets have a sequence numbering separate from point-to-point packets.

  The transmitted broadcast packets have correct values for LLID.

- Notes

  The Host Controller might not split HCI ACL Data packets in several BB packets if the max buffer size is less than 28 bytes. The Lower Tester might miss a packet so the number of repetitions recorded might be less than N_{BC}.

  The connection handle used by the Upper Tester for broadcast data is different from the connection handle used for point-to-point PDUs. The host controller can only use DM1 and DH1 packets for broadcast ACL data because the tester does not support longer packets. It is unlikely an IUT has a max buffer less than 28 bytes so most IUTs will split the first broadcast packet into multiple BB packets. A broadcast packet from the IUT may be transmitted once more than specified in the HCI command.

4.13.2 Piconet - Slave

Test subgroup objectives:

Verify that the Slave works correctly in the piconet.

4.13.2.1 BB/PROT/PIC/BV-04-C [Broadcast NAK]

- Test Purpose

  Verify that broadcast messages are not acknowledged.

- Reference

  [1] 7.6.1, 7.6.5

- Initial Condition

  The IUT is Slave and the Lower Tester is Master. ACL connection established using only DM1 packets. The Lower Tester does not support any features (features = 0x0000000000000000).

- Test Procedure

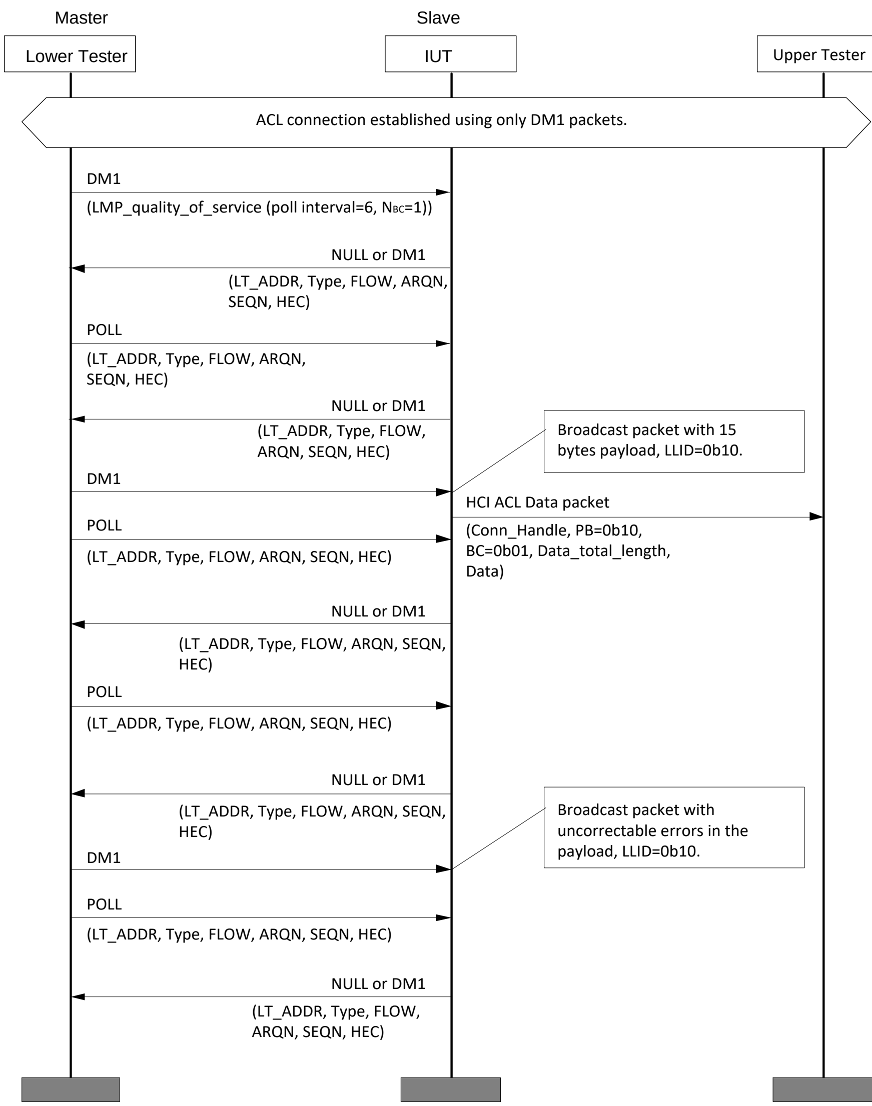

Figure 4.102: BB/PROT/PIC/BV-04-C

The Lower Tester transmits LMP_quality_of_service to notify the IUT of poll interval and N_{BC}.

The Lower Tester transmits a POLL packet and stores the received ARQN bit (ARQN1).

The Lower Tester transmits a broadcast packet N_{BC} times with data payload correctly inserted.

The Lower Tester transmits a POLL packet and stores the received ARQN bit (ARQN2).

The Lower Tester transmits a POLL packet again and stores the received ARQN bit (ARQN3).

The Lower Tester transmits a broadcast packet N_{BC} times with uncorrectable errors in the data payload.

The Lower Tester transmits a POLL packet and stores the received ARQN bit (ARQN4).

- Expected Outcome

  Pass Verdict

  ARQN1=ARQN2 and ARQN3=ARQN4. The IUT does not respond to the broadcast packets.

- Notes

  The Lower Tester might transmit a DM1 packet instead of POLL affecting the acknowledgment mechanism. Packets might get lost. If a Fail Verdict is set the test case should be repeated a few times to possibly get a test session without lost or unintentional DM1 packets. An IUT with a very high packet error rate might result in a Fail Verdict.

4.14 Erroneous Data Reporting

4.14.1 Erroneous Data Reporting

Test subgroup objectives

Verify the Erroneous Data Reporting procedure.

4.14.1.1 BB/PROT/ED/BV-01-C [Missed eSCO Data Packet]

- Test Purpose

  Verify that the IUT correctly informs the host when no eSCO data was received in an interval.

- Reference

  [10] 7.7

  [11] 5.4.3

- Initial Conditions

  The IUT is a Slave of a connection.

  The IUT has an eSCO EV3 connection to the Lower Tester, size of the eSCO retransmission window= 0.

  Erroneous Data Reporting is enabled on the IUT's eSCO link.

- Test Procedure

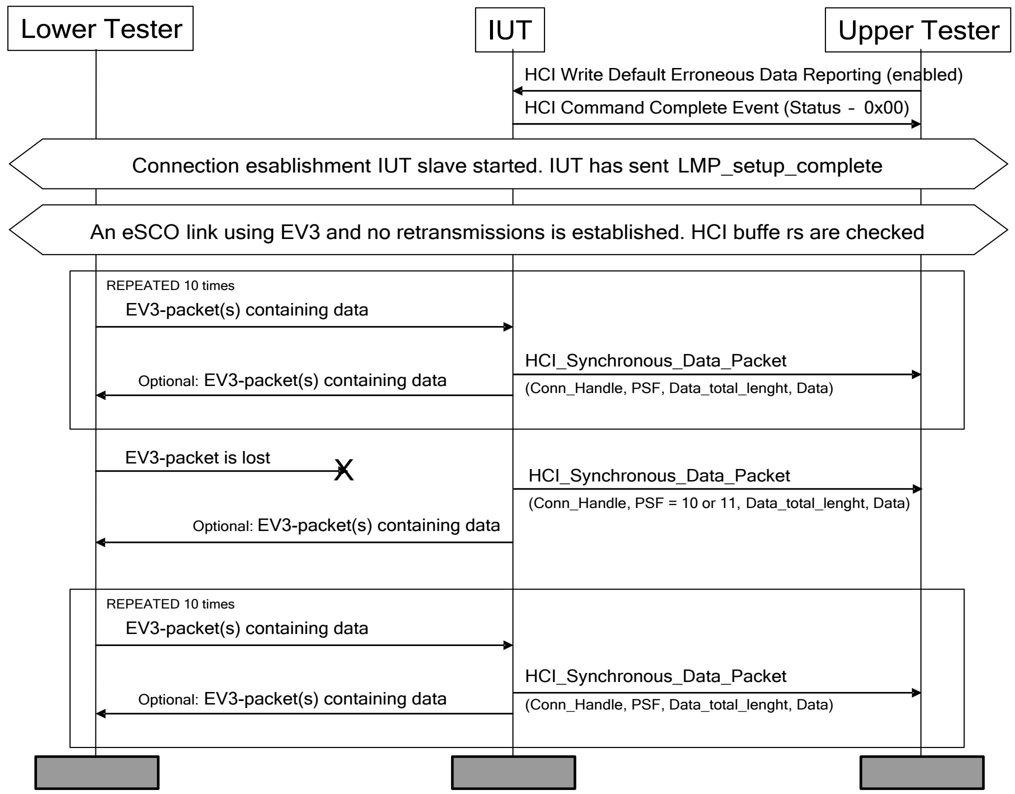

Figure 4.103: BB/PROT/ED/BV-01-C (Missed eSCO data packet)

The Lower Tester sends 1 eSCO air packet every interval during 10 intervals.

The Lower Tester doesn't send an eSCO packet on the air interface in 1 interval.

The Lower Tester continues sending 1 eSCO air packet every interval during 10 intervals.

- Expected Outcome

  Pass Verdict

  After the first 10 intervals, the IUT sends at least 1 HCI Synchronous Data Packet to the Upper Tester, with the Packet_Status_Flag set to '10' (No data received) or '11' (Data partially lost).

- Notes

  This test case assumes a 1-to-1 mapping between eSCO air packets that are received by the IUT and HCI Synchronous Data Packets sent by the IUT. In case the IUT segments or reassembles received eSCO air packets there will not be a 1-to-1 relation; not every interval will have a HCI Synchronous Data Packet.

  The number of HCI Synchronous Data Packets to the Upper Tester, with the Packet_Status_Flag set to '10' or '11' may vary (but at least 1 should be sent) in case the IUT segments or reassembles received eSCO air packets.

4.14.1.2 BB/PROT/ED/BV-02-C [eSCO data received with incorrect CRC or TYPE not allowed for the connection when eSCO retransmission window = 0]

- Test Purpose

  Verify that the IUT correctly informs the host when eSCO data was received with an incorrect CRC or a TYPE that is not allowed for the connection.

- Reference

  [10] 7.7

  [11] 5.4.3

- Initial Condition

  The IUT is a Slave of a connection.

  The IUT has an eSCO EV3 connection to the Lower Tester, size of the eSCO retransmission window= 0.

  Erroneous Data Reporting is enabled on the IUT's eSCO link.

- Test Procedure

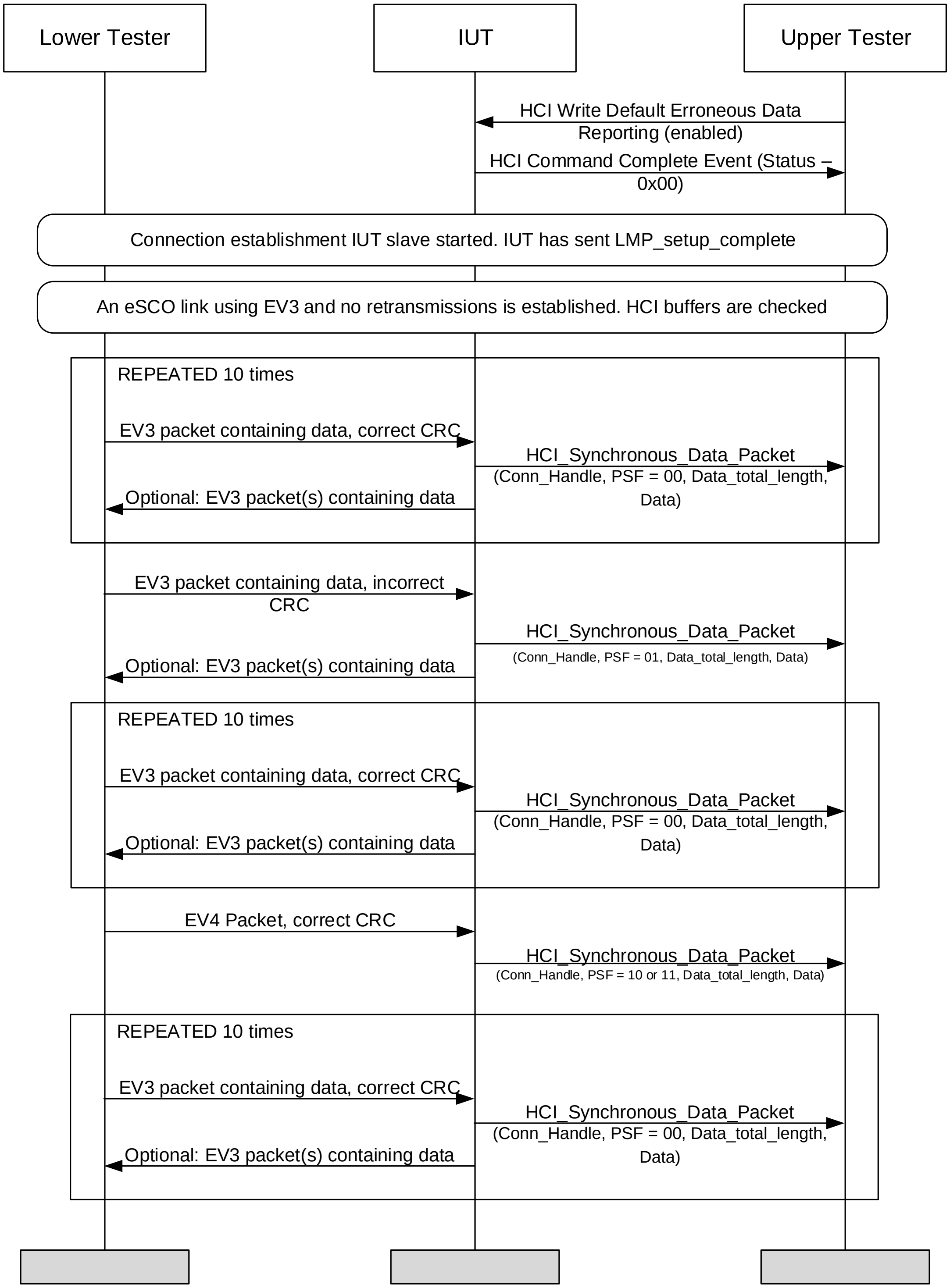

Figure 4.104: BB/PROT/ED/BV-02-C (eSCO data received with incorrect CRC and no retransmissions)

The Lower Tester sends one eSCO EV3 packet with a correct CRC in every interval for 10 intervals.

The Lower Tester sends one eSCO EV3 packet with an incorrect CRC.

The Lower Tester sends one eSCO EV3 packet with a correct CRC in every interval for 10 intervals.

The Lower Tester sends one eSCO EV4 packet with the correct CRC.

The Lower Tester continues sending one eSCO EV3 packet with a correct CRC in every interval for 10 intervals.

- Expected Outcome

  Pass Verdict

  After the first 11 intervals, the IUT sends at least 1 HCI Synchronous Data Packet to the Upper Tester, with the Packet_Status_Flag set to '01' (Data received with invalid CRC).

  After the second 11 intervals, the IUT sends at least 1 HCI Synchronous Data Packet to the Upper Tester with the Packet_Status_Flag set to ‘10’ (No data received) or ‘11’ (Data partially lost).

- Notes

  The MSC assumes a 1-to-1 mapping between eSCO air packets that are received by the IUT and HCI Synchronous Data Packets sent by the IUT. However, this is not a requirement of the test.

  If the IUT segments or reassembles received eSCO air packets, there will not be a 1-to-1 relationship. In this case, not every interval will have an HCI Synchronous Data Packet, and the number of HCI Synchronous Data Packets sent to the Upper Tester with the Packet_Status_Flag set to values other than ‘00’ may vary (but at least one with ‘01’ and one with either ‘10’ or ‘11’ is required).

4.14.1.3 BB/PROT/ED/BV-03-C [eSCO Data Received with Correct CRC, followed by a Retransmission with Incorrect CRC or TYPE not allowed for the connection]

- Test Purpose

  Verify that the IUT delivers the data packet with the correct CRC and an allowed TYPE for the connection to the host. The IUT does not report the receipt of a corrupted packet if that packet has already been received without error in the interval.

- Reference

  [10] 7.7

  [11] 5.4.3

- Initial Condition

  The IUT is a Slave of a connection.

  The IUT has an eSCO EV3 connection to the Lower Tester, one eSCO retransmission.

  Erroneous Data Reporting is enabled on the IUT's eSCO link.

- Test Procedure

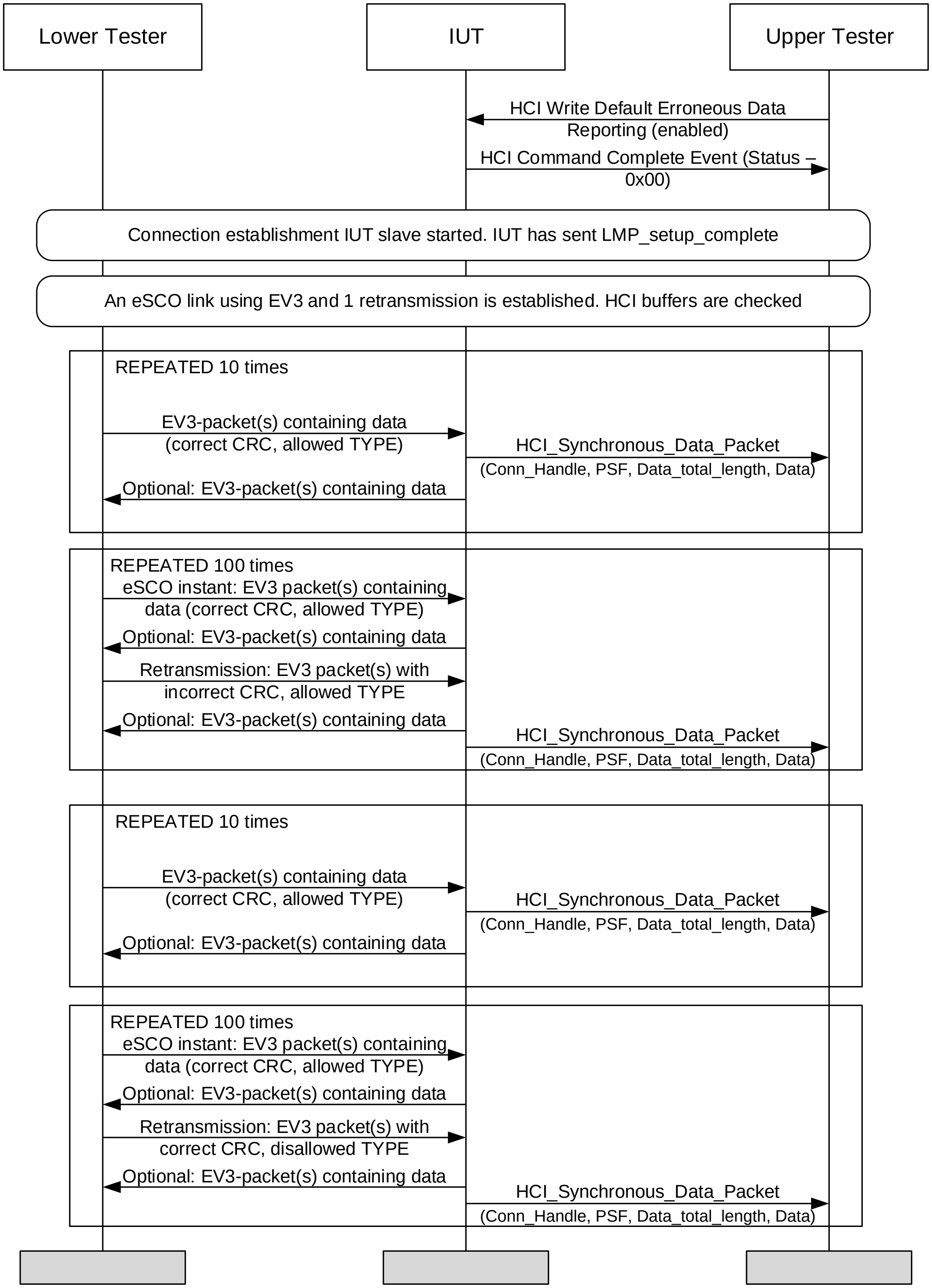

Figure 4.105: BB/PROT/ED/BV-03-C (eSCO data received with correct CRC, followed by a retransmission with incorrect CRC)

The Lower Tester sends one eSCO air packet (with correct CRC and an allowed TYPE for the connection) every interval during 10 intervals.

In every eSCO interval during 100 intervals, the Lower Tester sends one eSCO packet with correct CRC and an allowed TYPE, followed by a retransmission (independently of the IUT's ARQN bit) with incorrect CRC and an allowed TYPE.

The Lower Tester sends one eSCO air packet (with correct CRC and an allowed TYPE for the connection) every interval during 10 intervals.

In every eSCO interval during 100 intervals, the Lower Tester sends one eSCO packet with correct CRC and an allowed TYPE, followed by a retransmission (independently of the IUT's ARQN bit) with correct CRC and a TYPE that is not allowed for the connection.

- Expected Outcome

  Pass Verdict

  At least 95 percent of the HCI Synchronous Data packets sent by the IUT during the 2nd and 4th periods of 100 intervals have the Packet_Status_Flag set to '00' (Correctly received data).

- Notes

  This test case assumes a 1-to-1 mapping between eSCO air packets that are received by the IUT and HCI Synchronous Data Packets sent by the IUT. In case the IUT segments or reassembles received eSCO air packets there will not be a 1-to-1 relation; not every interval will have a HCI Synchronous Data Packet.

  The test requirement of 95 percent is to take into account the imperfect radio path but not to allow any errors due to incorrect handling of the retransmitted eSCO packets with incorrect CRC.

4.14.1.4 BB/PROT/ED/BV-04-C [Missed SCO Data Packet]

- Test Purpose

  Verify that the IUT correctly informs the host when no SCO data was received in an interval.

- Reference

  [10] 7.7

  [11] 5.4.3

- Initial Condition

  The IUT is a Slave of a connection.

  The IUT has a SCO HV3 connection to the Lower Tester.

  Erroneous Data Reporting is enabled on the IUT's SCO link.

- Test Procedure

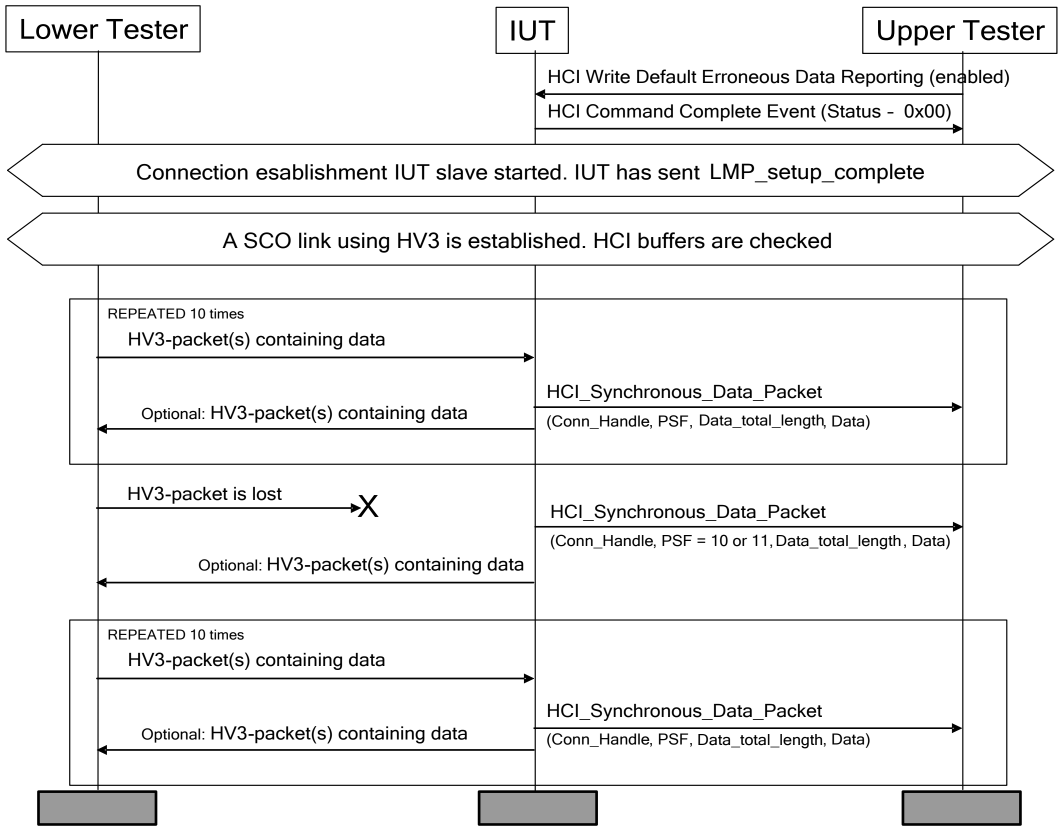

Figure 4.106: BB/PROT/ED/BV-04-C (Missed SCO data packet)

The Lower Tester sends one SCO air packet every interval during 10 intervals.

The Lower Tester doesn't send a SCO packet on the air interface in one interval.

The Lower Tester continues sending one SCO air packet every interval during 10 intervals.

- Expected Outcome

Pass Verdict

After the first 10 intervals, the IUT sends at least 1 HCI Synchronous Data Packet to the Upper Tester, with the Packet_Status_Flag set to '10' (No data received) or '11' (Data partially lost.

- Notes

This test case assumes a 1-to-1 mapping between SCO air packets that are received by the IUT and HCI Synchronous Data Packets sent by the IUT. In case the IUT segments or reassembles received SCO air packets there will not be a 1-to-1 relation; not every interval will have a HCI Synchronous Data Packet.

The number of HCI Synchronous Data Packet to the Upper Tester with the Packet_Status_Flag set to '10' or '11' may vary (but at least 1 should be sent) in case the IUT segments or reassembles received SCO air packets.

4.14.2 Sniff Subrating

Test group objectives

Verify the correct implementation of the Sniff Subrating procedure

4.14.2.1 Sniff Subrating Preamble

Sniff Subrating is based on Sniff mode. Some of the test cases assume that the connection between the Lower Tester and the IUT is in Sniff mode already. This section addresses the preamble of how to put an ACL link into Sniff mode and how to enable the Sniff Subrating Event to be sent to the host.

4.14.2.2 IUT Unmasks Subrating Event

The Upper Tester issues HCI Set Event Masks with the Sniff Subrating Event bit set; that is, byte 5 and bit 1 or bit 41. This enables the IUT to send Sniff Subrating Event to the host if necessary.

4.14.2.3 IUT as a Slave Entering Sniff Mode

When the IUT is acting as a Slave, the procedures shown use the following parameters to get the connection into sniff mode:

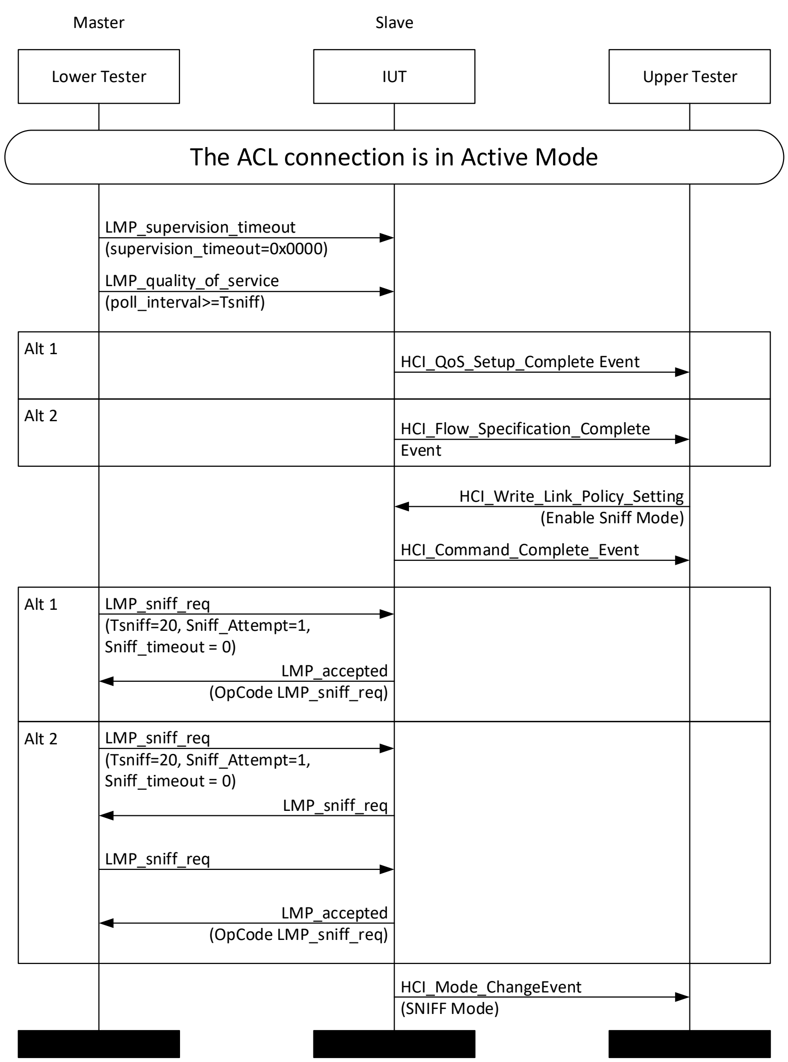

Figure 4.107: Slave entering Sniff Mode

Tsniff = 20 slots

Sniff attempt = 1

Sniff timeout = 0

4.14.2.4 IUT as a Master Entering Sniff Mode

When the IUT is acting as a Master, the procedures shown use the following parameters to get the connection into Sniff mode.

Tsniff = 20 slots

Sniff attempt = 1

Sniff timeout = 0

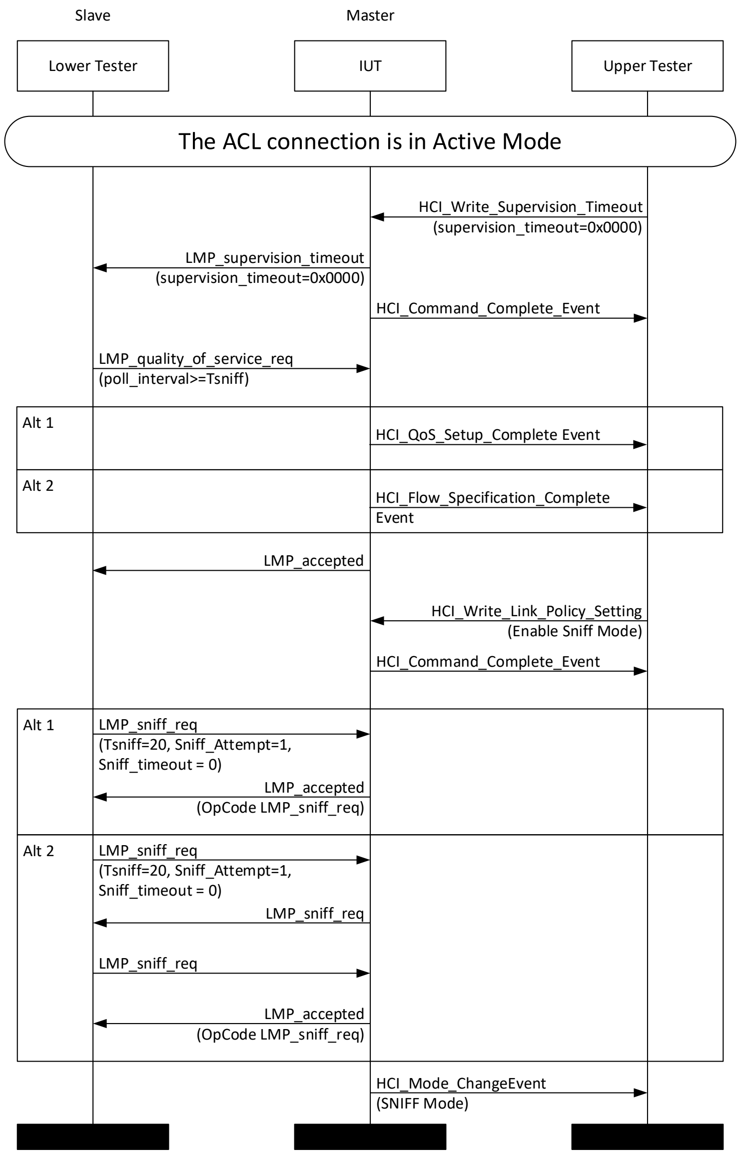

Figure 4.108: Master entering Sniff mode

4.14.2.5 Sniff Subrating Test Subgroup Objectives

Verify the Sniff Subrating procedure is correctly implemented. The ACL connection, which has entered sniff mode already, can enter and exit sniff subrating mode correctly.

4.14.2.6 BB/PROT/SSR/BV-01-C [Master Transitioning from Sniff Mode to Sniff Subrating Mode]

- Test Purpose

  Verify that the IUT as a Master will transition to sniff subrating mode from sniff mode after the sniff subrating instant has passed.

- Reference

  [1] 8.5, 8.7.2

- Initial Condition

  The IUT is Master.

  Lower Tester and IUT have a connection in sniff mode. The sniff parameters are,

    Tsniff = 20 slots

    Sniff attempt = 1

    Sniff timeout = 0.

  The Lower Tester and IUT have not experienced sniff subrating mode in the past.

- Test Procedure

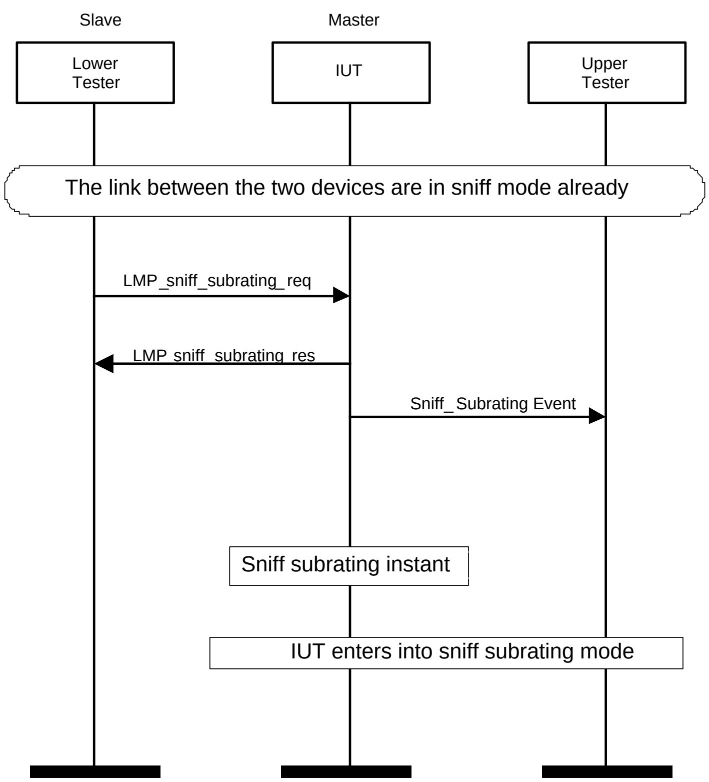

Figure 4.109: BB/PROT/SSR-BV-01-C Master transitioning from Sniff Mode to Sniff Subrating Mode

Lower Tester sends LMP_sniff_subrating_req to the IUT with the following parameters

max_sniff_subrate = 4

min_sniff_mode_timeout = 0

IUT sends LMP_sniff_subrating_res to the Lower Tester with the sniff subrating default parameters

max_sniff_subrate = 1

min_sniff_mode_timeout = 0

sniff_subrating_instant = a sniff anchor point not more than 2^{16} slots in the future

Sniff Subrate Event has been observed with the following parameters received by the Upper Tester.

Maximum_Transmit_Latency = 20 slots

Maximum_Receive_Latency = 80 slots

Minimum_Remote_Timeout = 0 slots

Minimum_Local_Timeout = 0 slots

- Expected Outcome

  Pass Verdict

  The IUT sends POLL, NULL, or data packet at the anchor points of sniff subrate 4, 3, 2, or 1 after the sniff subrating instant. The observation shall be done for a minimum of 3 Maximum Latency intervals (3x80 = 240 slots).

- Notes

  Sniff subrating instant could be in the past when the LMP_sniff_subrating_res is sent over the air.

4.14.2.7 BB/PROT/SSR/BV-02-C [Slave transitioning from Sniff Mode to Sniff Subrating Mode]

- Test Purpose

  Verify that the IUT as a Slave will transition to sniff subrating mode from sniff mode after the sniff subrating instant has passed.

- Reference

  [1] 8.5, 8.7.2

- Initial Condition

  The IUT is Slave.

  Lower Tester and IUT have a connection in sniff mode. The sniff parameters are,

  Tsniff = 20 slots

  Sniff attempt = 1

  Sniff timeout = 0.

  The Lower Tester and IUT have not experienced sniff subrating mode in the past.

- Test Procedure

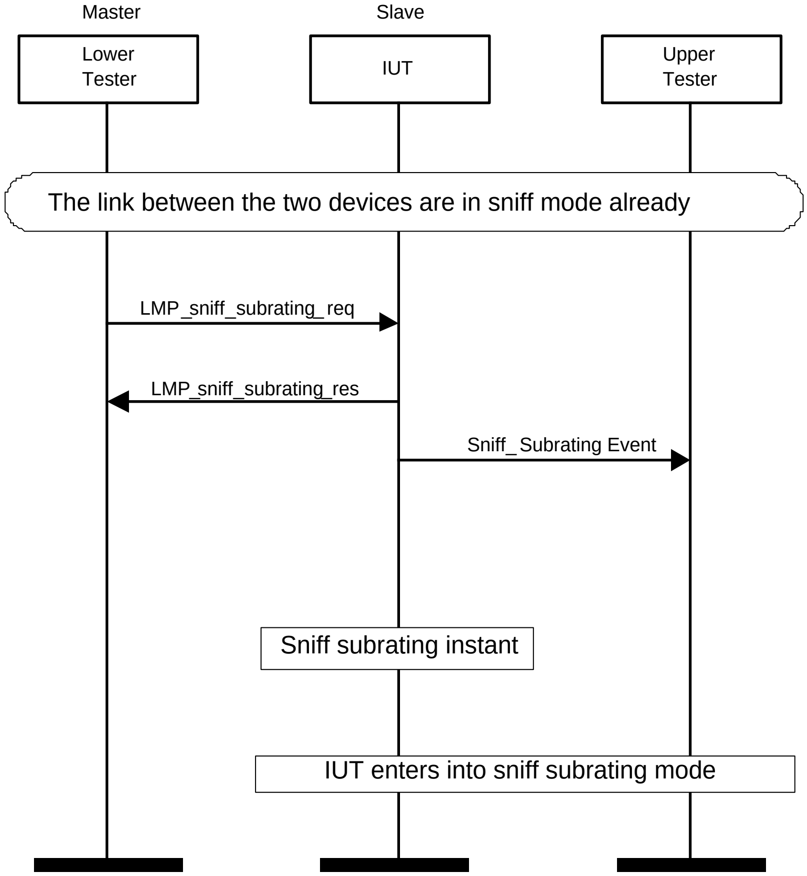

Figure 4.110: BB/PROT/SSR/BV-02-C Slave transitioning from Sniff Mode to Sniff Subrating Mode

Lower Tester sends LMP_sniff_subrating_req to the IUT with the following parameters,

max_sniff_subrate = 4

min_sniff_mode_timeout = 0

sniff_subrating_instant = at least 80 slots ahead of the current piconet clock but not more than 800 slots.

IUT sends LMP_sniff_subrating_res to the Lower Tester with the sniff subrating default parameters,

max_sniff_subrate = 1

min_sniff_mode_timeout = 0

Sniff Subrate Event has been observed with the following parameters received by the Upper Tester.

Maximum_Transmit_Latency = 20 slots

Maximum_Receive_Latency = 80 slots

Minimum_Remote_Timeout = 0 slots

Minimum_Local_Timeout = 0 slots

The Lower Tester stays in sniff mode before the instant and transitions to sniff subrating 1 after the sniff subrating instant. The Lower Tester sends POLL packets at sniff and sniff subrating anchor points when it has no LMP_C data to send. No ACL_U data will be sent from the tester to the IUT.

- Expected Outcome

  Pass Verdict

  The IUT sends NULL packets at the anchor points of sniff subrate 4, 3, 2, or 1 after the sniff subrating instant. The observation shall be done for a minimum of 3 Max_Latency intervals (3x80 = 240 slots).

4.14.2.8 BB/PROT/SSR/BV-03-C [Slave Transitioning to Sniff Mode After Transmitting Data]

- Test Purpose

  Verify that the IUT as a Slave will transition to sniff mode from sniff subrating mode after it sends ACL_U or ACL_C data. It will stay in sniff mode until the data is Baseband ACKed.

- Reference

  [1] 8.5, 8.7.2

- Initial Condition

  The IUT is Slave.

  Lower Tester and IUT have a connection in sniff mode. The sniff parameters are:

  Tsniff = 20 slots

  Sniff attempt = 1

  Sniff timeout = 0.

  The Upper Tester issues the HCI_Sniff_Subrating command to put the connection into sniff subrating mode with the following HCI parameters:

  Maximum_Latency = 80 slots

  Minimum_Remote_Timeout = 320 slots

  Minimum_Local_Timeout = 320 slots.

  Lower Tester has the following parameters received from the IUT (the IUT sends LMP_sniff_subrating_req with these parameters):

  max sniff subrate = 4

  min sniff mode timeout = 320 slots

  sniff_subrating_instant = any valid value

  Lower Tester sends LMP_sniff_subrating_res to the IUT with the following parameters:

  max sniff subrate = 4

  min sniff mode timeout = 320 slots

  Sniff Subrate Event has been observed with the following parameters received by the Upper Tester:

  Maximum_Transmit_Latency = 80 slots

  Maximum_Receive_Latency = 80 slots

Minimum_Remote_Timeout = 320 slots

Minimum_Local_Timeout = 320 slots

- Test Procedure

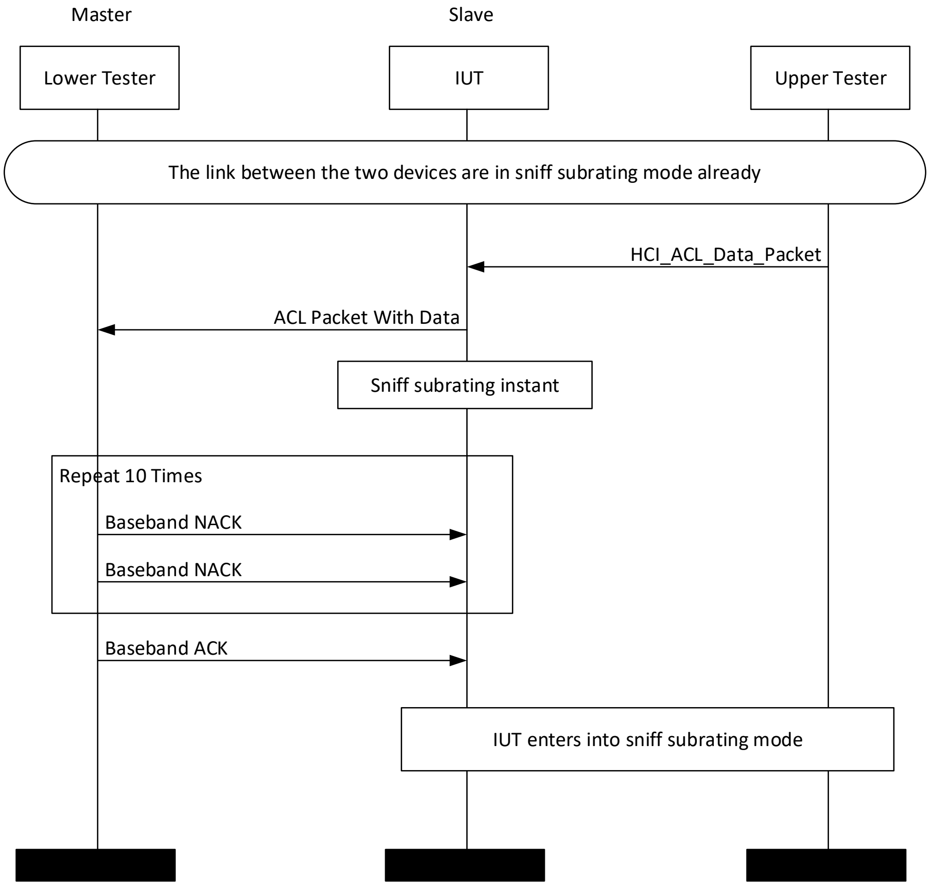

Figure 4.111: BB/PROT/SSR/BV-03-C Slave Transitioning to Sniff Mode After Transmitting Data

The Upper Tester sends an HCI ACL Data packet with a valid four-octet L2CAP header and zero octets of data.

Lower Tester shall send POLL packets at sniff or sniff subrate anchor points.

Lower Tester transitions to sniff mode from sniff subrating mode after it receives the data packet. Lower Tester stays in sniff mode and does not ACK the data until 10 consecutive sniff anchor points have passed after it receives the data.

- Expected Outcome

  Pass Verdict

  The IUT transitions into sniff mode and stays in sniff mode, retransmitting the ACL data packet at every sniff anchor points, until it receives a Baseband ACK. Then IUT transitions back to sniff subrating mode with max sniff subrate 4.

- Notes

  The observation shall be done for a minimum of 3 Max_Latency intervals (3x80 = 240 slots) after the IUT receives Baseband ACK from the Lower Tester.

4.14.2.9 BB/PROT/SSR/BV-04-C [Master Transitioning to Sniff Mode After Receiving Data]

- Test Purpose

  Verify that the IUT as a Master will transition to sniff mode from sniff subrating mode after it receives ACL_U or ACL_C data.

- Reference

  [1] 8.5, 8.7.2

- Initial Condition

  The IUT is Master.

  Lower Tester and IUT have a connection in sniff mode. The sniff parameters are,

  Tsniff = 20 slots

  Sniff attempt = 1

  Sniff timeout = 0.

  The Upper Tester issues the HCI_Sniff_Subrating command to put the connection into sniff subrating mode with the following HCI parameters:

  Maximum_Latency = 80 slots

  Minimum_Remote_Timeout = 320 slots

  Minimum_Local_Timeout = 320 slots.

  Lower Tester has the following parameters received from the IUT (the IUT sends LMP_sniff_subrating_req with these parameters):

  max sniff subrate = 4

  min sniff mode timeout = 320 slots

  sniff_subrating_instant = a sniff anchor point not more than 2^{16} slots in the future

  Lower Tester sends LMP_sniff_subrating_res to the IUT with the following parameters:

  max sniff subrate = 4

  min sniff mode timeout = 320 slots

  Sniff Subrate Event has been observed with the following parameters received by the Upper Tester:

  Maximum_Transmit_Latency = 80 slots

  Maximum_Receive_Latency = 80 slots

  Minimum_Remote_Timeout = 320 slots

  Minimum_Local_Timeout = 320 slots

- Test Procedure

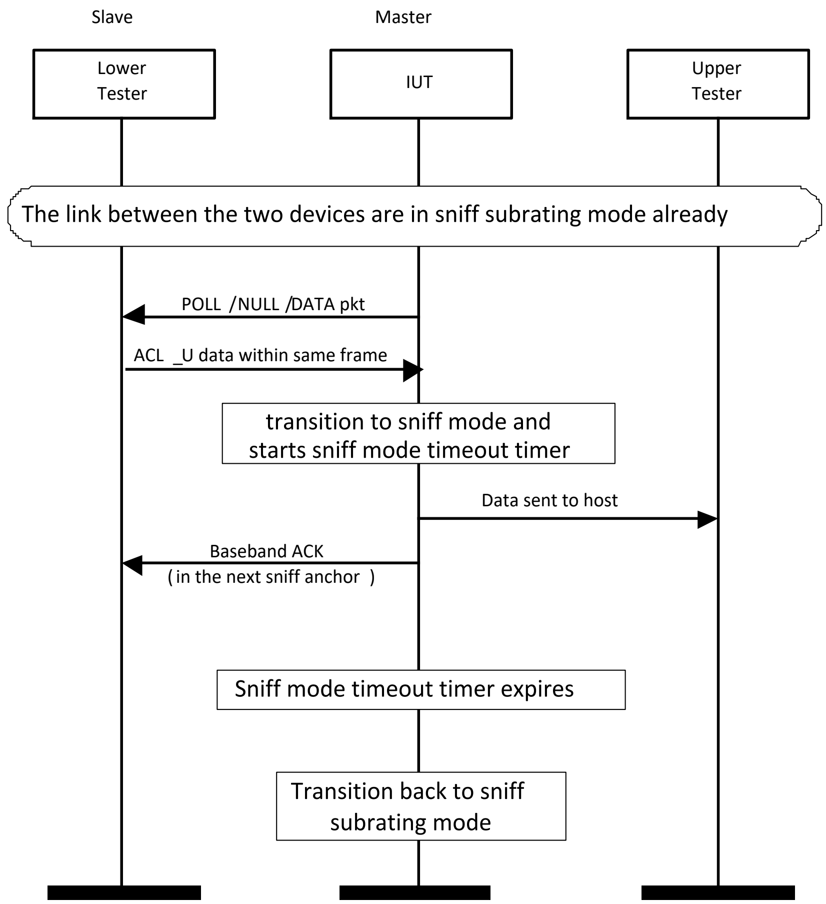

Figure 4.112: BB/PROT/SSR-BV-04-C Master transition in got sniff mode from sniff subrating mode.

Lower Tester sends a packet, in which the LLID in the payload-header is 'start of L2CAP message' and the length in the payload-header is '4' (the payload is an L2CAP message containing a four-octet L2CAP header and zero octets of data).

IUT receives the data at subrate 4 anchor point. It shall transition to sniff mode and try to ACK the data just received by sending a POLL, NULL, or data packet. While in sniff mode, the IUT shall send POLL, NULL, or data packets for a duration of 16 consecutive sniff anchor points (or an interval of 16 Tsniff).

- Expected Outcome

Pass Verdict

After receiving the packet, the IUT transitions into sniff mode, ACKs packet, remains in this mode, and transmits POLL/NULL/Data packets in the next 16 consecutive sniff anchor points. Then IUT transitions back to sniff subrating mode with max sniff subrate 4.

- Notes

The observation shall be done for a minimum of 3 Max_Latency intervals (3x80 = 240 slots) after the sniff mode timeout timer expires.

4.14.2.10 BB/PROT/SSR/BV-05-C [Slave Transitioning to Sniff Mode from Sniff Subrating Mode]

- Test Purpose

  Verify that the IUT as a Slave will transition to sniff mode from sniff subrating mode after the Lower Tester sends the packet.

- Reference

  [1] 8.5, 8.7.2

- Initial Condition

  The IUT is Slave.

  Lower Tester and IUT have a connection in sniff mode. The sniff parameters are:

    Tsniff = 20 slots

    Sniff attempt = 1

    Sniff timeout = 0.

  The Upper Tester issues the HCI_Sniff_Subrating command to put the connection into sniff subrating mode with the following HCI parameters:

    Maximum_Latency = 80 slots

    Minimum_Remote_Timeout = 320 slots

    Minimum_Local_Timeout = 320 slots.

  Lower Tester has the following parameters received from the IUT (the IUT sends LMP_sniff_subrating_req with these parameters):

    max sniff subrate = 4

    min sniff mode timeout = 320 slots

  Lower Tester sends LMP_sniff_subrating_res to the IUT with the following parameters:

    max sniff subrate = 4

    min sniff mode timeout = 320 slots

    sniff_subrating_instant = at least 80 slots ahead of the current piconet clock but not more than 800 slots

  Sniff Subrate Event has been observed with the following parameters received by the Upper Tester:

    Maximum_Transmit_Latency = 80 slots

    Maximum_Receive_Latency = 80 slots

    Minimum_Remote_Timeout = 320 slots

    Minimum_Local_Timeout = 320 slots

- Test Procedure

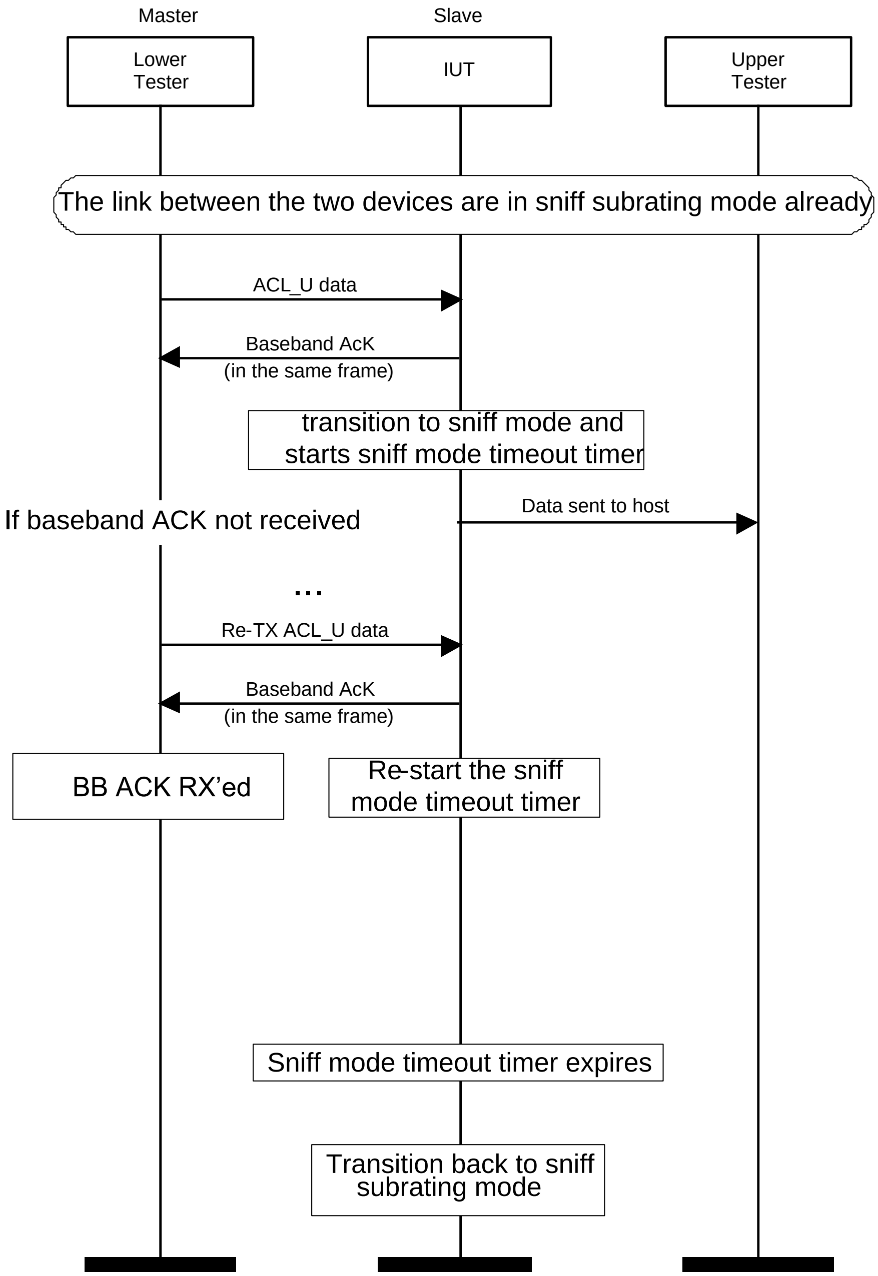

Figure 4.113: BB/PROT/SSR/BV-05-C Slave transitioning to Sniff Mode from Sniff Subrating Mode

Lower Tester sends a one byte ACL-U or ACL-C data to the IUT at subrate 4 anchor point.

IUT receives the data at subrate 4 anchor point. It shall transition to sniff mode and remain in sniff mode for the duration of 16 consecutive sniff anchor points while sending back NULL or data packet for each POLL packet received.

Lower Tester shall send POLL packets at every sniff anchor point even if after it receives an ACK from the IUT for 32 Tsniff intervals.

- Expected Outcome

  Pass Verdict

  After receiving the packet, the IUT transitions into sniff mode, ACKs packet, remains in this mode, and transmits NULL or Data packets in the next 16 consecutive sniff anchor points. When the Lower Tester polls with POLL packets at every sniff anchor point then the IUT transitions back to sniff subrating mode with max sniff subrate 4.

- Notes

  The observation shall be done for a minimum of 3 Max_Latency intervals (3x80 = 240 slots) after the sniff mode timeout timer expires.

4.14.2.11 BB/PROT/SSR/BV-06-C [Master Sniff Subrating Mandatory Anchor Points]

- Test Purpose

  Verify that the IUT as a Master will meet the sniff subrating mandatory anchor point requirement so to meet the maximum latency threshold when the IUT has a bigger sniff subrating value.

- Reference

  [1] 8.5, 8.7.2

- Initial Condition

  IUT is the Master.

  Lower Tester and IUT have a connection in sniff mode. The sniff parameters are:

  Tsniff = 20 slots

  Sniff attempt = 1

  Sniff timeout = 0

- Test Procedure

  For each round based on Table 4.3 (the order of the rows of the table should be randomized for each test but the first row shall have N > 1):

  1. In the first round or if the value of N differs from the previous round, do steps 2–4 then proceed to step 7. If the value of N is the same as the previous round, do steps 5 and 6 then proceed to step 7.
  2. The Upper Tester issues the HCI_Sniff_Subrating command with the following HCI parameters:

     Maximum_Latency = 20 * N slots

     Minimum_Remote_Timeout = 320 slots

     Minimum_Local_Timeout = 320 slots.

3. Lower Tester has the following parameters received from the IUT (the IUT sends LMP_sniff_subrating_req with these parameters):

   max sniff subrate = N

   min sniff mode timeout = 320 slots

   sniff_subrating_instant = a sniff anchor point not more than 2^{16} slots in the future

4. Lower Tester sends LMP_sniff_subrating_res to the IUT with the following parameters using the sniff subrating default values:

   max sniff subrate = M

   min sniff mode timeout = 0 slots

   sniff_subrating_instant = the value sent by the IUT

5. Lower Tester sends another LMP_sniff_subrating_req with the following parameters to the IUT:

   max sniff subrate = M

   min sniff mode timeout = 320 slots

   sniff_subrating_instant = any value

6. IUT sends an LMP_sniff_subrating_res to the Lower Tester with the following parameters (same parameters than former negotiation):

   max sniff subrate = N

   min sniff mode timeout = 320 slots

   sniff_subrating_instant = a sniff anchor point not more than 2^{16} slots in the future

7. Sniff Subrate Event has been observed with the following parameters received by the Upper Tester:

   Maximum_Transmit_Latency = 20 * N’ slots

   Maximum_Receive_Latency = 20 * M’ slots

   Minimum_Remote_Timeout = 320 slots

   Minimum_Local_Timeout = 320 slots

   Where:

   - N' equals N if M ≥ N and equals M times the greatest integer less than or equal to N/M if M < N;
   - M' equals M if N ≥ M and equals N times the greatest integer less than or equal to M/N if N < M.

8. The Lower Tester observes the IUT polling for at least P slots after the sniff subrating instant, where P is 120 times the greater of M and N.

   No data is exchanged between the Lower Tester and the IUT.

N	**M**
1	1
1	2
1	5
1	30
2	1
2	2
2	5
5	1
5	2
5	5
5	24
24	5
30	1

Table 4.3: Max Sniff Subrate parameters for BB/PROT/SSR/BV-06-C

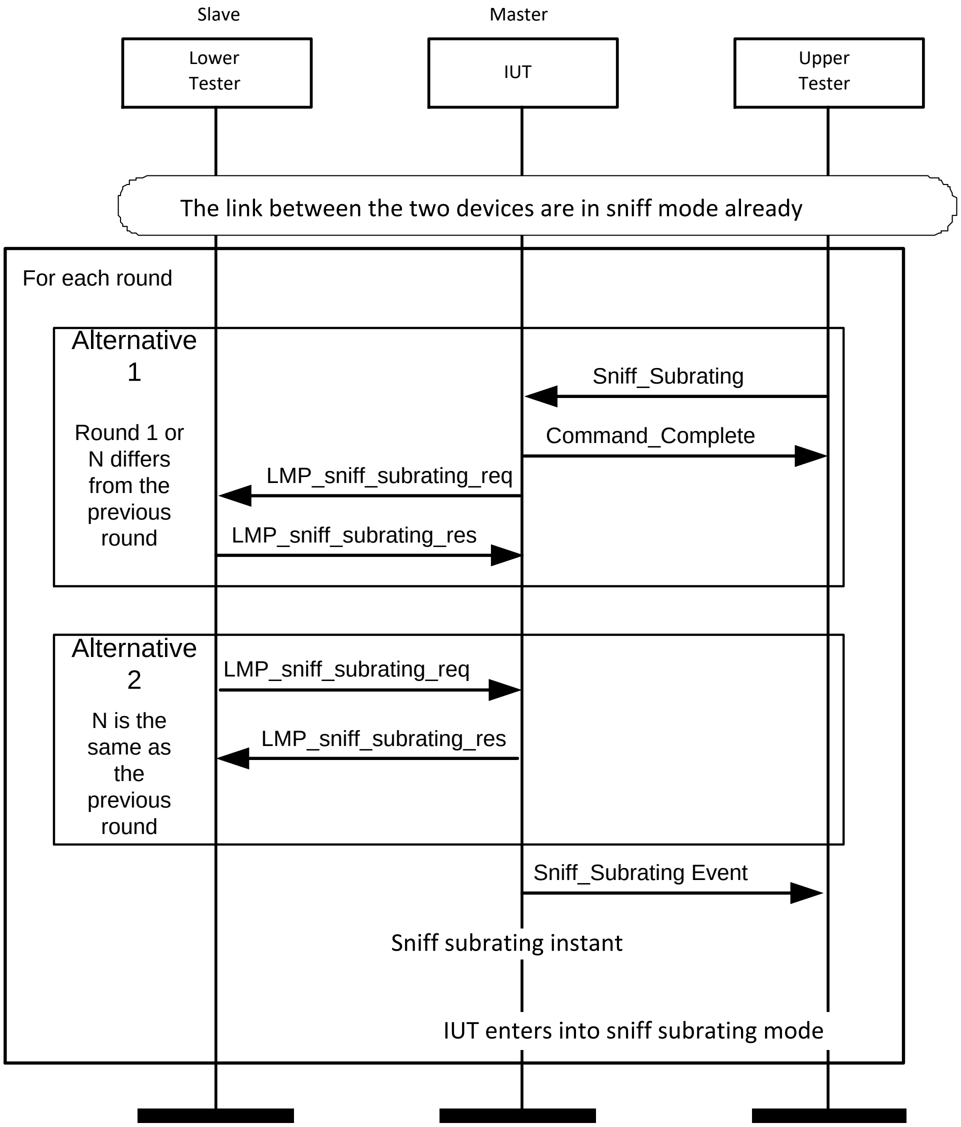

Figure 4.114: BB/PROT/SSR/BV-06-C Master Sniff Subrating Mandatory Anchor Points

- Expected Outcome

  Pass Verdict

  If N ≥ M, the IUT polls every 20 * M slots starting at the instant.

  If N < M, the IUT polls at least once in every consecutive N' anchor points, which are every 20 * N slots starting at the instant.

  In each round, the Lower Tester receives at least 95 percent of the polls that the IUT is required to send.

- Notes

  The IUT may poll at other times as well.

4.14.2.12 BB/PROT/SSR/BV-07-C [Slave Sniff Subrating Mandatory Anchor Points]

- Test Purpose

  Verify that the IUT as a Slave will meet the sniff subrating mandatory anchor point requirement so to meet the maximum latency threshold when the IUT has a bigger sniff subrating value.

- Reference

  [1] 8.5, 8.7.2

- Initial Condition

  IUT is the Slave.

  Lower Tester and IUT have a connection in sniff mode. The sniff parameters are:

  Tsniff = 20 slots

  Sniff attempt = 1

  Sniff timeout = 0

- Test Procedure

  For each round based on Table 4.4 (the order of the rows of the table should be randomized for each test but the first row shall have M > 1):

1. In the first round or if the value of M differs from the previous round, do steps 2–4 then proceed to step 7. If the value of M is the same as the previous round, do steps 5 and 6 then proceed to step 7.
2. The Upper Tester issues the HCI_Sniff_Subrating command with the following HCI parameters:

   Maximum_Latency = 20 * M slots

   Minimum_Remote_Timeout = 320 slots

   Minimum_Local_Timeout = 320 slots.

3. Lower Tester has the following parameters received from the IUT (the IUT sends LMP_sniff_subrating_req with these parameters):

   max sniff subrate = M

   min sniff mode timeout = 320 slots

   sniff_subrating_instant = any value

4. Lower Tester sends LMP_sniff_subrating_res to the IUT with the following parameters:

   max sniff subrate = N

   min sniff mode timeout = 0 slots

   sniff_subrating_instant = at least 80 slots ahead of the current piconet clock but not more than 400 slots

5. Lower Tester sends anLMP_sniff_subrating_req with the following parameters to the IUT:

   max sniff subrate = N

   min sniff mode timeout = 320 slots

   sniff_subrating_instant = at least 80 slots ahead of the current piconet clock but not more than 400 slots

6. IUT sends an LMP_sniff_subrating_res to the Lower Tester with the following parameters (same parameters than former negotiation):

   max sniff subrate = M

   min sniff mode timeout = 320 slots

   sniff_subrating_instant = the value sent by the Lower Tester

7. Sniff Subrate Event has been observed with the following parameters received by the Upper Tester:

   Maximum_Transmit_Latency = 20 * M' slots

   Maximum_Receive_Latency = 20 * N' slots

   Minimum_Remote_Timeout = 320 slots

   Minimum_Local_Timeout = 320 slots

   Where:

   - M' equals M if N ≥ M and equals N times the greatest integer less than or equal to M/N if N < M.
   - N' equals N if M ≥ N and equals M times the greatest integer less than or equal to N/M if M < N;

8. The Lower Tester sends POLL packets every 20 * N slots after the sniff subrating instant for at least P slots, where P is 120 times the greater of M and N, and observes when the IUT replies.

   No data is exchanged between the Lower Tester and the IUT.

N	M
1	1
1	2
1	5
1	30
2	1
2	2
2	5

N	M
5	1
5	2
5	5
5	24
24	5
30	1

Table 4.4: Max Sniff Subrate parameters for BB/PROT/SSR/BV-07-C

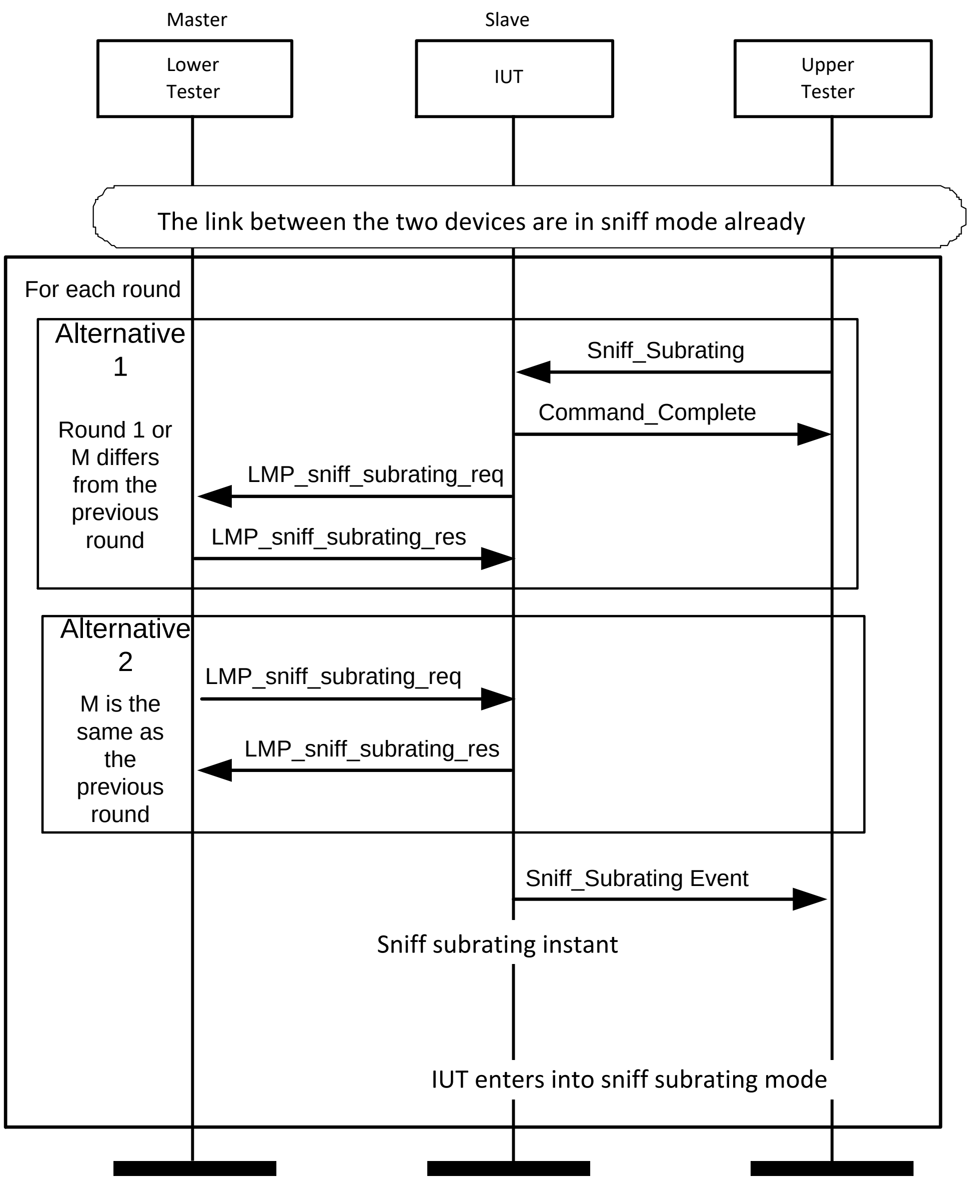

Figure 4.115: BB/PROT/SSR/BV-07-C Slave Sniff Subrating Mandatory Anchor Points

- Expected Outcome

  Pass Verdict

  If M ≥ N, the IUT responds every 20 * N slots starting at the instant.

  If M < N, the IUT responds at least once in every consecutive M' anchor points, which are every 20 * M slots starting at the instant.

  In each round, the Lower Tester receives at least 95 percent of the polls that the IUT is required to send.

- Notes

  The IUT may respond at other times as well.

4.15 Connectionless Slave Broadcast

Test group objectives

To verify Connectionless Slave Broadcast transmission and reception

4.15.1 Connectionless Slave Broadcast Parameters

The following parameters shall be used to configure Connectionless Slave Broadcasts on the IUT as well as the Lower Tester:

- LT_ADDR: 1
- LPO_Allowed: 0 (No)
- Packet_Type: 0x330E (only DM1 packets allowed)
- Interval_Min: 0x0080 (80 ms)
- Interval_Max: 0x0080 (80 ms)
- Data_Length = 0x02
- Data = [0xAA, 0x55]
- synchronization_scanTO = 0x2000 (5.12s)
- synchronization_trainTO = 0xFFFE (approx. 40.1s)
- Skip = 0x00 (no skip) unless specified otherwise in the test
- Sync scan window = 0x090 (90 ms)
- Sync scan interval = 0x092 (92 ms)

4.15.2 Connectionless Slave Broadcast – Transmitter

Test subgroup objectives

To verify Connectionless Slave Broadcast transmission procedure.

4.15.2.1 Connectionless Slave Broadcast Transmission - With Profile Data

The procedures in Figure 4.116 shall be used to place the IUT in Connectionless Broadcast Transmission with profile data.

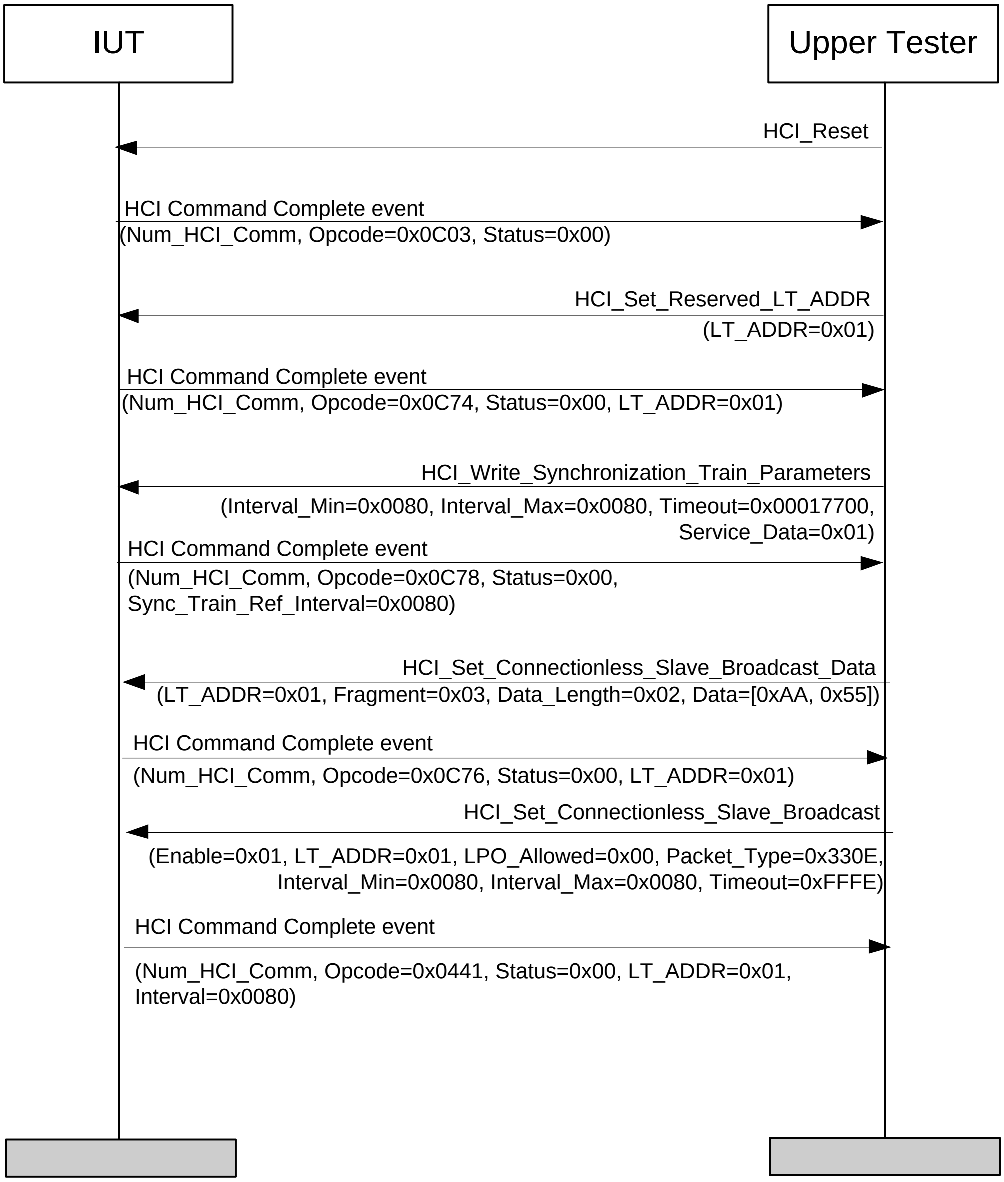

Figure 4.116: IUT Connectionless Slave Broadcast Setup – With Profile Data

4.15.2.2 Connectionless Slave Broadcast Transmission – Without Profile Data

The procedures in Figure 4.117 shall be used to place the IUT in Connectionless Broadcast Transmission without profile data.

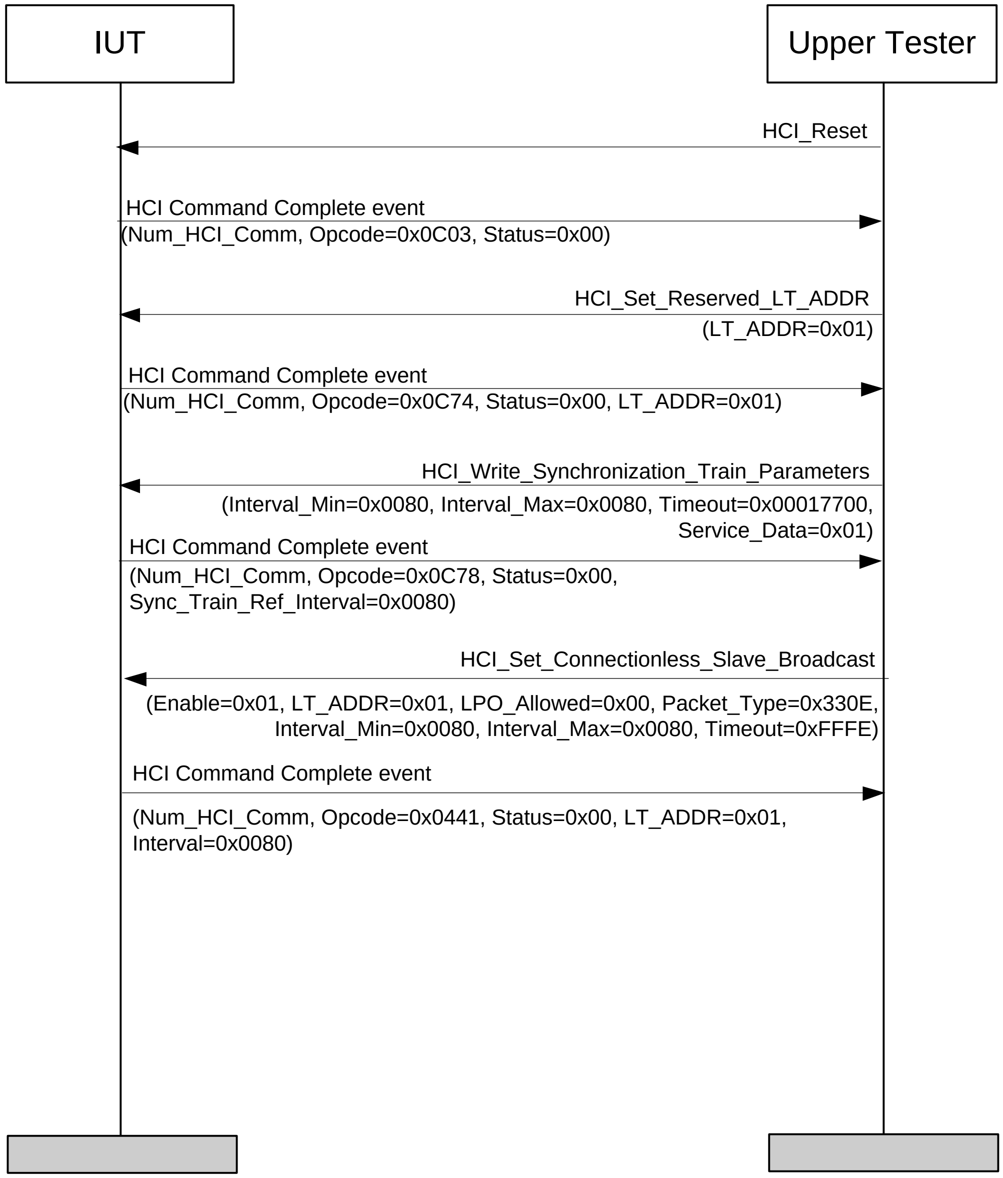

Figure 4.117: IUT Connectionless Slave Broadcast Setup – Without Profile Data

4.15.2.3 BB/PROT/CB/BV-01-C [Connectionless Slave Broadcast Transmission]

- Test Purpose

  Verify that the IUT will transmit Connectionless Slave Broadcast data.

- Reference

  [9] 8.10

- Initial Condition

  IUT has an active Connectionless Slave Broadcast (see Section 4.15.2.1).

  Lower Tester is in standby mode.

- Test Procedure

1. Start Synchronization Train on the IUT.
2. Synchronize Lower Tester to Connectionless Slave Broadcast from IUT.
3. IUT transmits Connectionless Slave Broadcast data to the Lower Tester.

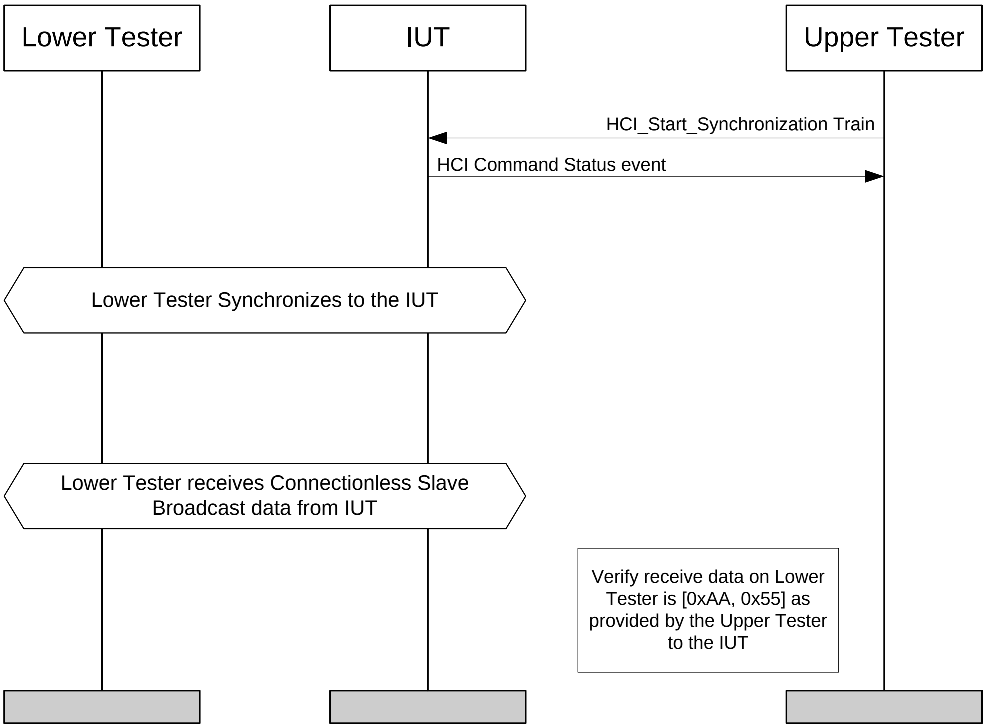

Figure 4.118: Connectionless Slave Broadcast Transmission

- Expected Outcome

<u>Pass Verdict</u>

The IUT correctly transmits connectionless broadcast data to the Lower Tester Data=[0xAA, 0x55].

4.15.2.4 BB/PROT/CB/BV-02-C [AFH for Connectionless Slave Broadcast Transmission]

- Test Purpose

Verify that the IUT will change its channel map based on AFH map changes provided by the host.

- Reference

[9] 8.10.3

- Initial Condition

IUT has an active Connectionless Slave Broadcast (see Section 4.15.2.1).

AFH is enabled on the IUT (CSB is only supported on the Adapted Piconet Physical Channel).

Lower Tester is in standby mode.

- Test Procedure

  a) Start Synchronization Train on the IUT
  b) Synchronize Lower Tester to Connectionless Slave Broadcast from IUT
  c) Receive Connectionless Slave Broadcast data on Lower Tester from IUT
  d) Change IUT AFH Channel map restricting it to channels 40–77
  e) Receive Connectionless Slave Broadcast data on Lower Tester from IUT using the updated channel map
  f) Change IUT AFH Channel map restricting it to channels 40–59 inclusive.
  g) Receive Connectionless Slave Broadcast data on Lower Tester from IUT using the updated channel map

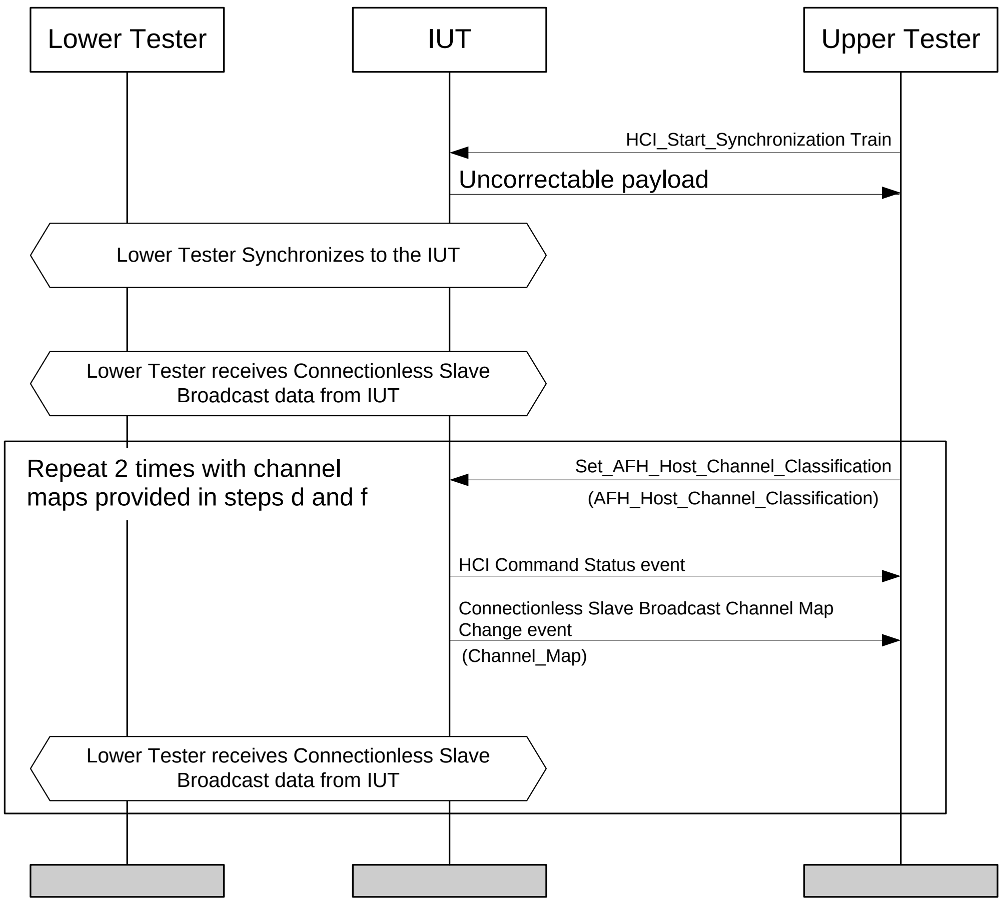

Figure 4.119: AFH for Connectionless Broadcast Transmission

- Expected Outcome

  Pass Verdict

  The IUT transmits Connectionless Slave Broadcast data to the Lower Tester using the updated channel map in steps e) and g).

4.15.2.5 BB/PROT/CB/BV-04-C [Connectionless Slave Broadcast Header Bits – Transmit]

- Test Purpose

  Verify that the IUT transmits connectionless broadcast packets with the FLOW, ARQN, and SEQN bits set to 0 and LLID set to 010b.

- Reference

  [9] 5.7, 6.4.3, 6.4.4, 6.4.5

- Initial Condition

  IUT has an active Connectionless Slave Broadcast (see Section 4.15.2.1).

  Lower Tester is in standby mode.

- Test Procedure

  a) Start Synchronization Train on the IUT
  b) Synchronize Lower Tester to Connectionless Slave Broadcast from IUT
  c) Receive Connectionless Slave Broadcast packets on Lower Tester and check FLOW, ARQN, SEQN, and LLID fields

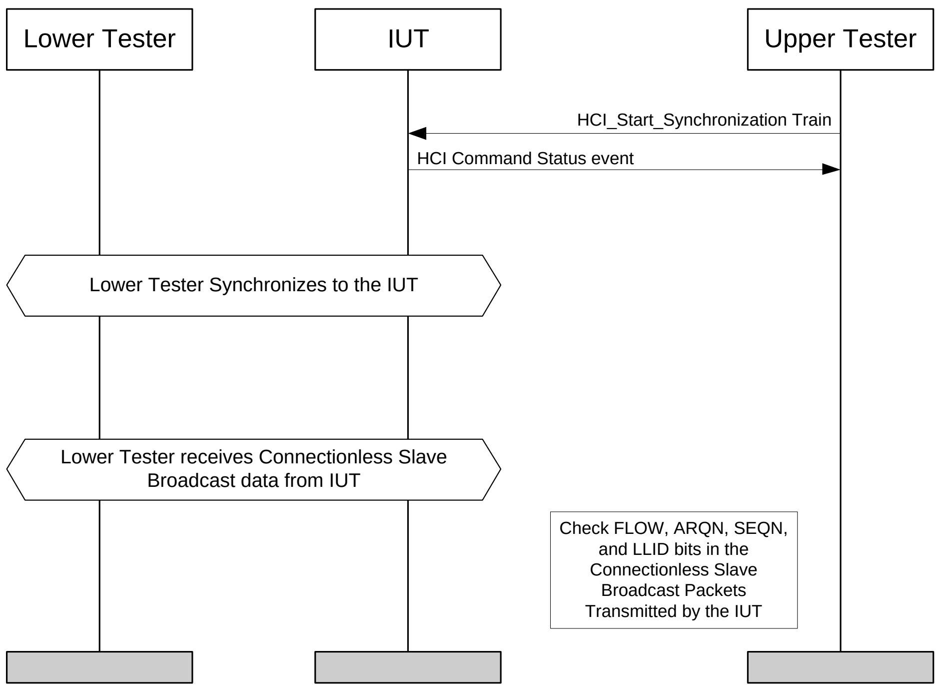

Figure 4.120: Connectionless Slave Broadcast Header Bits - Transmit

- Expected Outcome

  Pass Verdict

  Broadcast packets from IUT have FLOW=0, ARQN=0, SEQN=0, and LLID=010b.

4.15.2.6 BB/PROT/CB/BV-06-C [Connectionless Slave Broadcast Data Retransmission]

- Test Purpose

  Verify that the IUT transmits current host data on every Connectionless Slave Broadcast instant until new data is received from the host.

- Reference

  [9] 8.6.4

- Initial Condition

  IUT has an active Connectionless Slave Broadcast (see Section 4.15.2.1).

  Lower Tester is in standby mode.

- Test Procedure

  a) Start Synchronization Train on the IUT.
  b) Synchronize Lower Tester to Connectionless Slave Broadcast from IUT.
  c) Receive 3 Connectionless Slave Broadcast data packets on Lower Tester from IUT.
  d) Change Connectionless Slave Broadcast data on the IUT to [0x00, 0x01, 0x02] (Data_Length=0x03).
  e) Receive 3 Connectionless Slave Broadcast data on Lower Tester from IUT.

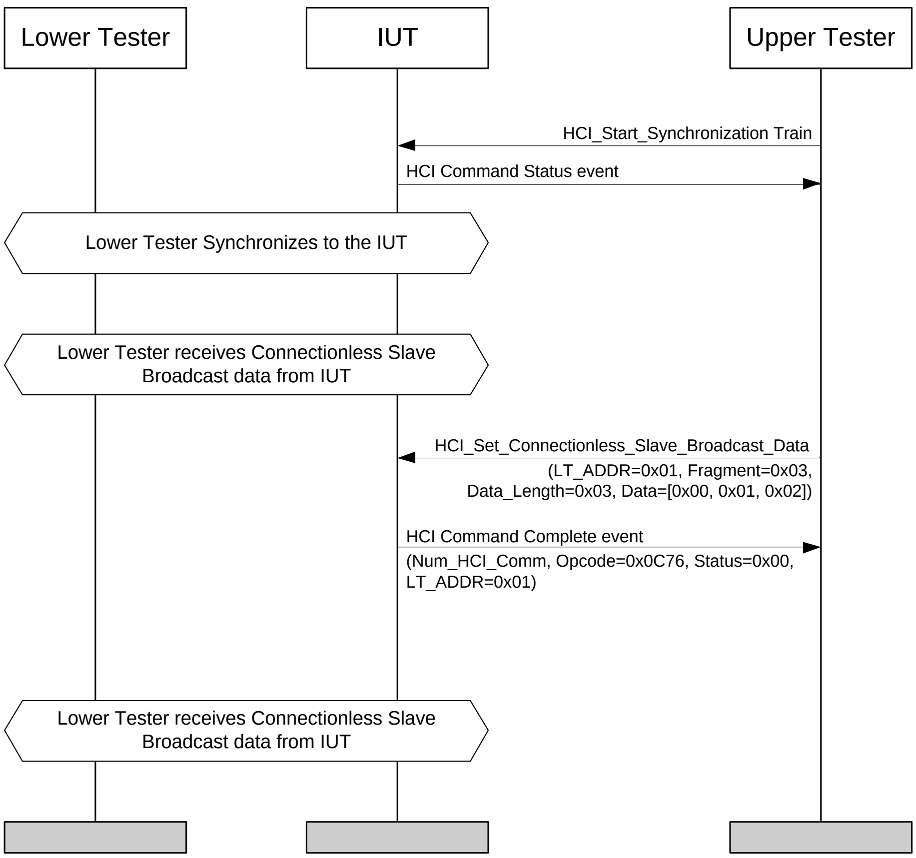

Figure 4.121: Connectionless Slave Broadcast Data Retransmission

- Expected Outcome

  Pass Verdict

  Lower Tester receives 3 connectionless broadcast data packets from the IUT (Data=[0xAA, 0x55]) in step c) AND

  Lower Tester receives 3 connectionless broadcast data packets from the IUT (Data=[0x00, 0x01, 0x02]) in step e).

4.15.2.7 BB/PROT/CB/BV-07-C [Connectionless Slave Broadcast NULL Retransmission]

- Test Purpose

  Verify that the IUT transmits NULL packets on every Connectionless Slave Broadcast instant until data is received from the host.

- Reference

  [9] 8.10.1

- Initial Condition

  IUT has an active Connectionless Slave Broadcast without profile data (see Section 4.15.2.1).

  Lower Tester is in standby mode.

- Test Procedure

  a) Start Synchronization Train on the IUT.
  b) Synchronize Lower Tester to Connectionless Slave Broadcast from IUT.
  c) Lower Tester receives NULL packets from the IUT during Connectionless Slave Broadcast instants.
  d) Change Connectionless Slave Broadcast data on the IUT to [0x00, 0x01, 0x02] (Data_Length=0x03).
  e) Receive Connectionless Slave Broadcast data on Lower Tester from IUT.

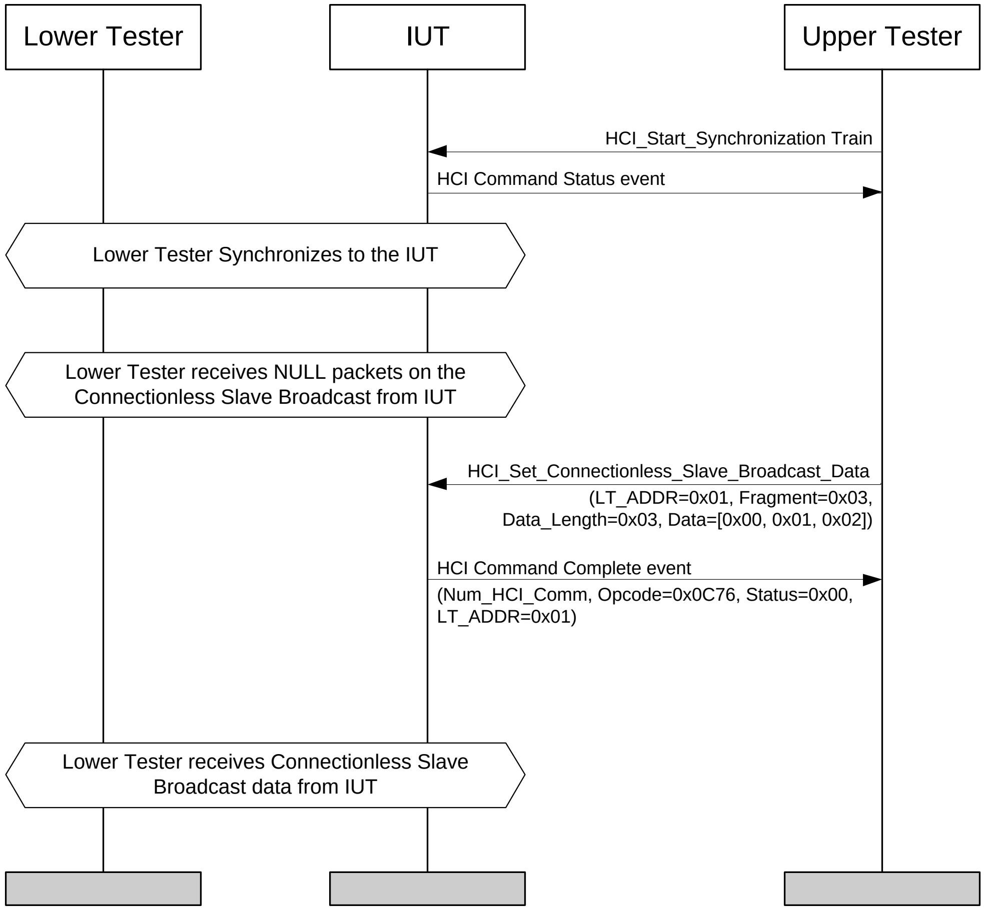

Figure 4.122: Connectionless Slave Broadcast NULL Retransmission

- Expected Outcome

  <u>Pass Verdict</u>

  Lower Tester receives NULL packets from the IUT in step c) AND

  Lower Tester receives connectionless broadcast data from the IUT (Data= [0x00, 0x01, 0x02]) in step e.

4.15.3 Connectionless Slave Broadcast – Receiver

Test subgroup objectives:

To verify Connectionless Slave Broadcast reception procedure.

4.15.3.1 Setup and Preamble - Connectionless Slave Broadcast Reception

The procedures below shall be used to prepare the IUT for Connectionless Broadcast reception.

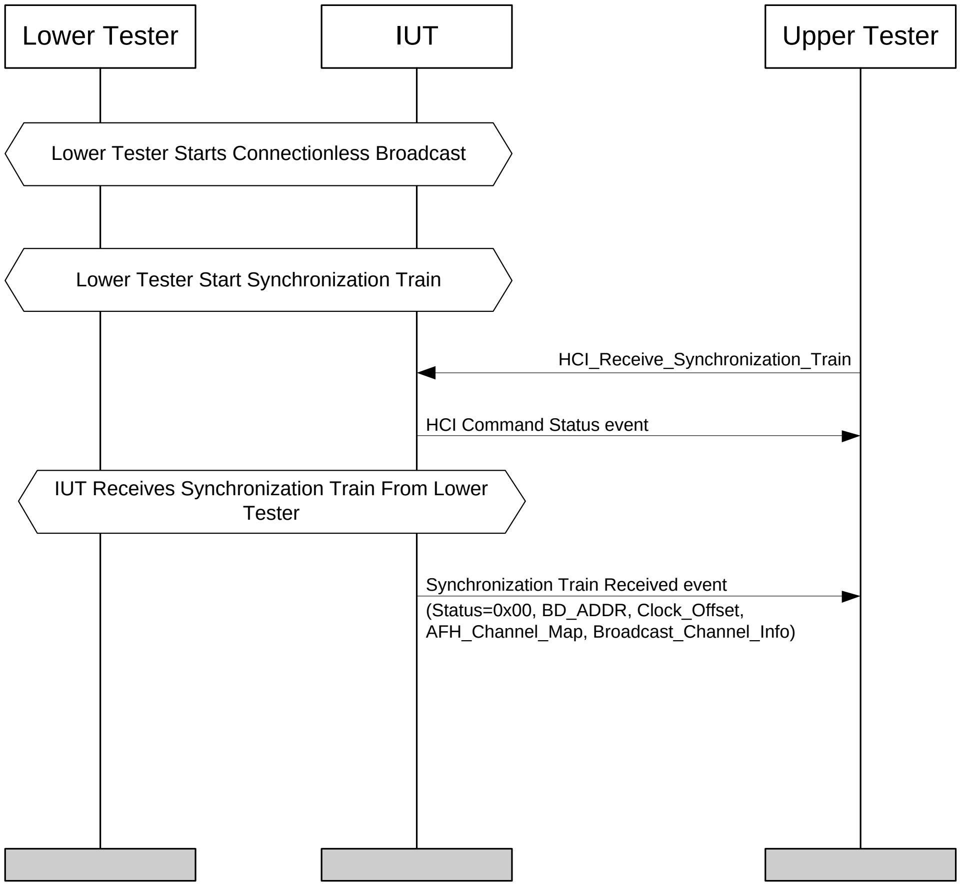

Figure 4.123: Connectionless Slave Broadcast Reception

Unless otherwise noted in the test description, subsequent testing shall begin within 200 ms after the Synchronization Train received event to ensure that received Synchronization Train data remains valid.

The Lower Tester shall use the following parameters for the Connectionless Slave Broadcast unless otherwise noted in the test description:

- LT_ADDR: 1
- LPO_Allowed: 0 (No)
- Packet_Type: 0x330E (only DM1 packets allowed)
- Interval: 0x0080 (80 ms)
- Data_Length = 0x02
- Data = [0xAA, 0x55]

The Lower Tester shall use the following parameters for the Synchronization Train unless otherwise noted in the test description:

- Interval: 0x0080 (80 ms)
- Timeout: Continuous
- Service Data: 0x01

4.15.3.2 BB/PROT/CB/BV-03-C [Connectionless Slave Broadcast Reception]

- Test Purpose

  Verify that the IUT can synchronize to and receive Connectionless Slave Broadcast data.

- Reference

  [9] 8.10.2

- Initial Condition

  IUT is prepared to receive Connectionless Slave Broadcast as described in Section 4.15.3.1.

  Lower Tester is configured as described in Section 4.15.2.1.

- Test Procedure

  a) Upper Tester directs the IUT to receive Connectionless Slave Broadcast from the Lower Tester.
  b) IUT receives Connectionless Slave Broadcast data from the Lower Tester and passes it to the Upper Tester.

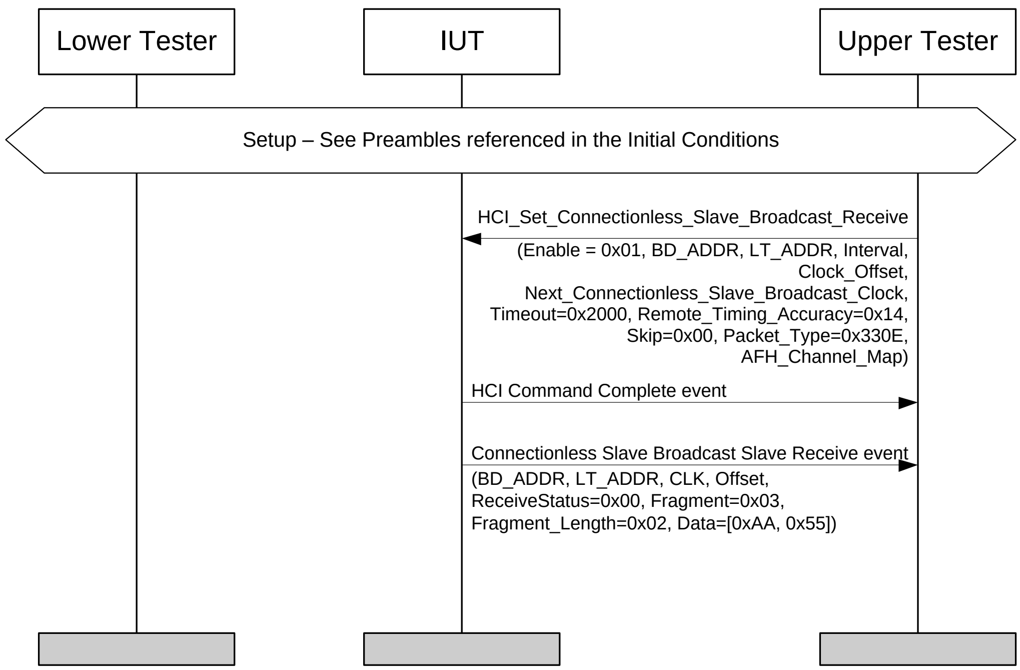

Figure 4.124: Connectionless Slave Broadcast Reception

- Expected Outcome

  <u>Pass Verdict</u>

  IUT correctly receives Connectionless Slave Broadcast data from the Lower Tester (Data= [0xAA, 0x55]).

4.15.3.3 BB/PROT/CB/BV-05-C [Connectionless Slave Broadcast Header Bits – Receive]

- Test Purpose

  Verify that the IUT correctly receives Connectionless Slave Broadcast messages with FLOW, ARQN, and SEQN bits equal to 0 or 1, and LLID set to 010b, and ignores any data with LLID not equal to 010b.

- Reference

  [9] 5.7, 6.4.3, 6.4.4, 6.4.5

- Initial Condition

  IUT is prepared to receive Connectionless Slave Broadcast as described in Section 4.15.3.1.

  Lower Tester is configured as described in Section 4.15.2.1.

  IUT is in Standby.

  Lower Tester is in Standby.

- Test Procedure

  a) Start Connectionless Slave Broadcast on Lower Tester.
  b) Start Synchronization Train on Lower Tester.
  c) Have IUT synchronize to the Connectionless Slave Broadcast from Lower Tester.
  d) Connectionless Slave Broadcast data is received by IUT and passed to the Upper Tester.
  e) Change Lower Tester to transmit FLOW=1.
  f) IUT continues to receive Connectionless Slave Broadcast data.
  g) Change Lower Tester to transmit FLOW=0 and ARQN=1.
  h) IUT continues to receive Connectionless Slave Broadcast data.
  i) Change Lower Tester to transmit ARQN=0 and SEQN=1.
  j) IUT continues to receive Connectionless Slave Broadcast data.
  k) Change Lower Tester to transmit LLID=011b.
  l) IUT stops receiving Connectionless Slave Broadcast data.

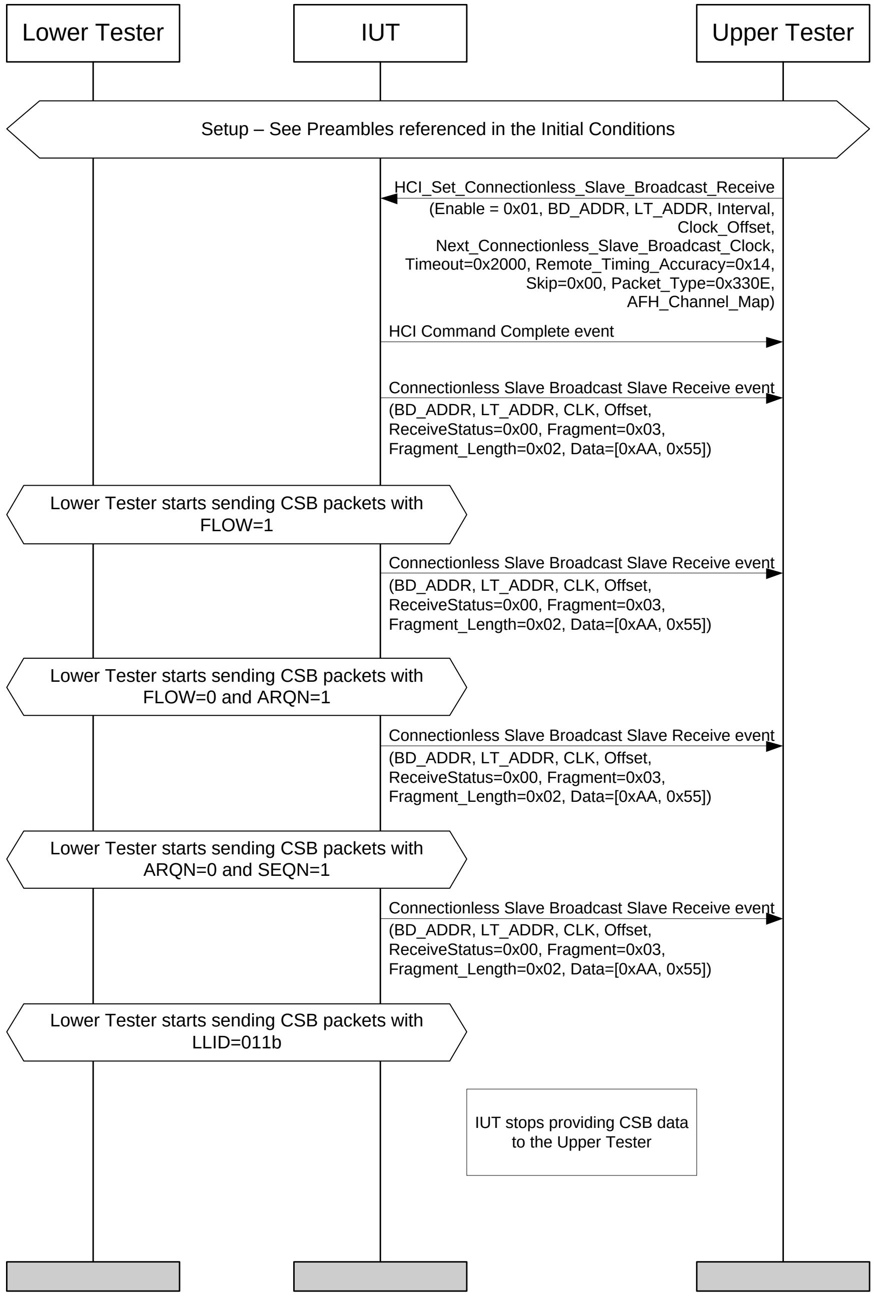

Figure 4.125: Connectionless Slave Broadcast Header Bits - Receive

- Expected Outcome

  Pass Verdict

  IUT correctly receives Connectionless Slave Broadcast data from the Lower Tester (Data= [0xAA, 0x55]) in steps (d), (f), (h), and (j) AND

  IUT does not receive Connectionless Slave Broadcast data from the Lower Tester in step (l).

4.15.3.4 BB/PROT/CB/BV-08-C [Connectionless Slave Broadcast Synchronization Delay]

- Test Purpose

  Verify that the IUT synchronizes to a Connectionless Slave Broadcast when the specified Connectionless Slave Broadcast Instant is 1 second in the past.

- Reference

  [9] 8.10.2

- Initial Condition

  IUT is prepared to receive Connectionless Slave Broadcast as described in Section 4.15.3.1.

  Lower Tester is configured as described in Section 4.15.2.1.

  IUT is configured in Standby.

  Lower Tester is in Standby.

- Test Procedure

  a) Stop Synchronization Train on Lower Tester.
  b) Delay 1 second from reception of Synchronization Train received event from IUT.
  c) Have IUT synchronize to the Connectionless Slave Broadcast from Lower Tester.

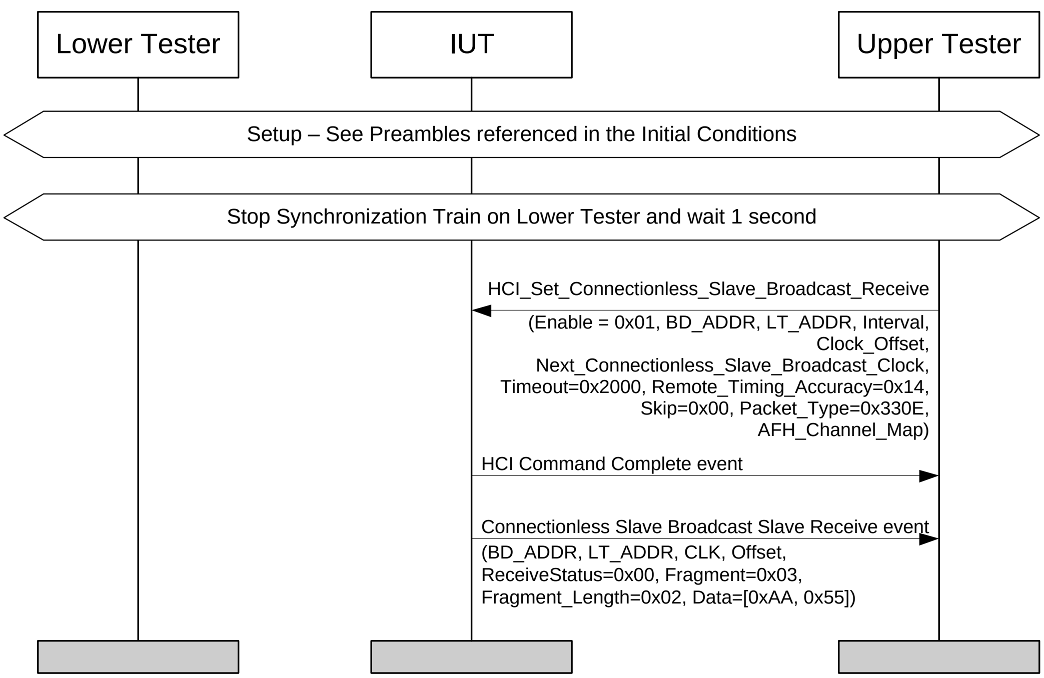

Figure 4.126: Connectionless Slave Broadcast Synchronization Delay

- Expected Outcome

  Pass Verdict

  IUT correctly receives Connectionless Slave Broadcast data from the Lower Tester (Data= [0xAA, 0x55]).

4.15.3.5 BB/PROT/CB/BV-09-C [Connectionless Slave Broadcast – Skip]

- Test Purpose

  Verify that the IUT skips the configured number of broadcasts while receiving Connectionless Slave Broadcast packets.

- Reference

  [9] 8.10.2

- Initial Condition

  IUT is prepared to receive Connectionless Slave Broadcast as described in Section 4.15.3.1.

  Lower Tester is configured as described in Section 4.15.2.1.

  IUT is in Standby.

  Lower Tester is in Standby.

- Test Procedure

  a) Start Connectionless Slave Broadcast on Lower Tester.
  b) Start Synchronization Train on Lower Tester.
  c) Have IUT synchronize to the Connectionless Slave Broadcast from Lower Tester with Skip = 0x06.
  d) Connectionless Slave Broadcast data is received by IUT and passed to the Upper Tester.
  e) Configure Lower Tester to transmit incrementing data every Broadcast Instant. Transmitted data shall be 0x0000, 0x0001, etc. rolling over from 0xFFFF to 0x0000.

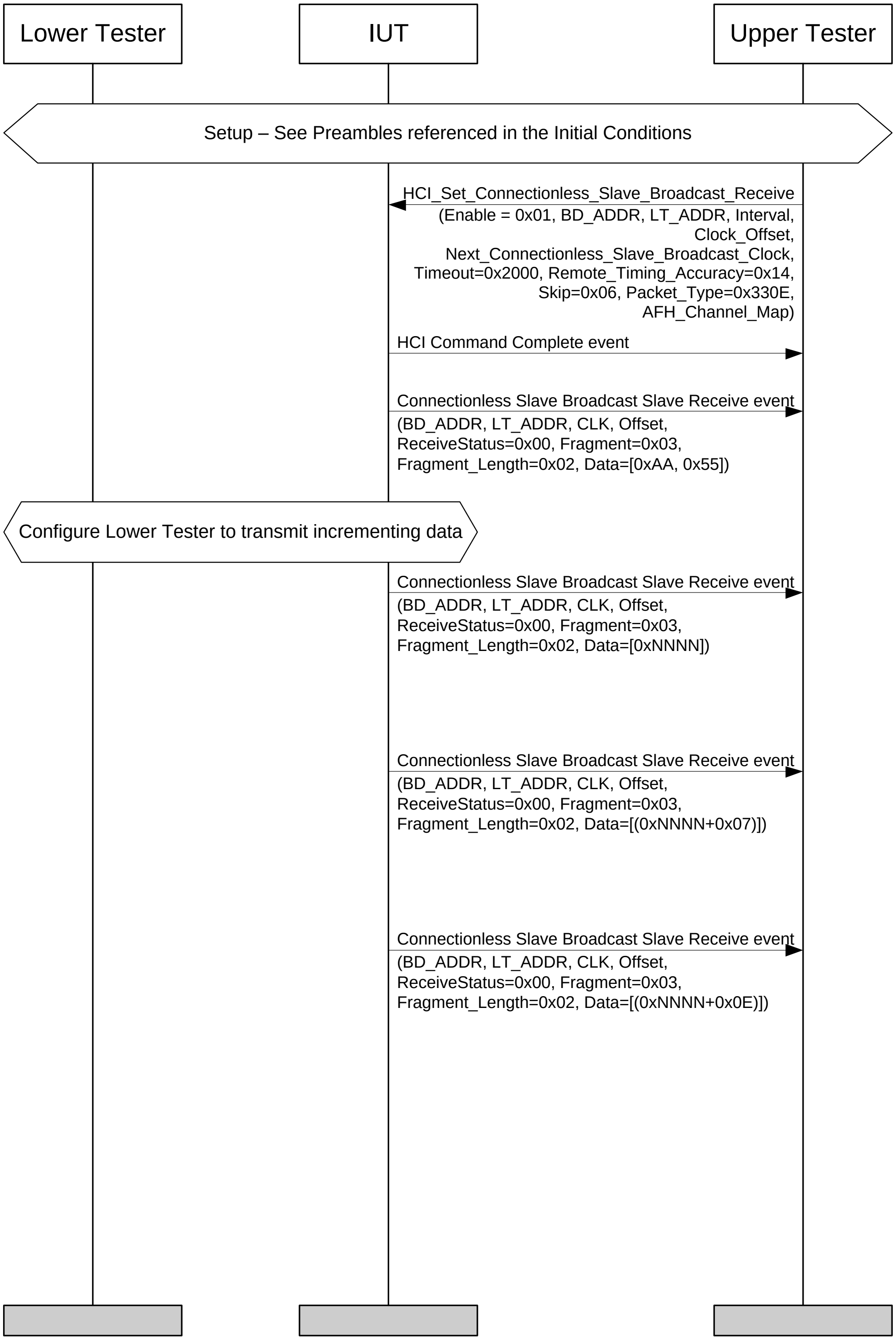

Figure 4.127: Connectionless Slave Broadcast - Skip

- Expected Outcome

  <u>Pass Verdict</u>

  IUT doesn’t skip more than 6 consecutive instants.

4.15.3.6 BB/PROT/CB/BV-10-C [Connectionless Slave Broadcast - Ignore Skip]

- Test Purpose

  Verify that the IUT listens to the very next broadcast instant thereby ignoring the skip parameter if it is unable to receive a Connectionless Slave Broadcast packet.

- Reference

  [9] 8.10.2

- Initial Condition

  IUT is prepared to receive Connectionless Slave Broadcast as described in Section 4.15.3.1.

  Lower Tester is configured as described in Section 4.15.2.1.

  IUT is in Standby.

  Lower Tester is in Standby.

- Test Procedure

  a) Start Connectionless Slave Broadcast on Lower Tester.
  b) Start Synchronization Train on Lower Tester.
  c) Have IUT synchronize to the Connectionless Slave Broadcast from Lower Tester using a Skip parameter value of 0x06.
  d) Connectionless Slave Broadcast data is received by IUT and passed to the Upper Tester.
  e) Configure Lower Tester to transmit incrementing data every Broadcast Instant, suppressing every 8th packet. Transmit sequence is shown below:

     1) 0x0000, 0x0001, 0x0002, 0x0003, 0x0004, 0x0005, 0x0006, (suppress 0x0007)

     2) 0x0008, 0x0009, 0x000A, 0x000B, 0x000C, 0x000D, 0x000E, (suppress 0x000F)

     3) 0x0010, 0x0011, 0x0012, 0x0013, 0x0014, 0x0015, 0x0016, (suppress 0x0017)

     4) etc.

  f) Ignore receive packets at the IUT whose data field is less than 0x0040. Receive 160 packets at the IUT.

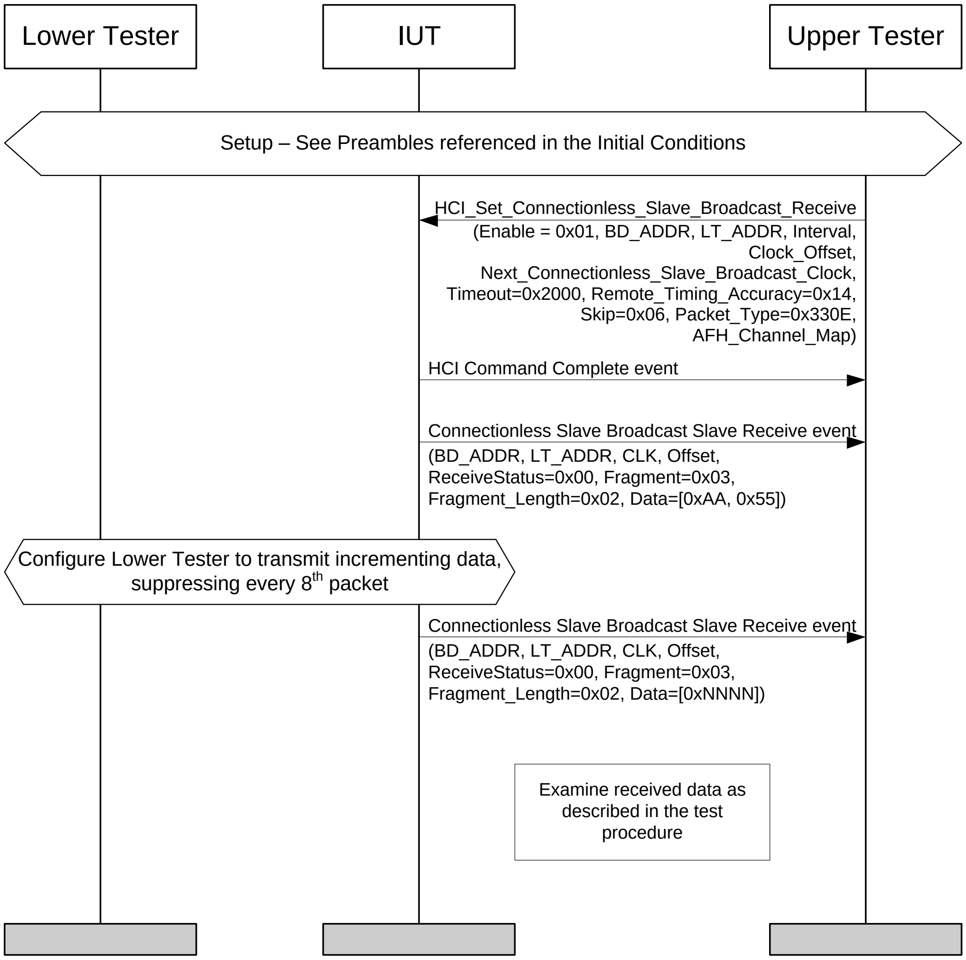

Figure 4.128: Connectionless Slave Broadcast - Ignore Skip

- Expected Outcome

  Pass Verdict

  IUT correctly receives Connectionless Slave Broadcast data from the Lower Tester (Data= [0xAA, 0x55]) in step d AND

  In step f) when IUT receives a packet with (Data Modulus 0x08 = 0), it also receives one of the packets with (Data+0x0008) to (Date+0x0008) inclusive. For example if IUT receives packet with Data=0x0080 it also receives one of the packets with Data=0x0081 to Data=0x0088 inclusive.

4.15.3.7 BB/PROT/CB/BV-11-C [Connectionless Slave Broadcast Timeout]

- Test Purpose

  Verify that the IUT stops listening for Connectionless Slave Broadcasts if it does not receive a packet for the configured timeout period.

- Reference

  [9] 8.10.2

- Initial Condition

  IUT is prepared to receive Connectionless Slave Broadcast as described in Section 4.15.3.1.

  Lower Tester is configured as described in Section 4.15.2.1.

  IUT is in Standby.

  Lower Tester is in Standby.

- Test Procedure

  a) Start Connectionless Slave Broadcast on Lower Tester.
  b) Start Synchronization Train on Lower Tester.
  c) Have IUT synchronize to the Connectionless Slave Broadcast from Lower Tester with a broadcast reception timeout of 5.12s.
  d) Connectionless Slave Broadcast data is received by IUT and passed to the Upper Tester.
  e) Stop Connectionless Slave Broadcast on Lower Tester.
  f) Wait for Connectionless Slave Broadcast timeout on IUT.

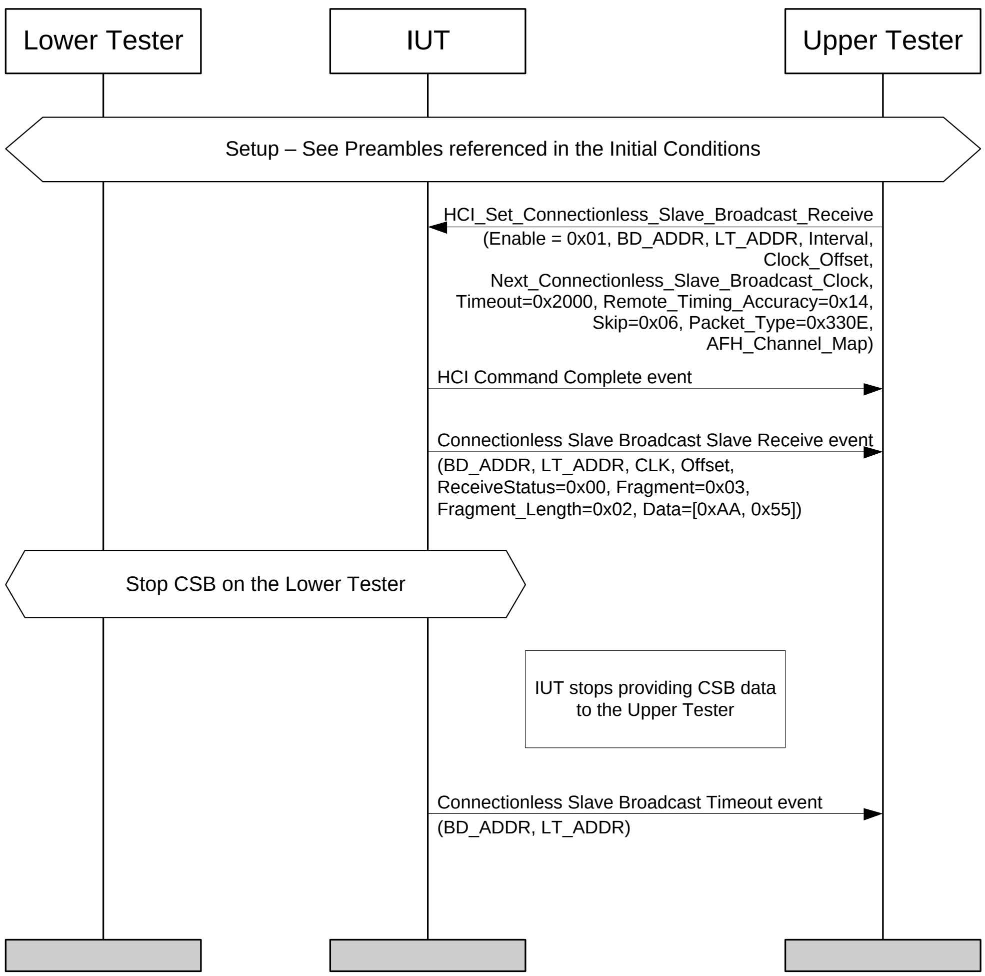

Figure 4.129: Connectionless Slave Broadcast Timeout

- Expected Outcome

  Pass Verdict

  IUT correctly receives Connectionless Slave Broadcast data from the Lower Tester (Data= [0xAA, 0x55]) in step d) AND

  IUT does not receive any Connectionless Slave Broadcast data after step e) AND

  IUT experiences Connectionless Slave Broadcast timeout within 4.9- 5.3s in step f).

4.16 Truncated Paging

Test group objectives:

Verify the Truncated Paging procedures.

4.16.1 Truncated Paging – Master

Test subgroup objectives:

To verify the Truncated Paging procedures for the Master.

4.16.1.1 Page Scan Parameters – Lower Tester

For Truncated Paging Master tests, the Lower Tester shall be configured as follows:

- Page_Scan_Interval: 0x0800
- Page_Scan_Window: 0x0012
- Interlaced Scans: Disabled

4.16.1.2 Paging Parameters – IUT

The following parameters shall be used for Truncated Paging from the IUT:

- Page_Scan_Repetition_Mode: 0x01 (R1)
- Clock_Offset: 0x0000

4.16.1.3 BB/PHYS/TP/BV-01-C [Truncated Page Transmission]

- Test Purpose

  Verify that when the IUT performs a truncated page, it does not send an FHS packet after receiving an ID response from the paged device.

- Reference

  [9] 8.3.3

- Initial Condition

  IUT is in standby.

  Lower Tester is configured for page scan using the parameters in Section 4.16.1.1.

- Test Procedure

  a) Start Truncated Paging from IUT.
  b) Upon receiving an ID packet from the IUT, the Lower Tester responds with an ID packet as part of the Slave page response procedure.
  c) After responding with an ID packet, the Lower Tester confirms that the IUT stops paging and does not send an FHS packet within pagerespTO period.
  d) IUT indicates that truncated paging has completed successfully after receiving the ID packet from the Lower Tester.

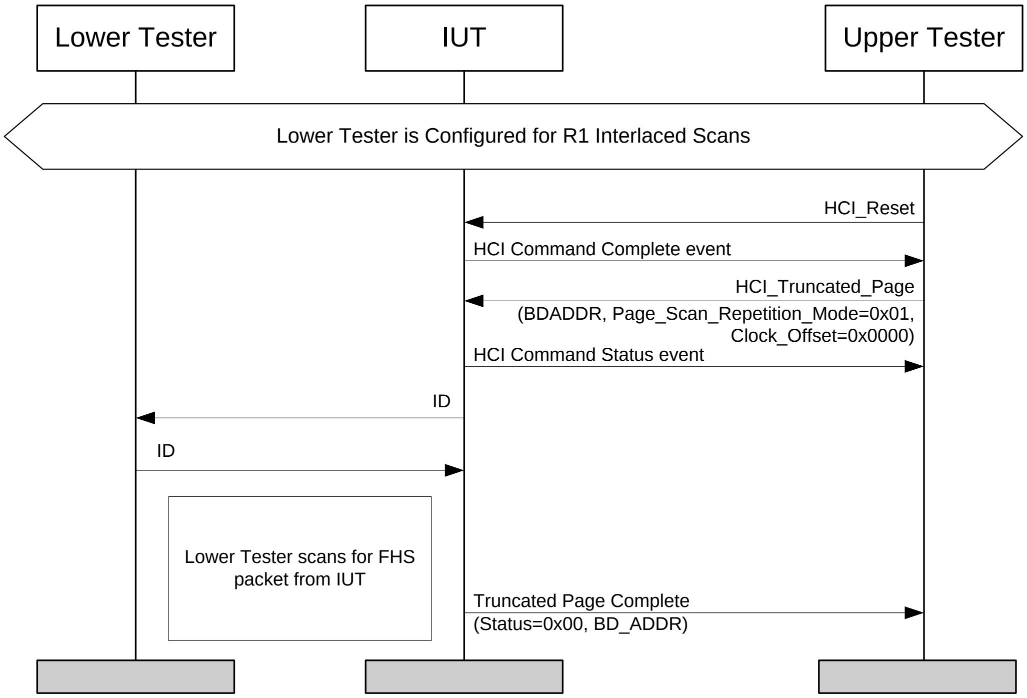

Figure 4.130: Truncated Paging Transmission

- Expected Outcome

  Pass Verdict

  IUT stops paging after the ID response from the Lower Tester AND

  IUT does not send an FHS after the ID response from the Lower Tester.

4.16.2 Truncated Paging – Slave

Test subgroup objectives:

To verify the Truncated Paging procedures for the Slave.

4.16.2.1 Paging Parameters – Lower Tester

The following parameters shall be used for Truncated Paging from the Lower Tester:

- Page_Scan_Repetition_Mode: 0x01 (R1)
- Clock_Offset: 0x0000

4.16.2.2 Page Scan Parameters – IUT

For Truncated Paging Slave tests, the IUT shall be configured as follows:

- Page_Scan_Interval: 0x0800
- Page_Scan_Window: 0x0012
- Interlaced Scans: Disabled

4.16.2.3 BB/PHYS/TP/BV-02-C [Slave Page Response Timeout Detection]

- Test Purpose

  Verify that the IUT as Slave can detect a Slave page response timeout.

- Reference

  [9] 8.3.3

- Initial Condition

  IUT is configured for page scan using the parameters in Section 4.16.2.2.

  Lower Tester is in standby mode.

- Test Procedure

  a) Perform a truncated page from the Lower Tester to the IUT.
  b) Lower Tester receives an ID response from the IUT.
  c) IUT indicates that a Slave page response timeout has occurred to the Upper Tester.

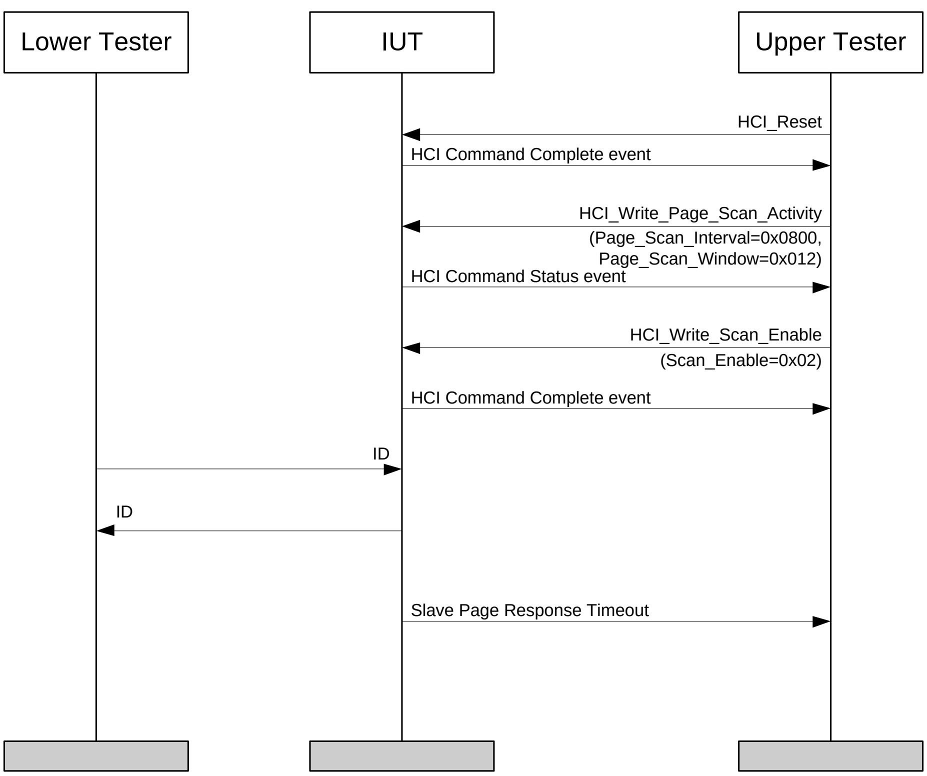

Figure 4.131: Slave Page Response Timeout Detection

- Expected Outcome

  Pass Verdict

  The Lower Tester receives ID response from the IUT AND

  IUT indicates that a Slave page response timeout has occurred to the Upper Tester.

4.17 Synchronization Train

Test group objectives:

Verify Synchronization Train transmission and reception.

4.17.1 Synchronization Train Parameters

The following Synchronization Train configuration shall be used for all Synchronization Train transmitter and receiver tests:

- Interval_Min: 0x0080 (80 ms)
- Interval_Max: 0x0080 (80 ms)
- Timeout: 0x00017700 (60s)

4.17.2 Synchronization Train - Transmission

Test subgroup objectives:

Verify Synchronization Train transmit timing, frequency, and packet format.

4.17.2.1 Synchronization Train Transmission – Setup and Preamble

The procedures in Figure 4.132 shall be used to place the IUT in Synchronization Train transmit setup state.

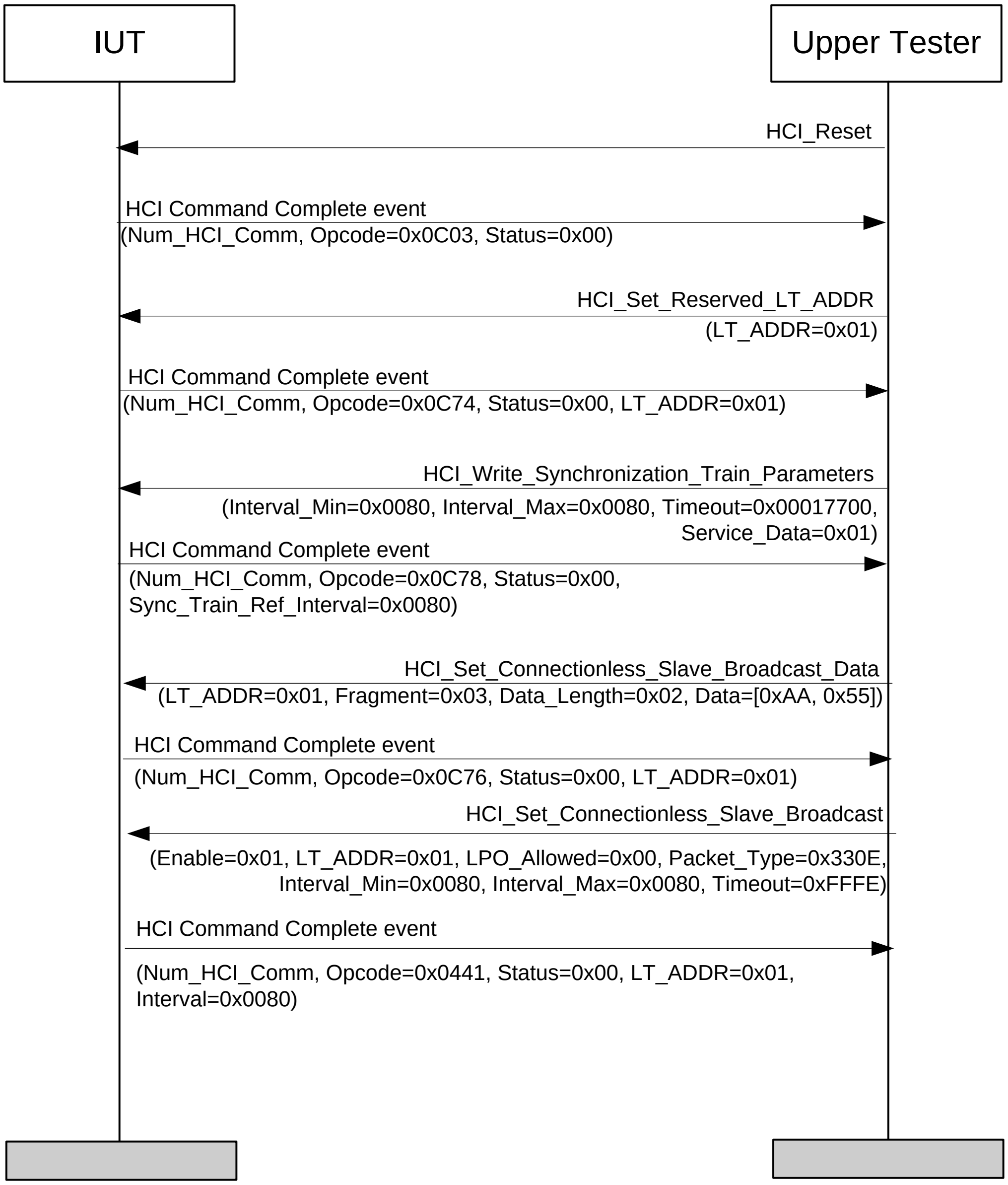

Figure 4.132: IUT Synchronization Train Transmit Setup

4.17.2.2 BB/PHYS/ST/BV-01-C [Synchronization Train Transmission]

- Test Purpose

  Verify that the IUT transmits valid Synchronization Train packets on all Synchronization Train frequencies.

- Reference

  [9] 2.6.4.8, 8.3.5

- Initial Condition

  IUT has an active Connectionless Slave Broadcast (see Section 4.15.2).

  Lower Tester is in standby mode.

- Test Procedure

  a) Start Synchronization Train on the IUT.
  b) Receive Synchronization Train packets on Lower Tester on all Synchronization Train frequencies.

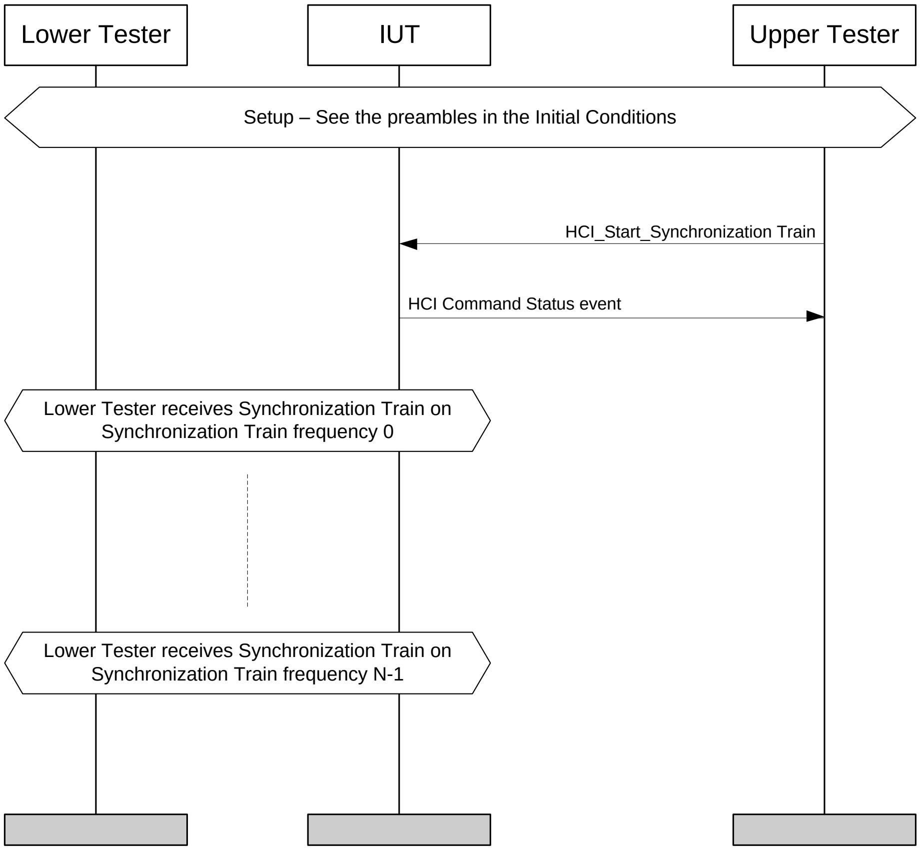

Figure 4.133: Synchronization Train Transmission

- Expected Outcome

  Pass Verdict

  IUT transmits Synchronization Train packets on all frequencies.

4.17.2.3 BB/PHYS/ST/BV-04-C [Synchronization Train Transmission Timing]

- Test Purpose

  Verify that the IUT follows the Synchronization Train timing for all Synchronization Train channels in the absence of conflicting traffic.

- Reference

  [9] 2.7.2

- Initial Condition

  IUT has an active Connectionless Slave Broadcast (see Section 4.15.2).

  Lower Tester is in standby mode.

- Test Procedure

  a) Start Synchronization Train on the IUT.
  b) Receive Synchronization Train packets on one Synchronization Train frequency on the Lower Tester for the duration (timeout) of the Synchronization Train.
  c) Lower Tester stops receiving Synchronization Train packets after Synchronization Train timeout.
  d) Repeat the previous steps for the remaining Synchronization Train frequencies.

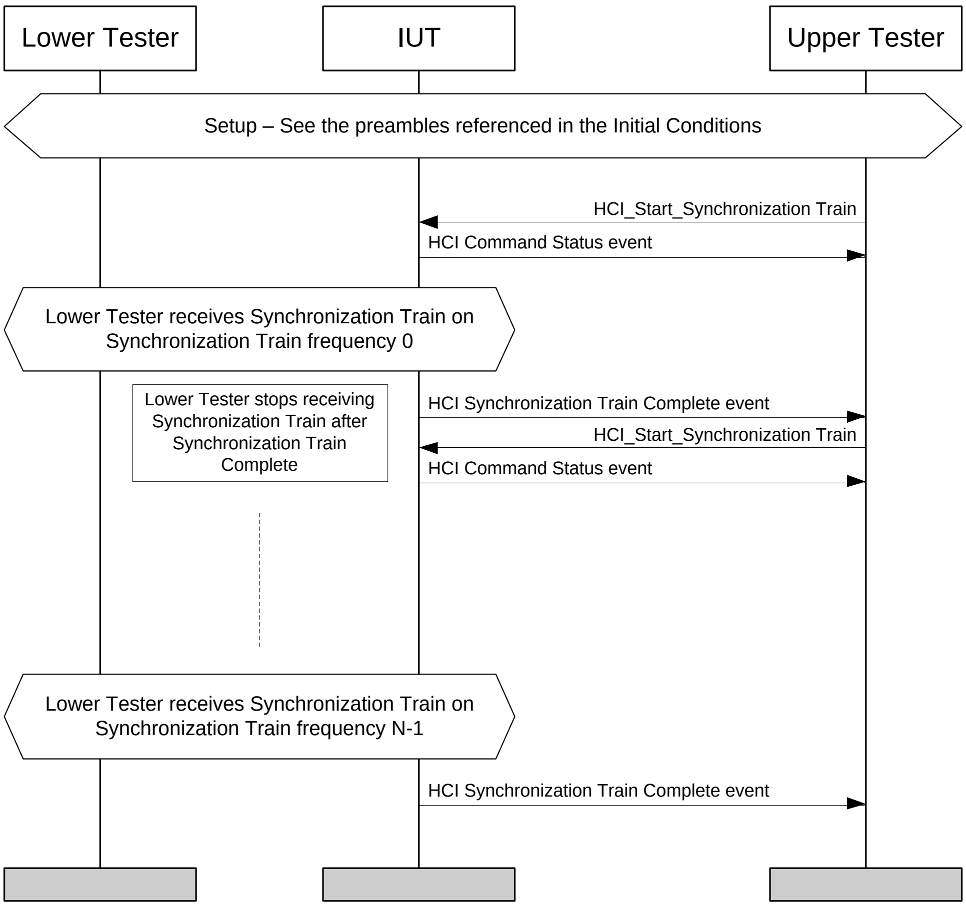

Figure 4.134: Synchronization Train Transmission Timing

- Expected Outcome

  <u>Pass Verdict</u>

  IUT transmits Synchronization Train packets on each frequency with a mean period of 79–81 ms and a delay of 70–90 ms between consecutive Synchronization Train packets on the same frequency.

4.17.2.4 BB/PHYS/ST/BV-05-C [Synchronization Train Timeout]

- Test Purpose

  Verify that the IUT transmits the Synchronization Train on all Synchronization Train frequencies for the configured time and terminates the Synchronization Train when the configured time expires.

- Reference

  [9] 8.3.5

- Initial Condition

  IUT has an active Connectionless Slave Broadcast (see Section 4.15.2).

  Lower Tester is in standby mode.

- Test Procedure

  a) Start Synchronization Train on the IUT.
  b) Lower Tester receives Synchronization Train packets on one Synchronization Train frequency for the duration (timeout) of the Synchronization Train.
  c) Lower Tester stops receiving Synchronization Train packets after Synchronization Train timeout.
  d) Repeat the previous steps for the remaining Synchronization Train frequencies.

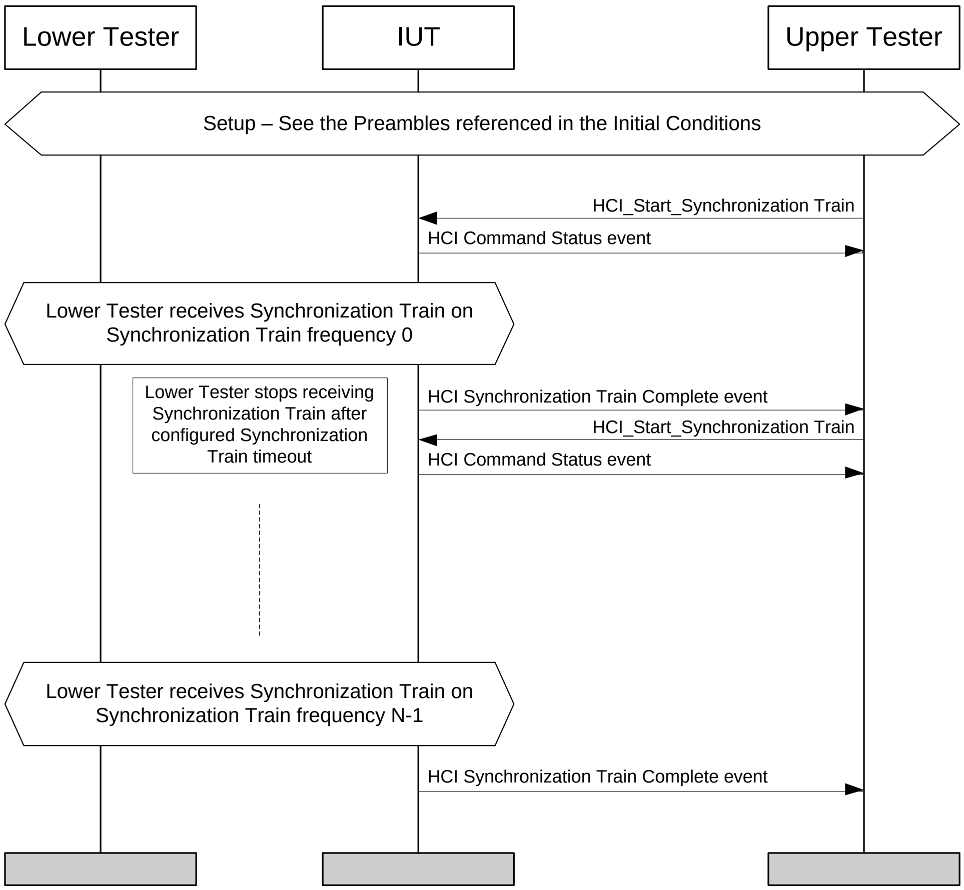

Figure 4.135: Synchronization Train Timeout

- Expected Outcome

  <u>Pass Verdict</u>

  IUT transmits Synchronization Train on all frequencies and terminates the Synchronization Train after the configured Synchronization Train timeout.

4.17.2.5 BB/PHYS/ST/BV-06-C [Next Broadcast Instant Value in Synchronization Train]

- Test Purpose

  Verify that the IUT transmits Synchronization Train Packets with the Connectionless Slave Broadcast Instant in the Synchronization Packet payload set to the Master's CLKN corresponding to one of the next 4 broadcast instants.

- Reference

  [9] 8.3.5

- Initial Condition

  IUT has an active Connectionless Slave Broadcast (see Section 4.15.2).

  Lower Tester is in standby mode.

- Test Procedure

  a) Start Synchronization Train on the IUT.
  b) Lower Tester receives Synchronization Train packets on one Synchronization Train frequency for the duration (timeout) of the Synchronization Train. Lower Tester examines the contents to determine if received Synchronization Train packets refers to one of the four allowed future Broadcast Instants.
  c) Repeat the previous steps for the remaining Synchronization Train frequencies.

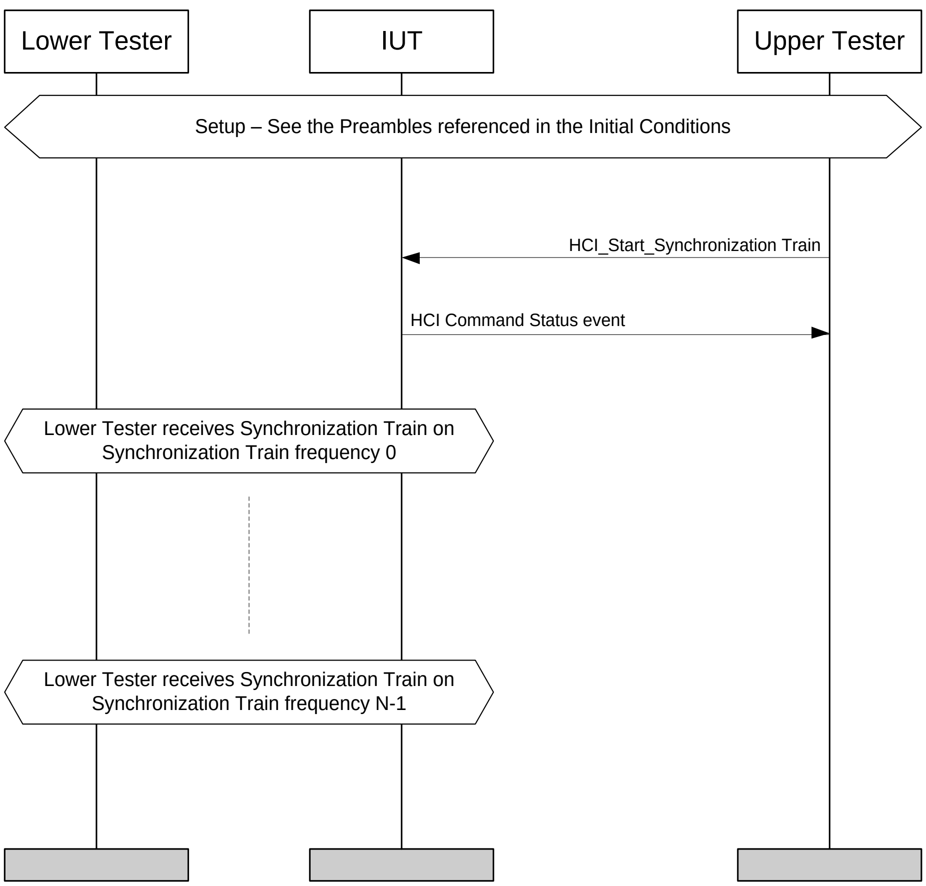

Figure 4.136: Next Broadcast Instant Value in Synchronization Train

- Expected Outcome

  Pass Verdict

  The contents of the received IUT Synchronization Train packets on all frequencies refer to one of the four allowed future Broadcast Instants.

4.17.3 Synchronization Train - Reception

Test subgroup objectives

Verify Synchronization Train receive timing, frequencies, and packet format.

4.17.3.1 BB/PHYS/ST/BV-02-C [Synchronization Train Reception]

- Test Purpose

  Verify that the IUT can receive Synchronization Train packets on all Synchronization Train frequencies.

- Reference

  [9] 2.7

- Initial Condition

  IUT is in Standby.

  Lower Tower Tester is in Standby.

- Test Procedure

  a) Start Connectionless Slave Broadcast on the Lower Tester.
  b) Start Synchronization Train on the Lower Tester on only one of the Synchronization Train frequencies.
  c) Have IUT receive a Synchronization Train packet.
  d) Repeat previous steps with remaining Synchronization Train frequencies.

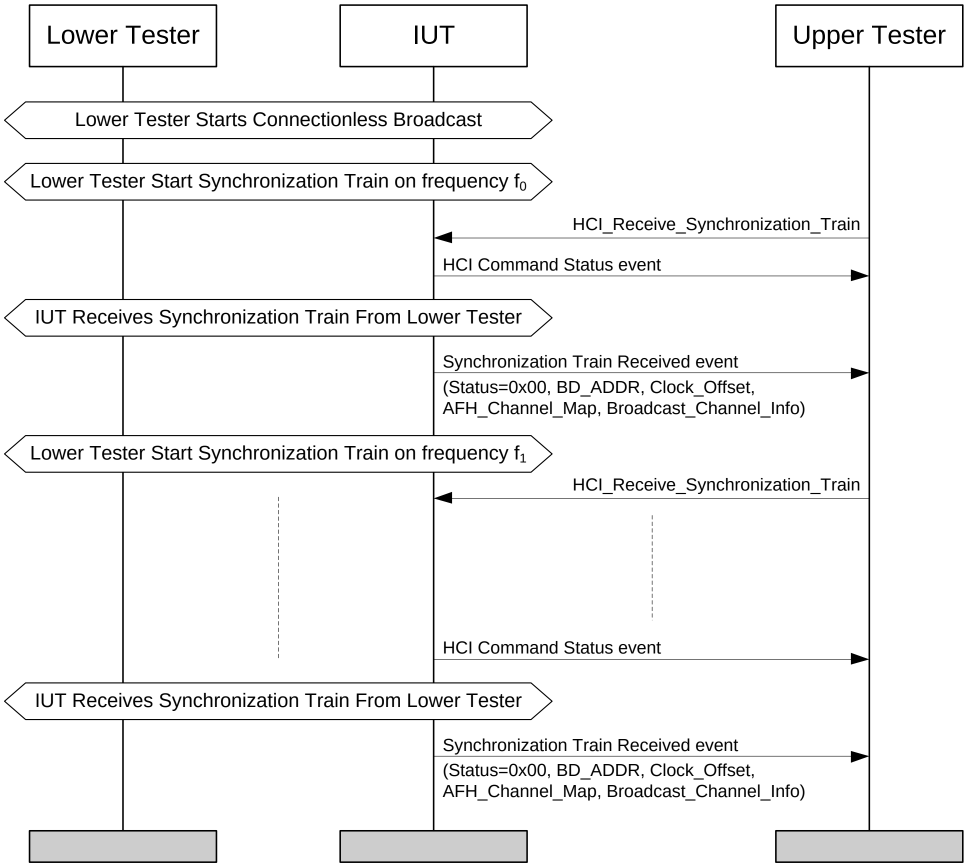

Figure 4.137: Synchronization Train Reception

- Expected Outcome

  Pass Verdict

  IUT is able to receive Synchronization Train packets on all Synchronization Train frequencies.

4.17.3.2 BB/PHYS/ST/BV-03-C [Reception of Synchronization Train with Extra Bytes]

- Test Purpose

  Verify that the IUT can correctly receive Synchronization packets larger than 28 bytes.

- Reference

  [9] 8.3.5

- Initial Condition

  IUT is in Standby.

  Lower Tester is in Standby.

- Test Procedure

  a) Start Connectionless Slave Broadcast on the Lower Tester.
  b) Start Synchronization Train on the Lower Tester with Synchronization Train packet of size 30 bytes.

c) Have IUT receive the Synchronization Train packet.

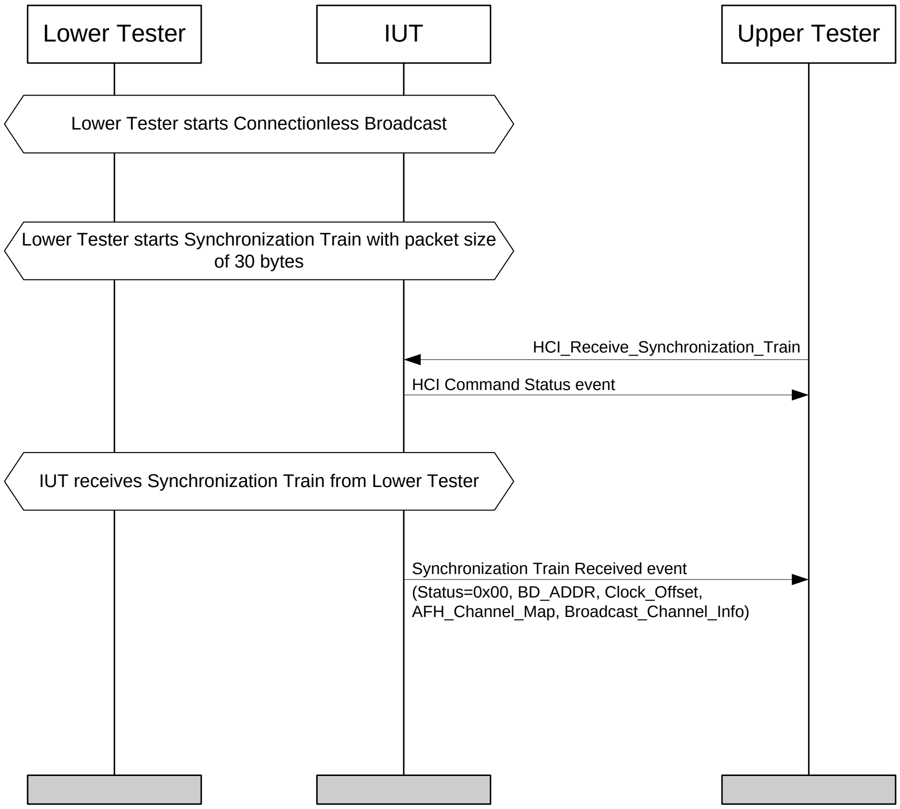

Figure 4.138: Reception of Synchronization Train with Extra Bytes

- Expected Outcome

  <u>Pass Verdict</u>

  IUT is able to receive the Synchronization Train packet correctly.

4.18 Piconet Clock Adjust

Test group objectives:

Verify the correct implementation of the Piconet Clock Adjustment procedure.

4.18.1 Coarse Clock Adjustment

Test subgroup objectives:

Verify the Coarse Clock Adjustment procedure.

4.18.1.1 BB/XCB/BV-01-C [Slave handles small adjustment when polled before instant]

- Test Purpose

  Verify that the IUT as Slave will correctly respond to and act on a Coarse Clock Adjustment when adjustment is less than a BT Frame and Master polls for LMP_clk_adj_ack before clk_adj_instant.

- Reference

  [1] 8.6.10.1

- Initial Condition

Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link).

The Bluetooth clock of the Lower Tester is chosen to include clock wrap-around (2^{27}-1 to 0) between the first time LMP_clk_adj is sent in the first loop iteration and the corresponding Instant.

Upper Tester: Not involved after connection has been established

IUT: Configured as Slave in state CONNECTION (active mode, ACL link)

- Test Procedure

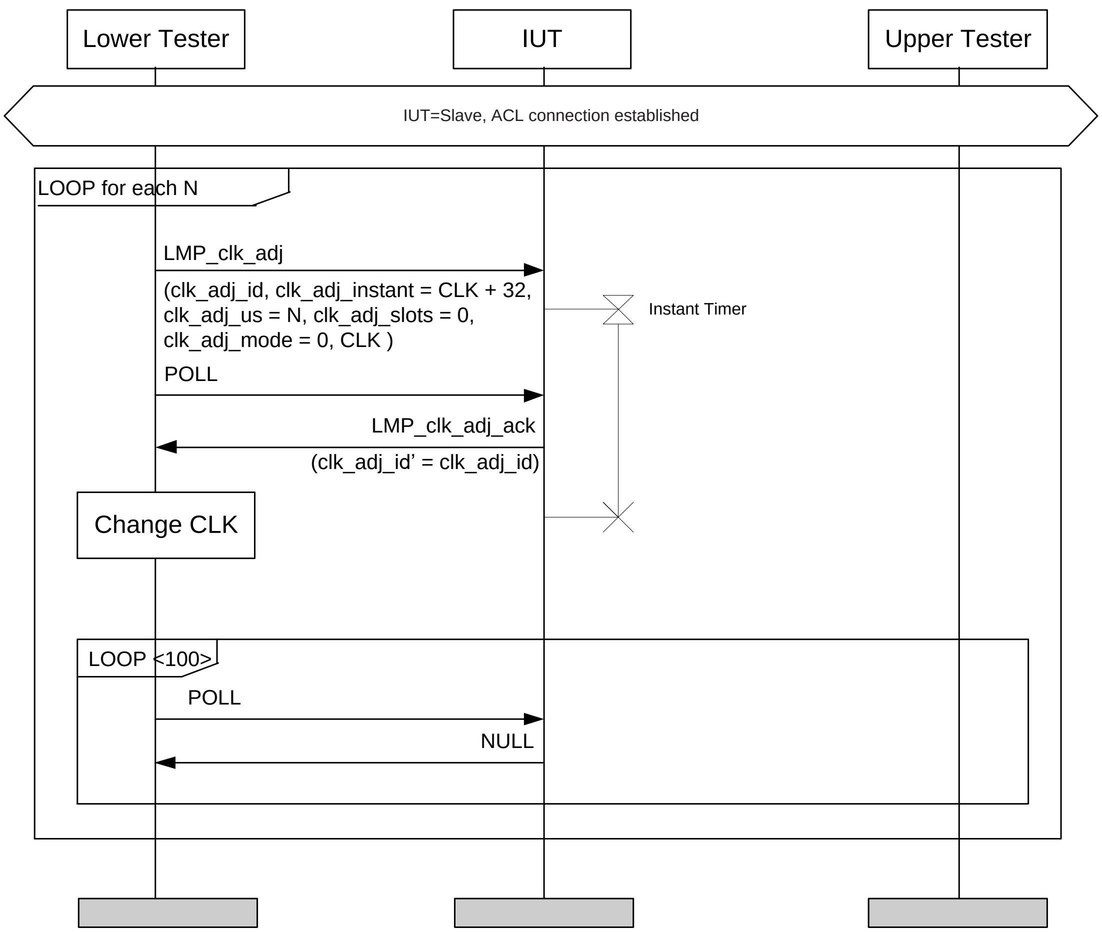

Figure 4.139: Coarse Clock Adjustment - Slave handles small adjustment when polled before instant

a) Set N = 395.
b) Lower Tester sends LMP_clk_adj with clk_adj_id = {0:255}, clk_adj_instant = CLK[27:1] + 32 slots, clk_adj_us = N, clk_adj_slots = 0 and clk_adj_mode = 0.
c) Lower Tester sends POLL packets until IUT responds or LSTO expires.
d) IUT responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj.

e) At the clk_adj_instant, tester adjusts $CLK_{new} = CLK_{old}$ +395 µs.
f) Lower Tester sends POLL packet in every Master slot at least 100 times.
g) IUT responds to POLL packets with a NULL packet.
h) Set N = -395. Repeat steps b)–g).
i) Set N = 624. Repeat steps b)–g).
j) Set N = -624. Repeat steps b)–g).
k) Set N = 0. Repeat steps b)–g).

- Expected Outcome

Pass Verdict

The criterion for a pass verdict is that for each of the test sets with parameters clk_adj_us = 395, -395, 624, -624 and 0 the IUT does the following: After first POLL, IUT responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj. For subsequent POLL packets, IUT responds to at least 95% with a NULL packet.

4.18.1.2 BB/XCB/BV-02-C [Slave handles small adjustment when polled after instant]

- Test Purpose

Verify that the IUT as Slave will correctly respond to and act on a Coarse Clock Adjustment when adjustment is less than a BT Frame and Master polls for LMP_clk_adj_ack after clk_adj_instant.

- Reference

[1] 8.6.10.1

- Initial Condition

Lower Tester:	Configured as Master in state CONNECTION (active mode, ACL link). The Bluetooth clock of the Lower Tester is chosen to include clock wrap-around (2^{27}-1 to 0) between the first time LMP_clk_adj is sent in the first loop iteration and the corresponding Instant.
Upper Tester:	Not involved after connection has been established.
IUT:	Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

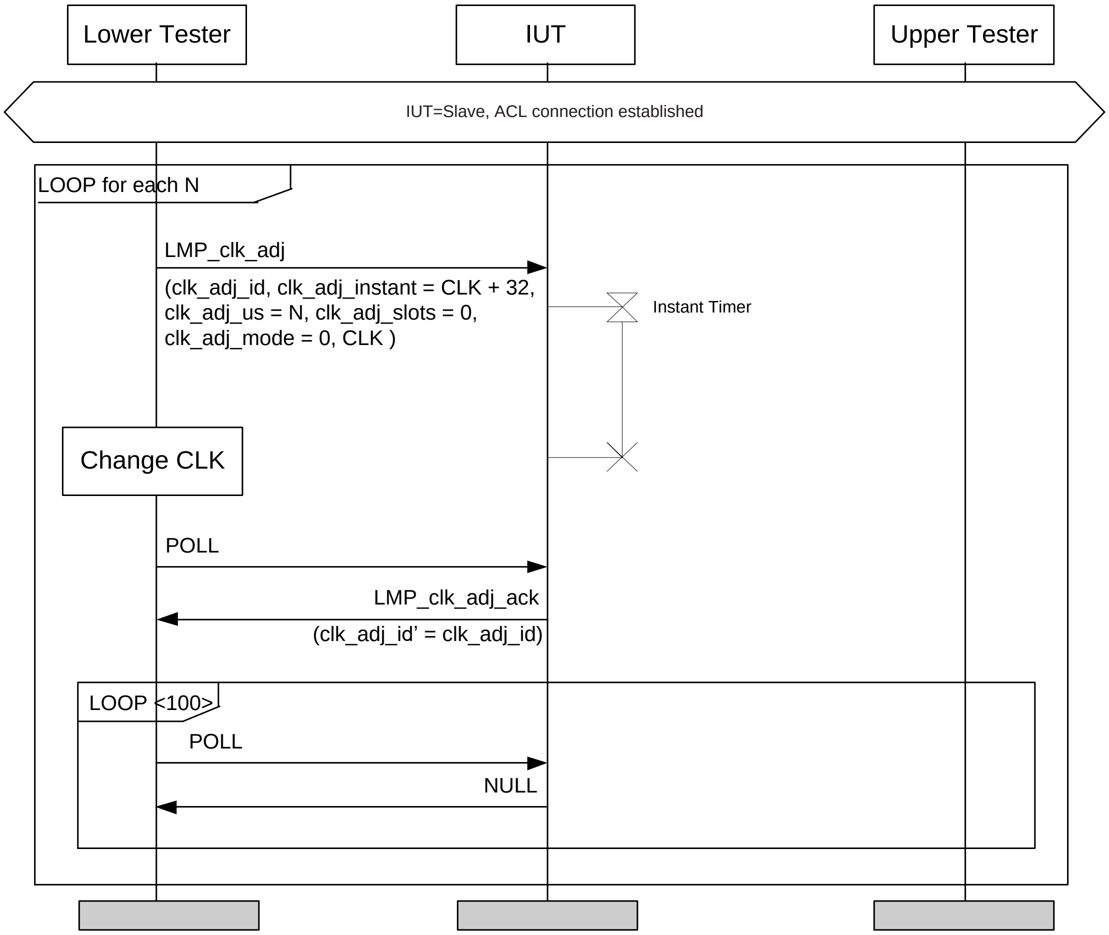

Figure 4.140: Coarse Clock Adjustment - Slave handles small adjustment when polled after instant

a) Set N = 395.
b) Lower Tester sends LMP_clk_adj with clk_adj_id = {0:255}, clk_adj_instant = CLK[27:1] + 32 slots, clk_adj_us = N, clk_adj_slots = 0 and clk_adj_mode = 0.
c) At the clk_adj_instant, Lower Tester adjusts $CLK_{new} = CLK_{old}$ +395 µs.
d) Lower Tester sends POLL packets until IUT responds or LSTO expires.
e) IUT responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj.
f) Lower Tester sends POLL packet in every Master slot at least 100 times.
g) IUT responds to POLL packets with a NULL packet.
h) Set N = -395. Repeat steps b) to g).
i) Set N = 624. Repeat steps b) to g).
j) Set N = -624. Repeat steps b) to g).
k) Set N = 0. Repeat steps b) to g).

- Expected Outcome

<u>Pass Verdict</u>

The criterion for a pass verdict is that for each of the test sets with parameters clk_adj_us = 395, -395, 624, -624 and 0 the IUT does the following: After first POLL, IUT responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj. For subsequent POLL packets, IUT responds to at least 95% with a NULL packet.

4.18.1.3 BB/XCB/BV-03-C [Slave handles large adjustment when polled before instant]

- Test Purpose

  Verify that the IUT as Slave will correctly respond to and act on a Coarse Clock Adjustment when adjustment is greater than a BT Frame and Master polls for LMP_clk_adj_ack before clk_adj_instant. This test moves the clock several Bluetooth frames away to ensure that the hopping frequency pattern changes.

- Reference

  [1] 8.6.10.1

- Initial Condition

Lower Tester:	Configured as Master in state CONNECTION (active mode, ACL link). The Bluetooth clock of the Lower Tester is chosen to include clock wrap-around (2^{27}-1 to 0) between the first time LMP_clk_adj is sent (in test procedure step a) and the corresponding Instant.
Upper Tester:	Not involved after connection has been established.
IUT:	Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

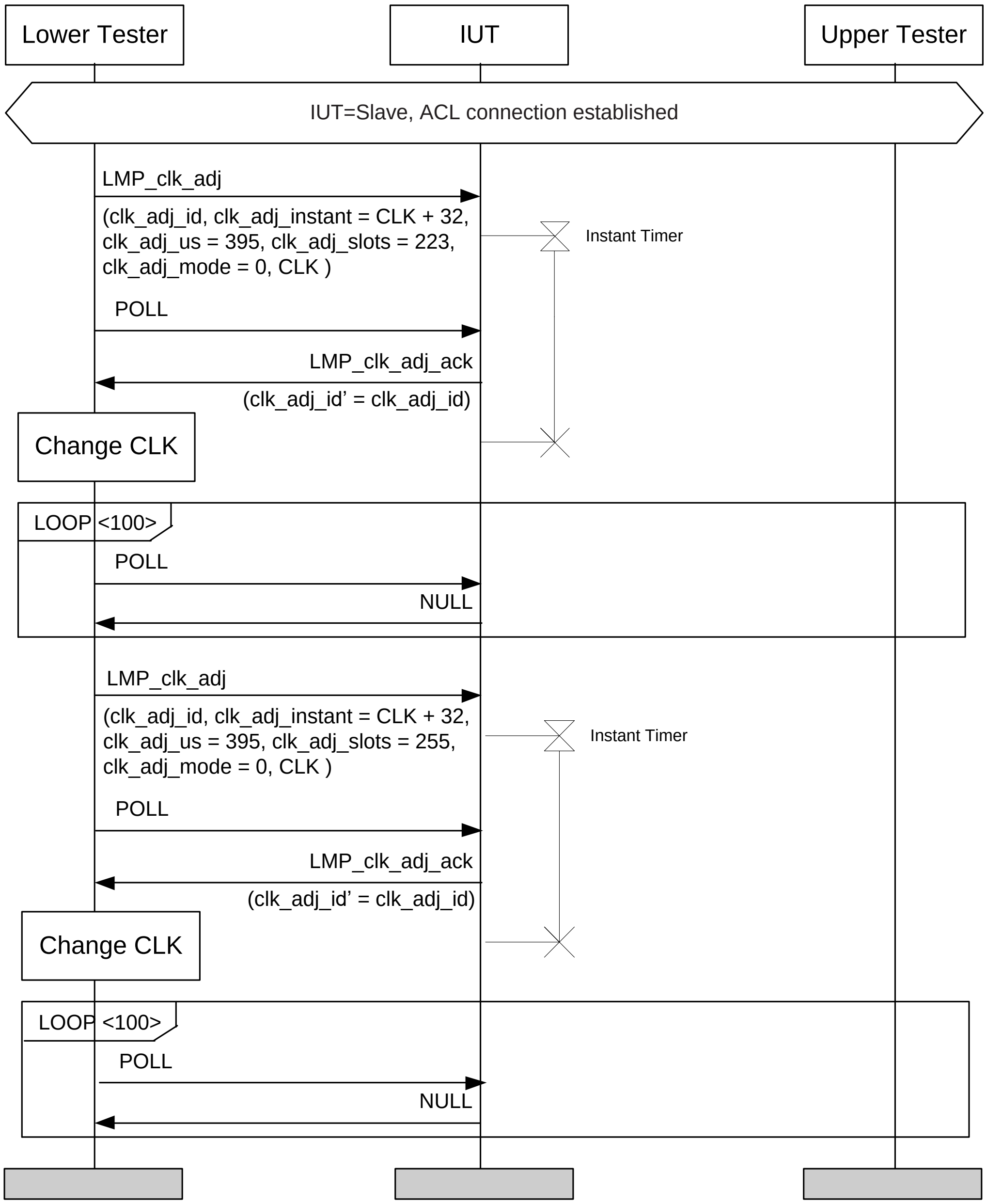

Figure 4.141: Coarse Clock Adjustment - Slave handles large adjustment when polled before instant

a) Lower Tester sends LMP_clk_adj with clk_adj_id = {0:255}, clk_adj_instant = CLK[27:1] + 32 slots, clk_adj_us = 395, clk_adj_slots = 223 and clk_adj_mode = 0.
b) Lower Tester sends POLL packets until IUT responds or LSTO expires.
c) IUT responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj.
d) At the clk_adj_instant, tester adjusts $CLK_{new} = CLK_{old} + (223 * 625 + 395)$ µs.
e) Lower Tester sends POLL packet in every Master slot at least 100 times.
f) IUT responds to POLL packets with a NULL packet.
g) Lower Tester sends LMP_clk_adj with clk_adj_id = {0:255}, clk_adj_instant = CLK[27:1] + 32 slots, clk_adj_us = 395 and clk_adj_slots = 255.
h) Lower Tester sends POLL packets until IUT responds or LSTO expires.
i) IUT responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj.

j) At the clk_adj_instant, tester adjusts $CLK_{new} = CLK_{old} + (255 * 625 + 395)$ µs.
k) Lower Tester sends POLL packet in every Master slot at least 100 times.
l) IUT responds to POLL packets with a NULL packet.

- Expected Outcome

  Pass Verdict

  For both tests (starting at a) and g)), after first poll, IUT responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj. For subsequent POLL packets, IUT responds to at least 95% with a NULL packet.

4.18.1.4 BB/XCB/BV-04-C [Slave handles large adjustment when polled after instant]

- Test Purpose

  Verify that the IUT as Slave will correctly respond to and act on a Coarse Clock Adjustment when adjustment is greater than a BT Frame and Master polls for LMP_clk_adj_ack after clk_adj_instant. This test moves the clock several Bluetooth frames away to ensure that the hopping frequency pattern changes.

- Reference

  [1] 8.6.10.1

- Initial Condition

Lower Tester:	Configured as Master in state CONNECTION (active mode, ACL link). The Bluetooth clock of the Lower Tester is chosen to include clock wrap-around (2^{27}-1 to 0) between the first time LMP_clk_adj is sent (in test procedure step a) and the corresponding Instant.
Upper Tester:	Not involved after connection has been established.
IUT:	Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

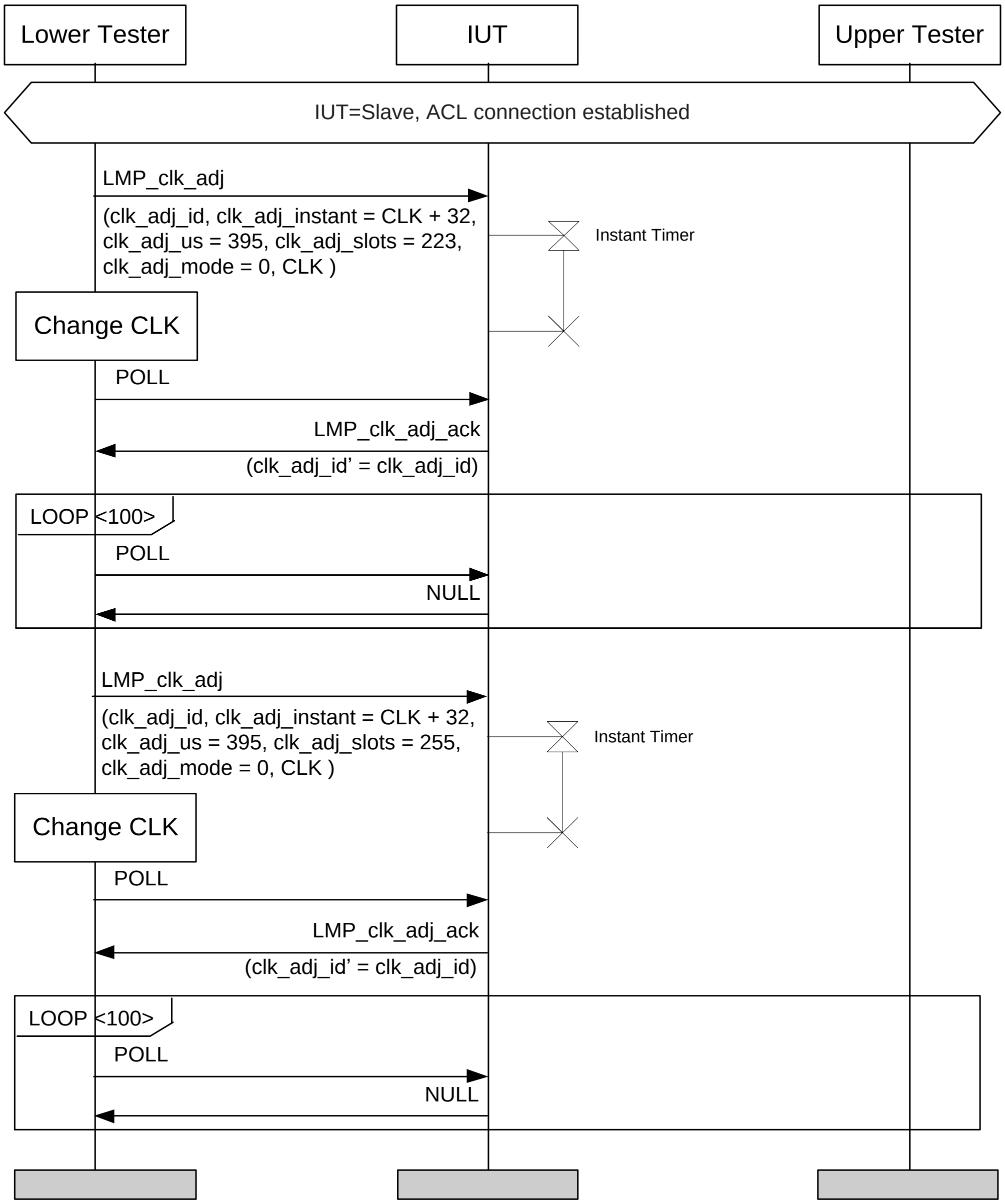

Figure 4.142: Coarse Clock Adjustment - Slave handles large adjustment when polled after instant

a) Lower Tester sends LMP_clk_adj with clk_adj_id = {0:255}, clk_adj_instant = CLK[27:1] + 32 slots, clk_adj_us = 395, clk_adj_slots = 223 and clk_adj_mode = 0.
b) At the clk_adj_instant, Lower Tester adjusts $CLK_{new} = CLK_{old} + (223 * 625 + 395)$ µs.
c) Lower Tester sends POLL packets until IUT responds or LSTO expires.
d) IUT responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj.
e) Lower Tester sends POLL packet in every Master slot at least 100 times.
f) IUT responds to POLL packets with a NULL packet.
g) Lower Tester sends LMP_clk_adj with clk_adj_id = {0:255}, clk_adj_instant = CLK[27:1] + 32 slots, clk_adj_us = 395 and clk_adj_slots = 255.
h) At the clk_adj_instant, Lower Tester adjusts $CLK_{new} = CLK_{old} + (255 * 625 + 395)$ µs.
i) Lower Tester sends POLL packets until IUT responds or LSTO expires.
j) IUT responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj.

k) Lower Tester sends POLL packet in every Master slot at least 100 times.
l) IUT responds to POLL packets with a NULL packet.

- Expected Outcome

  Pass Verdict

  For both tests (starting at a) and g)), after first POLL, IUT responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj. For subsequent POLL packets, IUT responds to at least 95 percent with a NULL packet.

4.18.1.5 BB/XCB/BV-05-C [Master Handles Request for positive Coarse Clock Adjustment]

- Test Purpose

  Verify that the IUT as Master will correctly respond to and act upon a request for a Coarse Clock Adjustment.

- Reference

  [1] 8.6.10.1

- Initial Condition

Lower Tester:	Configured as Slave in state CONNECTION (active mode, ACL link). Lower Tester shall be configured to collect time stamp for the first bit of the preamble of a poll packet as described in [5] 6.7. Time stamps shall be collected using a separate high accuracy reference clock.
Upper Tester:	Not involved after connection has been established.
IUT:	Configured as Master in state CONNECTION (active mode, ACL link). IUT shall be configured to accept PCA requests.

- Test Procedure

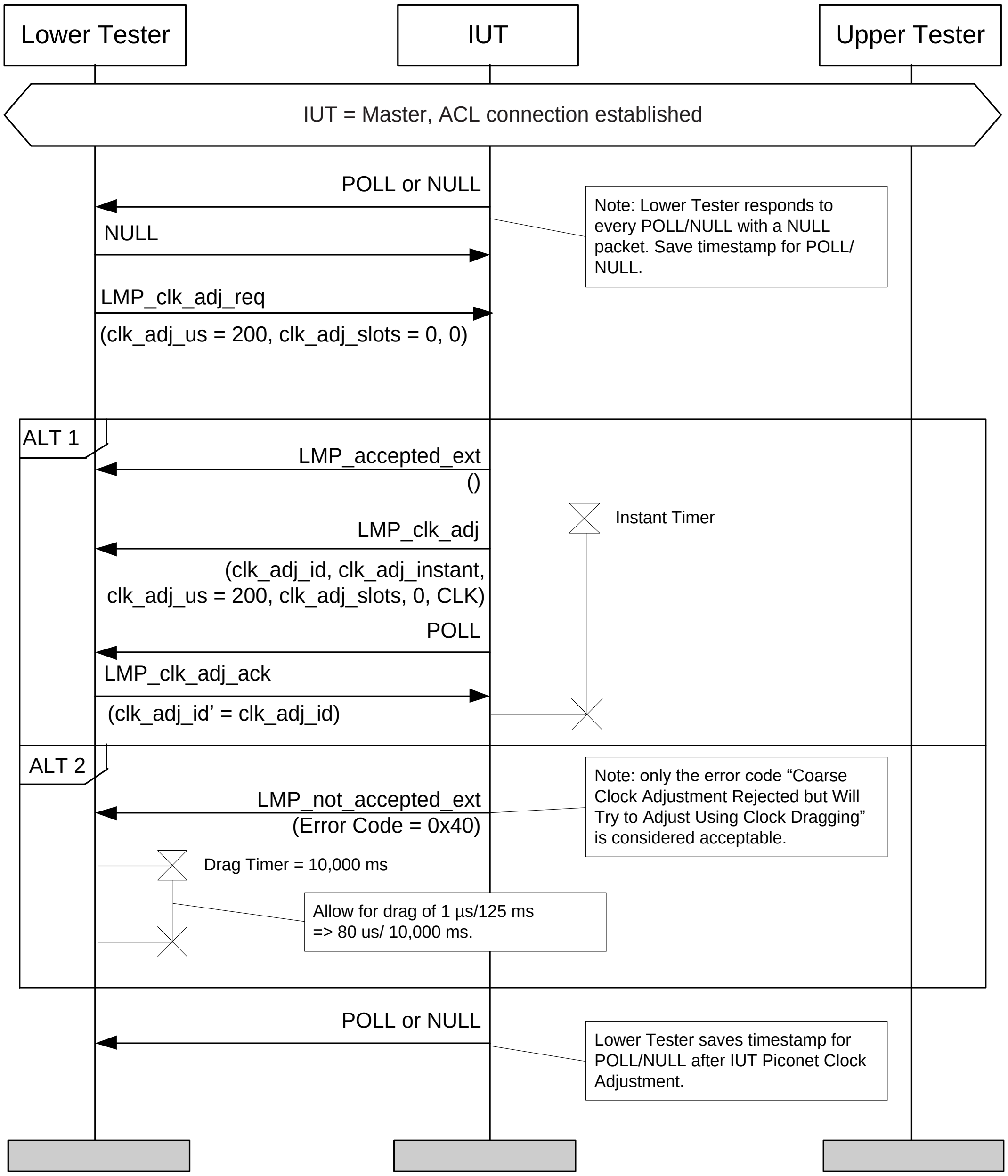

Figure 4.143: Coarse Clock Adjustment - Master responds to Coarse Clock Adjustment request

a) Lower Tester waits for a POLL or NULL and saves Timestamp1 for p0.
b) Lower Tester sends LMP_clk_adj_req to IUT.
c) IUT may accept the request or deny it and instead attempt to change CLK by dragging.

    i. If IUT accepts the request, it will send LMP_accepted_ext to the Lower Tester, followed by LMP_clk_adj. Lower Tester responds with LMP_clk_adj_ack and changes its clock according to protocol.

    ii. If IUT rejects the request, it may send an LMP_not_accepted_ext PDU with the error code = Coarse Clock Adjustment Rejected but Will Try to Adjust Using Clock Dragging (0x40). In this case the Lower Tester waits for a time corresponding to the maximum allowed drag rate.

iii. If the IUT rejects the request with any other error code this test will fail.

d) After IUT has completed clock adjustment, the Lower Tester collects Timestamp2 for a POLL or NULL.

e) Lower Tester calculates the IUT clock change as (Timestamp2 – Timestamp1) MOD 1250.

- Expected Outcome

  Pass Verdict

  IUT sends LMP_accepted followed by LMP_clk_adj or LMP_not_accepted with error code = Coarse Clock Adjustment Rejected but Will Try to Adjust Using Clock Dragging (0x40).

  If IUT performed a Coarse Clock Adjustment, (Timestamp2 – Timestamp1) MOD 1250 = 1050 µs ±5%.

  Else if IUT performed clock dragging, (Timestamp2 – Timestamp1) MOD 1250 ≥ 40 µs and ≤ 400 µs.

  If IUT performed a Coarse Clock Adjustment, clk_adj_instant = CLKp + X, where CLKp is CLK of the first LMP_clk_adj packet, and X is ≥ 12 slots and < 12 hours.

  The IUT enabled AFH as part of the connection establishment and kept it enabled throughout the test. Throughout the test, channels 0, 24, and 78 were marked as unused in the AFH_channel_map.

- Notes

  If the IUT uses Clock Dragging, it is allowed to drag the clock much slower than the maximum rate of 5 µs/125 ms. This test assumes that no implementation would drag the clock slower than 0.5 µs/125 ms. The maximum rate of 5 µs/125 ms corresponds to 400 µs / 10 s. The test is configured to change the clock only 200 µs. Allow for a maximum natural drift of 20 PPM during 10 s which is 200 µs. If natural drift and drag work in the same direction we can observe a total drag of < 400 µs / 10s.

4.18.1.6 BB/XCB/BV-06-C [Master Handles Request for negative Coarse Clock Adjustment]

- Test Purpose

  Verify that the IUT as Master will correctly respond to and act upon a request for a Coarse Clock Adjustment.

- Reference

  [1] 8.6.10.1

- Initial Condition

Lower Tester:	Configured as Slave in state CONNECTION (active mode, ACL link). Lower Tester shall be configured to collect time stamp for the first bit of the preamble of a poll packet as described in [5] 6.7. Time stamps shall be collected using a separate high accuracy reference clock.
Upper Tester:	Not involved after connection has been established.
IUT:	Configured as Master in state CONNECTION (active mode, ACL link). IUT shall be configured to accept PCA requests.

- Test Procedure

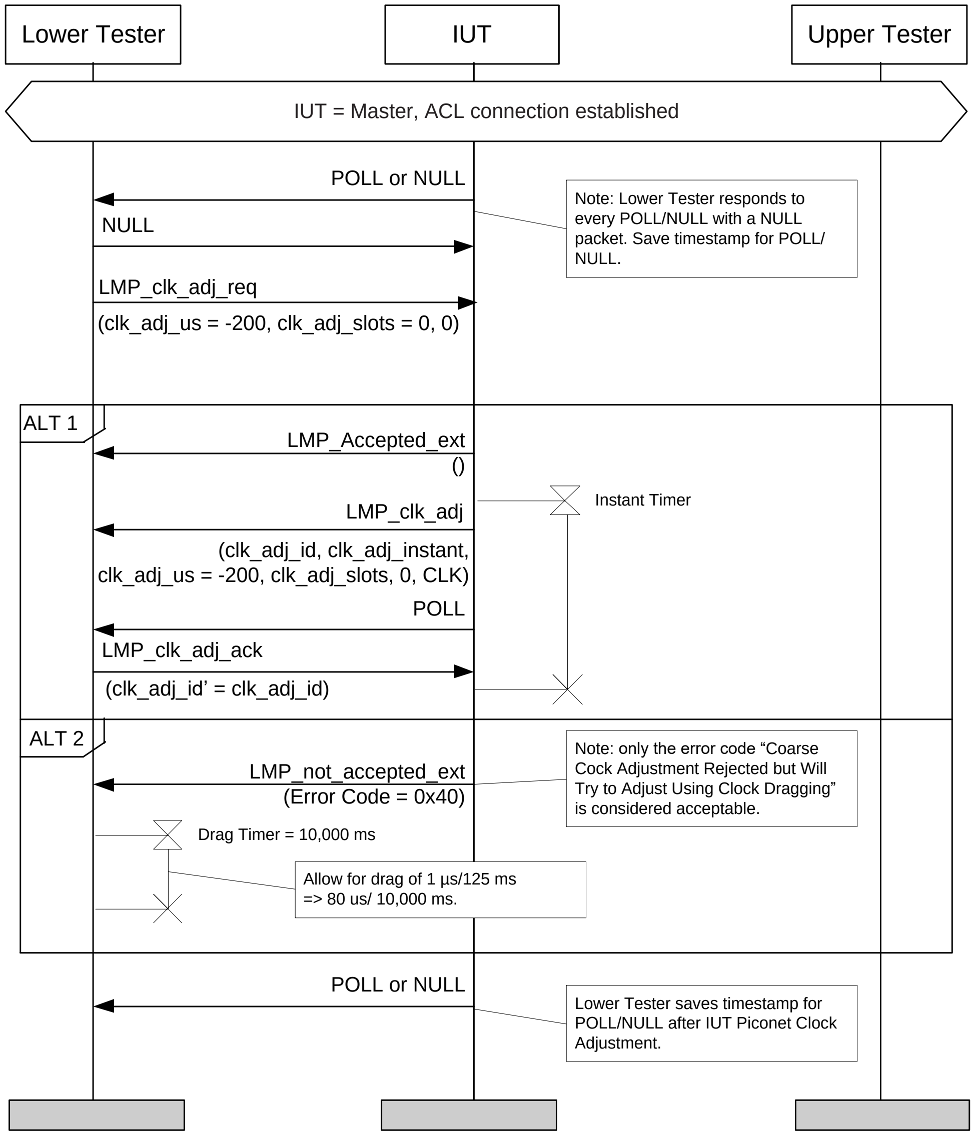

Figure 4.144: Coarse Clock Adjustment - Master responds to Coarse Clock Adjustment request

a) Lower Tester waits for a POLL or NULL and saves Timestamp1 for p0.
b) Lower Tester sends LMP_clk_adj_req to IUT.
c) IUT may accept the request or deny it and instead attempt to change CLK by dragging.

   i. If IUT accepts the request, it will send LMP_accepted_ext to the Lower Tester, followed by LMP_clk_adj. Lower Tester responds with LMP_clk_adj_ack and changes its clock according to protocol.

   ii. If IUT rejects the request, it may send an LMP_not_accepted PDU with the error code = Coarse Clock Adjustment Rejected but Will Try to Adjust Using Clock Dragging (0x40). In this case the Lower Tester waits for a time corresponding to the maximum allowed drag rate.

   iii. If the IUT rejects the request with any other error code this test will fail.

d) After IUT has completed clock adjustment, the Lower Tester collects Timestamp2 for a POLL or NULL.

e) Lower Tester calculates the IUT clock change as (Timestamp2 – Timestamp1) MOD 1250.

- Expected Outcome

  Pass Verdict

  IUT sends LMP_accepted_ext followed by LMP_clk_adj or LMP_not_accepted_ext with error code = Coarse Clock Adjustment Rejected but Will Try to Adjust Using Clock Dragging (0x40).

  If IUT performed a Coarse Clock Adjustment, (Timestamp2 – Timestamp1) MOD 1250 = 200 µs ±5%.

  Else if IUT performed clock dragging, (Timestamp2 – Timestamp1) MOD 1250 ≤ -40 µs and ≥ -400 µs.

  If IUT performed a Coarse Clock Adjustment, clk_adj_instant = CLKp + X, where CLKp is CLK of the first LMP_clk_adj packet, and X is ≥ 12 slots and < 12 hours.

  The IUT enabled AFH as part of the connection establishment and kept it enabled throughout the test. Throughout the test, channels 0, 24, and 78 were marked as unused in the AFH_channel_map.

- Notes

  If the IUT uses Clock Dragging, it is allowed to drag the clock much slower than the maximum rate of 5 µs/125 ms. This test assumes that no implementation would drag the clock slower than 0.5 µs/125 ms. The maximum rate of 5 µs/125 ms corresponds to 400 µs / 10 s. The test is configured to change the clock only 200 µs. Allow for a maximum natural drift of 20 PPM during 10 s which is 200 µs. If natural drift and drag work in the same direction we can observe a total drag of < 400 µs / 10s.

4.18.1.7 BB/XCB/BV-07-C [Master handles LMP_clk_adj_ack with correct clk_adj_id]

- Test Purpose

  Verify that the IUT as Master stops broadcasting LMP_clk_adj when it receives LMP_clk_adj_ack with the correct clk_adj_id.

- Reference

  [1] 8.6.10.1

- Initial Condition

Lower Tester:	Configured as Slave in state CONNECTION (active mode, ACL link).
Upper Tester:	Not involved after connection has been established.
IUT:	Configured as Master in state CONNECTION (active mode, ACL link). IUT shall be configured to accept PCA requests.

- Test Procedure

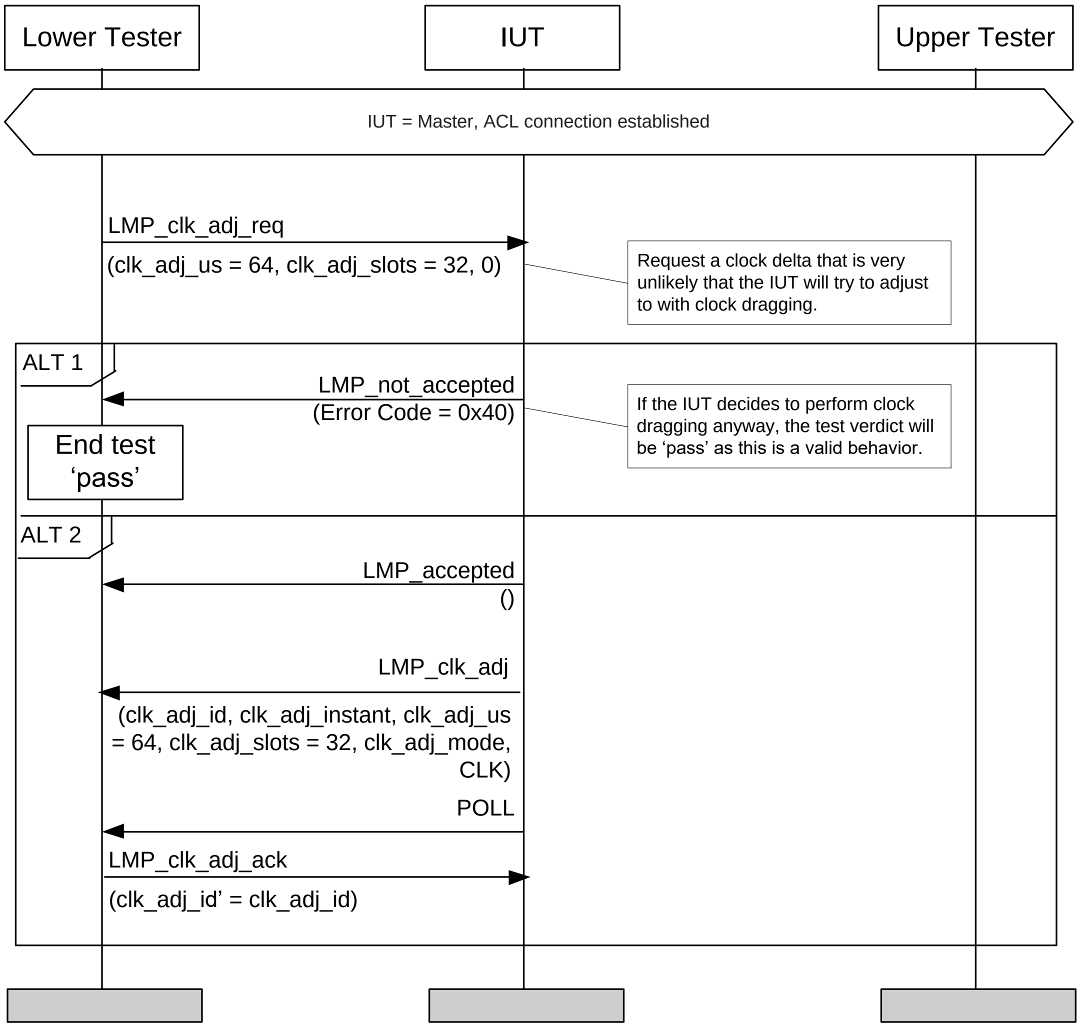

Figure 4.145: Coarse Clock Adjustment - Master handles LMP_clk_adj_ack - correct clk_adj_id

a) Lower Tester sends LMP_clk_adj_req to IUT.
b) IUT may accept the request or deny it and instead attempt to change CLK by dragging.

   i. If IUT accepts the coarse clock adjustment, it will send LMP_accepted to the Lower Tester.

   ii. If IUT rejects the coarse clock adjustment but indicates that it will perform clock dragging, this test is terminated with a ‘pass’ verdict.

   iii. If the IUT rejects the request with any other error code this test will fail.

c) IUT sends LMP_clk_adj.
d) When polled, Lower Tester responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj.
e) Lower Tester monitors IUT transmissions for 1s. No more LMP_clk_adj should be received.

- Expected Outcome

  Pass Verdict

  Alternative 1: IUT responds to LMP_clk_adj_req with LMP_not_accepted with error code = Coarse Clock Adjustment Rejected but Will Try to Adjust Using Clock Dragging (0x40)

  Alternative 2: IUT sends LMP_accepted followed by LMP_clk_adj. The IUT will stop sending LMP_clk_adj when it has received an LMP_clk_adj_ack packet with the correct clk_adj_id. Master sets clk_adj_instant = CLKp + X, where CLKp is CLK of the first LMP_clk_adj packet, and X is ≥ 12 slots and < 12 hours.

  The IUT enabled AFH as part of the connection establishment and kept it enabled throughout the test. Throughout the test, channels 0, 24, and 78 were marked as unused in the AFH_channel_map.

4.18.1.8 BB/XCB/BV-08-C [Master handles LMP_clk_adj_ack with incorrect clk_adj_id]

- Test Purpose

  Verify that the IUT as Master keeps polling and broadcasting LMP_clk_adj when it receives LMP_clk_adj_ack with an incorrect clk_adj_id.

- Reference

  [1] 8.6.10.1

- Initial Condition

Lower Tester:	Configured as Slave in state CONNECTION (active mode, ACL link).
Upper Tester:	Not involved after connection has been established.
IUT:	Configured as Master in state CONNECTION (active mode, ACL link). IUT shall be configured to accept PCA requests.

- Test Procedure

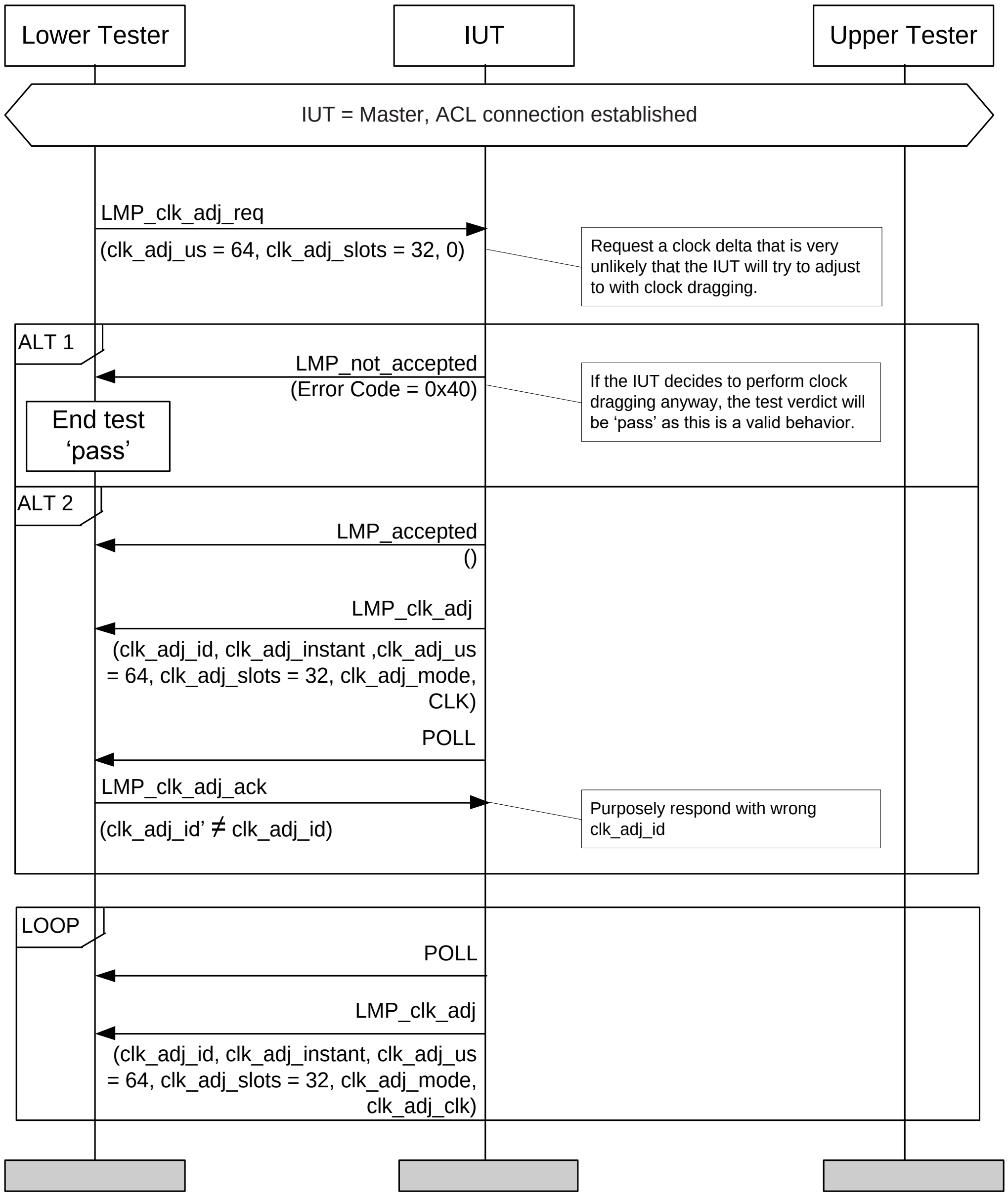

Figure 4.146: Coarse Clock Adjustment - Master handles LMP_clk_adj_ack - incorrect clk_adj_id

a) Lower Tester sends LMP_clk_adj_req to IUT.
b) IUT may accept the request or deny it and instead attempt to change CLK by dragging.
   i. If IUT accepts the coarse clock adjustment, it will send LMP_accepted to the Lower Tester.
   ii. If IUT rejects the coarse clock adjustment but indicates that it will perform clock dragging, this test is terminated with a 'pass' verdict.
   iii. If the IUT rejects the request with any other error code this test will fail.
c) IUT sends LMP_clk_adj.
d) When polled, Lower Tester responds with LMP_clk_adj_ack with clk_adj_id set to a value different from the value sent in LMP_clk_adj.

e) Lower Tester monitors IUT transmissions for 1s. IUT shall keep polling and sending LMP_clk_adj. All LMP_clk_adj shall have the same values for clk_adj_id, clk_adj_instant, clk_adj_us and clk_adj_slots.

- Expected Outcome

  Pass Verdict

  Alternative 1: IUT responds to LMP_clk_adj_req with LMP_not_accepted with error code = Coarse Clock Adjustment Rejected but Will Try to Adjust Using Clock Dragging (0x40).

  Alternative 2: IUT sends LMP_accepted followed by LMP_clk_adj. After tester sends LMP_clk_adj_ack with the incorrect clk_adj_id, IUT will keep polling and sending LMP_clk_adj.

  All LMP_clk_adj shall have the same values for clk_adj_id, clk_adj_instant, clk_adj_us and clk_adj_slots.

  The IUT enabled AFH as part of the connection establishment and kept it enabled throughout the test. Throughout the test, channels 0, 24, and 78 were marked as unused in the AFH_channel_map.

  If IUT performed a Coarse Clock Adjustment, clk_adj_instant = CLKp + X, where CLKp is CLK of the first LMP_clk_adj packet, and X is ≥ 12 slots and < 12 hours.

4.18.1.9 BB/XCB/BV-09-C [Master Recovery Mode, continuous LMP_clk_adj broadcast]

- Test Purpose

  Verify that the IUT as Master keeps broadcasting LMP_clk_adj when it does not receive LMP_clk_adj_ack from a Slave.

- Reference

  [1] 8.6.10.2

- Initial Condition

Lower Tester:	Configured as Slave in state CONNECTION (active mode, ACL link).
Upper Tester:	Not involved after connection has been established.
IUT:	Configured as Master in state CONNECTION (active mode, ACL link). IUT shall be configured to accept PCA requests.

- Test Procedure

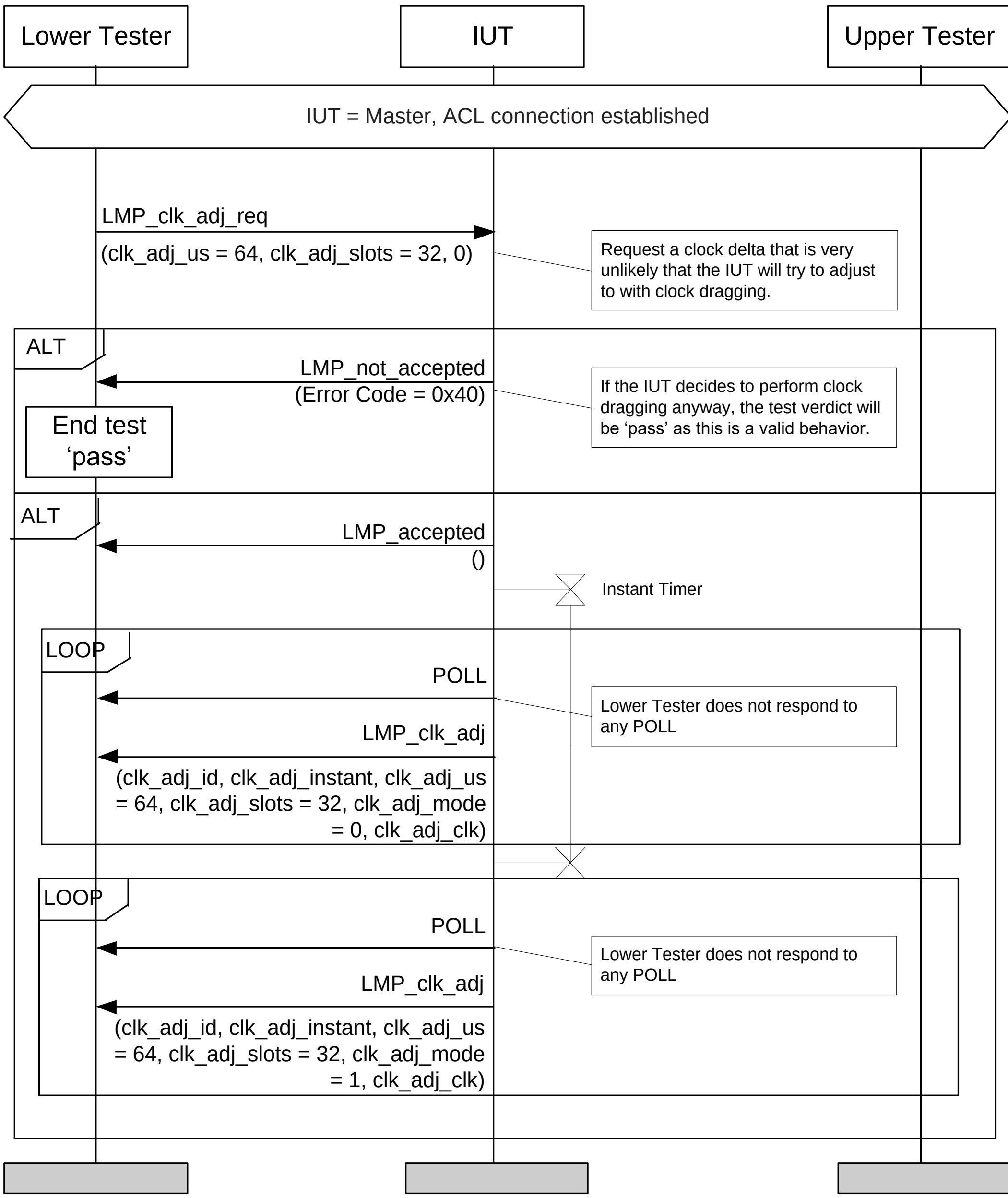

Figure 4.147: Coarse Clock Adjustment - Master Recovery Mode - continuous LMP_clk_adj broadcast

a) Lower Tester sends LMP_clk_adj_req to IUT.
b) IUT may accept the request or deny it and instead attempt to change CLK by dragging.
   i. If IUT accepts the coarse clock adjustment, it will send LMP_accepted to the Lower Tester.
   ii. If IUT rejects the coarse clock adjustment but indicates that it will perform clock dragging, this test is terminated with a 'pass' verdict.
   iii. If the IUT rejects the request with any other error code this test will fail.
c) IUT sends LMP_clk_adj with clk_adj_mode = 0. IUT may poll. Lower Tester does not respond.
d) clk_adj_instant occurs.

e) IUT sends LMP_clk_adj with clk_adj_mode = 1. All other parameters except CLK shall be identical to the initial LMP_clk_adj.

f) Lower Tester does not respond to polls.

- Expected Outcome

  Pass Verdict

  Alternative 1: IUT responds to LMP_clk_adj_req with LMP_not_accepted with error code = Coarse Clock Adjustment Rejected but Will Try to Adjust Using Clock Dragging (0x40).

  Alternative 2: IUT sends LMP_accepted followed by LMP_clk_adj and POLL packets. clk_adj_mode shall be set to 0 before clk_adj_instant and 1 after clk_adj_instant. All other parameters except clk_adj_clk (CLK[27:2]) shall remain unchanged.

  The IUT enabled AFH as part of the connection establishment and kept it enabled throughout the test. Throughout the test, channels 0, 24, and 78 were marked as unused in the AFH_channel_map.

  If IUT performed a Coarse Clock Adjustment, clk_adj_instant = CLKp + X, where CLKp is CLK of the first LMP_clk_adj packet, and X is ≥ 12 slots and < 12 hours.

4.18.1.10 BB/XCB/BV-10-C [Master Recovery Mode, Sync Train Transmission]

- Test Purpose

  Verify that the IUT as Master sends Sync Train on RF Channel 0, 24 and 78 when it does not receive LMP_clk_adj_ack from a Slave.

- Reference

  [1] 8.6.10.2

- Initial Condition

Lower Tester:	Configured as Slave in state CONNECTION (active mode, ACL link). Lower Tester shall be configured to receive sync train transmissions on RF channels 0, 24 and 78.
Upper Tester:	Not involved after connection has been established.
IUT:	Configured as Master in state CONNECTION (active mode, ACL link). IUT shall be configured to accept PCA requests.

- Test Procedure

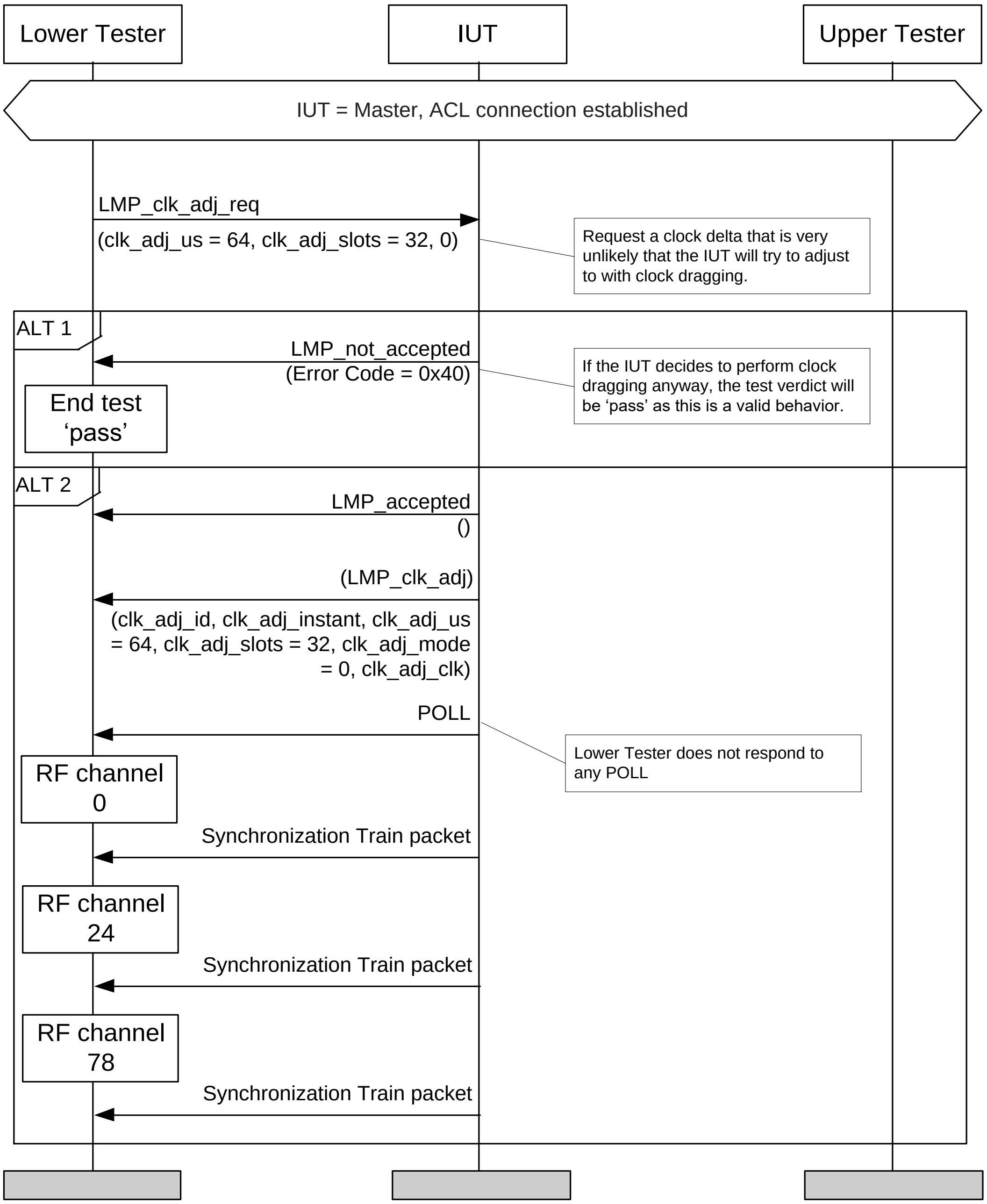

Figure 4.148: Coarse Clock Adjustment - Master Recovery Mode - Sync Train Transmission

a) Lower Tester sends LMP_clk_adj_req to IUT.
b) IUT may accept the request or deny it and instead attempt to change CLK by dragging.

   i. If IUT accepts the coarse clock adjustment, it sends LMP_accepted to the Lower Tester.

   ii. If IUT rejects the coarse clock adjustment but indicates that it will perform clock dragging, this test is terminated with a 'pass' verdict.

   iii. If the IUT rejects the request with any other error code this test will fail.

c) IUT sends LMP_clk_adj. IUT may send POLL packets. Tester does not respond.
d) Lower Tester listens to each of RF channel 0, 24, and 78 for up to 1s.

e) IUT sends Synchronization Train packets.

- Expected Outcome

  Pass Verdict

  Alternative 1: IUT responds to LMP_clk_adj_req with LMP_not_accepted with error code = Coarse Clock Adjustment Rejected but Will Try to Adjust Using Clock Dragging (0x40).

  Alternative 2: IUT sends LMP_accepted followed by LMP_clk_adj.

  IUT sends Synchronization Train PDU on RF channel 0.

  IUT sends Synchronization Train PDU on RF channel 24.

  IUT sends Synchronization Train PDU on RF channel 78.

  The IUT enabled AFH as part of the connection establishment and kept it enabled throughout the test. Throughout the test, channels 0, 24, and 78 were marked as unused in the AFH_channel_map.

  If IUT performed a Coarse Clock Adjustment, clk_adj_instant = CLKp + X, where CLKp is CLK of the first LMP_clk_adj packet, and X is ≥ 12 slots and < 12 hours.

4.18.1.11 BB/XCB/BV-11-C [Slave Recovery Mode, Sync Train Scan, LMP_clk_adj]

- Test Purpose

  Verify that the IUT as Slave scans for Sync Train on RF Channel 0, 24 and 78 when it does not receive any communications from the Master. Lower Tester will broadcast LMP_clk_adj. Verify that IUT responds to POLL with LMP_clk_adj_ack.

- Reference

  [1] 8.6.10.2

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link). Lower Tester shall be configured to transmit sync train on RF channels 0, 24 and 78. The Bluetooth clock of the Lower Tester is chosen to NOT include clock wrap-around (2^{27}-1 to 0) during the test procedure.

  Upper Tester: Not involved after connection has been established.

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

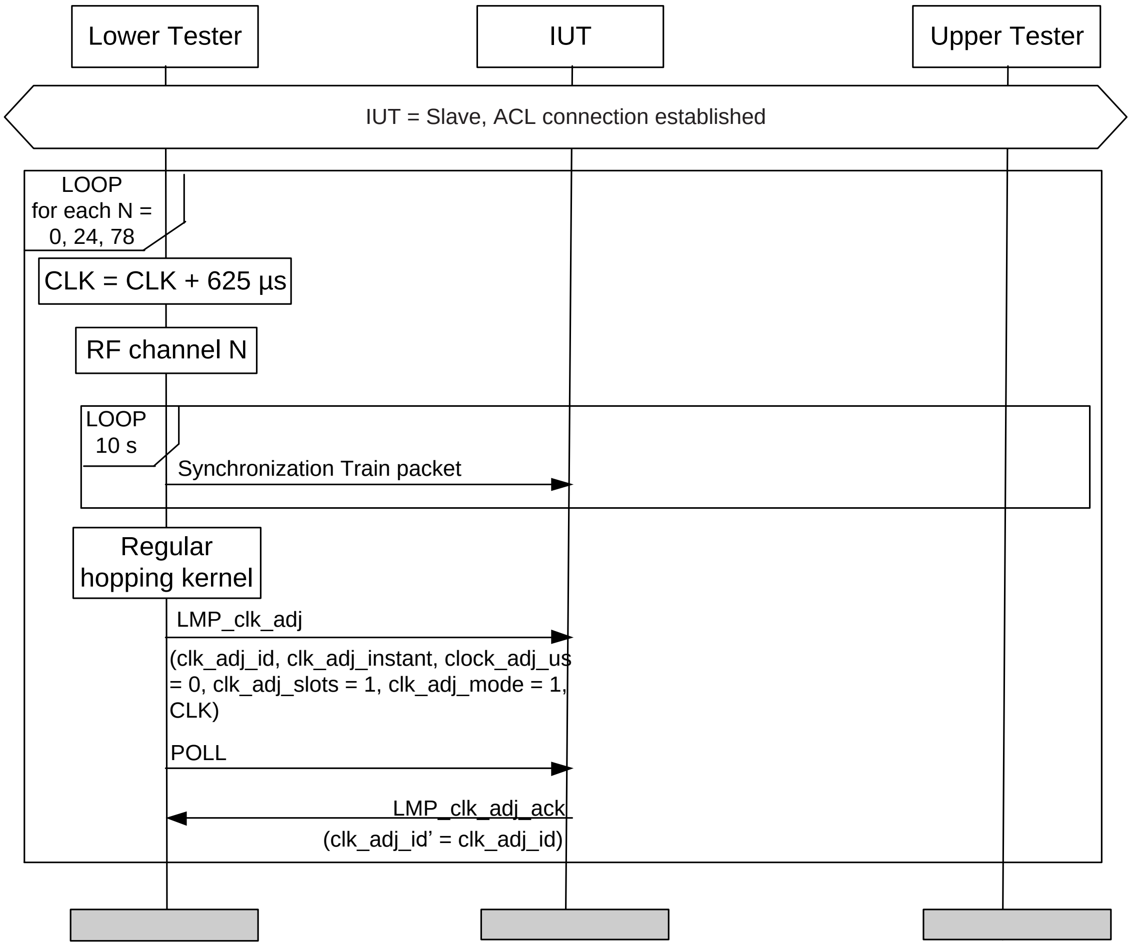

Figure 4.149: Coarse Clock Adjustment - Slave Recovery Mode - Sync Train Scan, LMP_clk_adj

a) Set N = 0.
b) Lower Tester changes CLK one slot.
c) Lower Tester sends Synchronization Train packets on RF channel N for 10 s.
d) Lower Tester switches back to regular BT hopping kernel.
e) Lower Tester sends LMP_clk_adj and polls IUT until IUT responds or LSTO expires.
f) IUT responds with LMP_clk_adj_ack with clk_adj_id being the same as in LMP_clk_adj.
g) Set N = 24. Repeat steps b) to f).
h) Set N = 78. Repeat steps b) to f).

- Expected Outcome

<u>Pass Verdict</u>

IUT responds to POLL with LMP_clk_adj_ack with clk_adj_id being the same as in LMP_clk_adj after sync train on RF channels 0, 24 and 78.

4.18.1.12 BB/XCB/BV-12-C [Slave Recovery Mode, Sync Train Scan, No LMP_clk_adj]

- Test Purpose

  Verify that the IUT as Slave scans for Sync Train on RF Channel 0, 24 and 78 when it does not receive any communications from the Master. Lower Tester will not broadcast LMP_clk_adj. Verify that IUT responds to POLL with NULL and not LMP_clk_adj_ack.

- Reference

  [1] 8.6.10.2

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link). Lower Tester shall be configured to transmit sync train on RF channels 0, 24 and 78. The Bluetooth clock of the Lower Tester is chosen to NOT include clock wrap-around (2^{27}-1 to 0) during the test procedure.

  Upper Tester: Not involved after connection has been established.

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

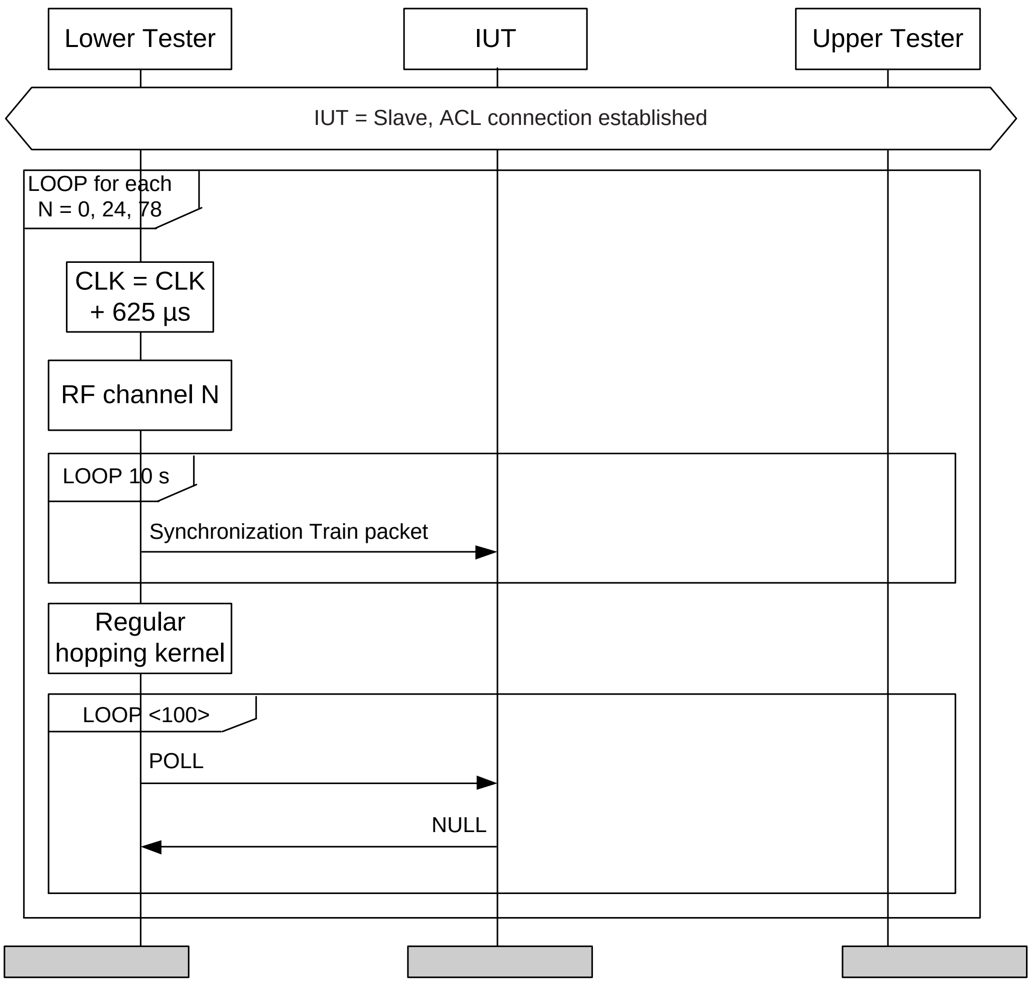

Figure 4.150: Coarse Clock Adjustment - Slave Recovery Mode - Sync Train Scan, No LMP_clk_adj

a) Set N = 0.
b) Lower Tester changes CLK one slot.
c) Lower Tester sends Synchronization Train PDU on RF channel N for 10 s.
d) Lower Tester switches back to regular BT hopping kernel.
e) Lower Tester sends POLL packet in every Master slot at least 100 times.
f) IUT responds to POLL packets with a NULL packet.
g) Set N = 24. Repeat steps b)–f).
h) Set N = 78. Repeat steps b)–f).

- Expected Outcome

  Pass Verdict

  IUT responds to at least 95 percent of POLL packets with a NULL packet after sync train on RF channels 0, 24 and 78.

4.18.1.13 BB/XCB/BV-13-C [Slave handles Coarse Clock Adjustment received after Instant]

- Test Purpose

  Verify that the IUT as Slave changes CLKN immediately after receiving a Coarse Clock Adjustment whose clk_adj_instant has passed in time.

- Reference

  [1] 8.6.10.1

  [10] 4.1.14.1

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link). The Bluetooth clock of the Lower Tester is chosen to NOT include clock wrap-around (2^{27}-1 to 0) during the test procedure.

  Upper Tester: Not involved after connection has been established.

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

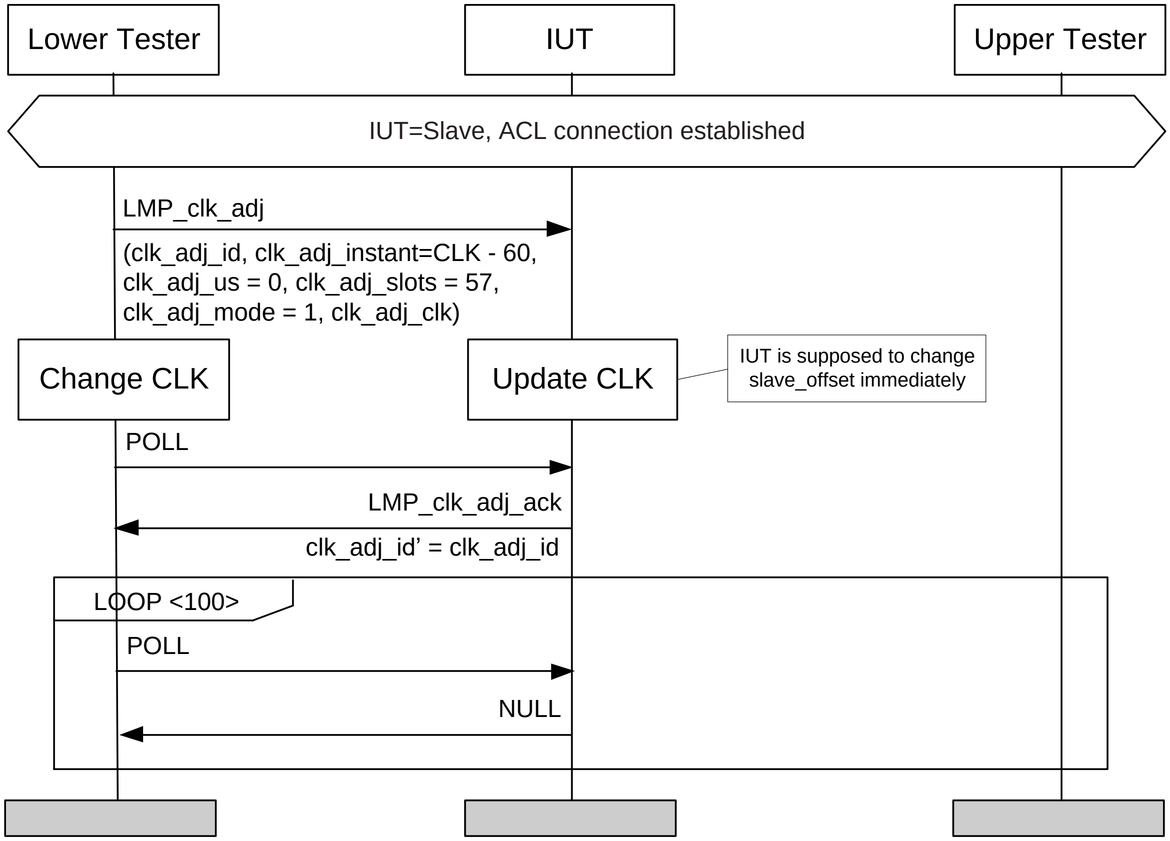

Figure 4.151: Coarse Clock Adjustment - Slave handles Coarse Clock Adjustment received after instant

a) Lower Tester sends LMP_clk_adj with clk_adj_instant = CLK[27:1] – 60 slots, clk_adj_us = 0, clk_adj_slots = 57 and clk_adj_mode = 1. This means that the instant has passed when IUT receives the command.
b) Lower Tester adjusts its own CLK + 57 slots.
c) IUT shall immediately set CLK_{new} to the value it would have had if it had performed clock adjustment at the instant by adding the time elapsed between the instant in the command and its current CLK_{old}.
d) Lower Tester polls IUT on CLK_{new} until IUT responds with an LMP_clk_adj_ack or LSTO expires.
e) IUT responds to POLL with LMP_clk_adj_ack with clk_adj_id being the same as in LMP_clk_adj.
f) Lower Tester sends POLL packet in every Master slot at least 100 times.
g) IUT responds to POLL packets with a NULL packet.

- Expected Outcome

<u>Pass Verdict</u>

After first POLL, IUT responds with LMP_clk_adj_ack with clk_adj_id set to the same value as in LMP_clk_adj. For subsequent POLL packets, IUT responds to at least 95% with a NULL packet.

- Notes

The purpose of this test is to simulate a very rare event where a Slave can receive a packet from its Master even though the two devices operate on different clocks. For this to happen, the old and new CLK would have to overlap in the use of RF channel and whitening code. It is not generally possible to force a situation like this without having access to the internal functions of the IUT. Therefore the test is initiated with both tester and IUT being on the same CLK. The Lower Tester sends LMP_clk_adj with parameters suggesting that the IUT has completely missed a PCA, and by random chance receives the PCA without having changed its clock. The trigger LMP must be received before the IUT would otherwise have started scanning for Sync Train packets. Once IUT has received an LMP_clk_adj packet with parameters suggesting that the instant has already passed, it is required by specification to change its clock to the new CLK immediately. At this point the Lower Tester will also update CLK to be able to verify that the IUT is correctly synchronized.

4.18.1.14 BB/XCB/BV-14-C [Slave protection against invalid adjustments]

- Test Purpose

  Verify that the IUT as Slave does not change CLK if it receives LMP_clk_adj with invalid adjustment parameters.

- Reference

  [1] 8.6.10.1

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link). The Bluetooth clock of the Lower Tester is chosen to NOT include clock wrap-around (2^{27}-1 to 0) during the test procedure.

  Upper Tester: Not involved after connection has been established.

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

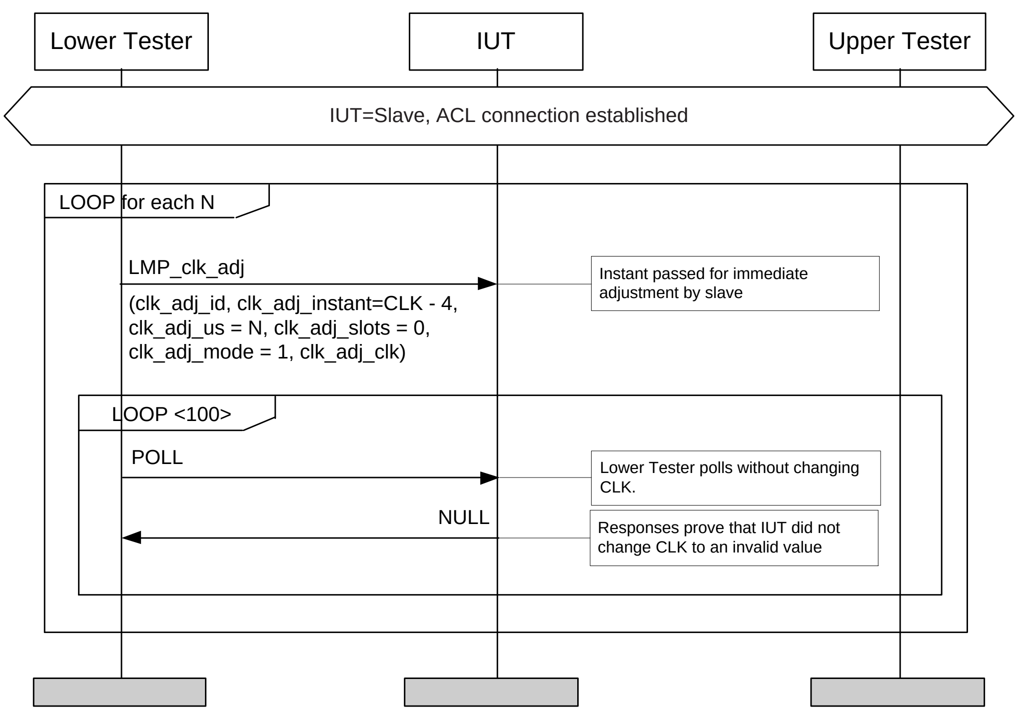

Figure 4.152: Coarse Clock Adjustment - Slave protection against invalid negative adjustment

a) Set N = –1023.
b) Lower Tester sends LMP_clk_adj with clk_adj_instant = CLK[27:1] – 4 slots, clk_adj_us = N, clk_adj_slots = 0 and clk_adj_mode = 1. (The instant has passed when IUT receives the command so an IUT that will fail this test would update slave_offset immediately).
c) Lower Tester sends a POLL packet in every Master slot for at least 100 times.
d) IUT responds to poll. IUT shall not have updated slave_offset to the invalid value.
e) Set N = –625. Repeat steps b)–d).
f) Set N = 625. Repeat steps b)–d).
g) Set N = 1023. Repeat steps b)–d).

- Expected Outcome

  Pass verdict

  IUT responds to at least 95 percent of POLL packets with a NULL packet.

4.18.1.15 BB/XCB/BV-15-C [Slave protection against greater than maximum adjustment]

- Test Purpose

  Verify that the IUT as Slave does not change CLK if it receives LMP_clk_adj with invalid positive adjustment parameters that would cause a clock adjustment greater than allowed.

- Reference

  [1] 8.6.10.1

- Initial Condition

  Lower Tester: Configured as Master in state CONNECTION (active mode, ACL link). The Bluetooth clock of the Lower Tester is chosen to NOT include clock wrap-around (2^{27}-1 to 0) during the test procedure.

  Upper Tester: Not involved after connection has been established.

  IUT: Configured as Slave in state CONNECTION (active mode, ACL link).

- Test Procedure

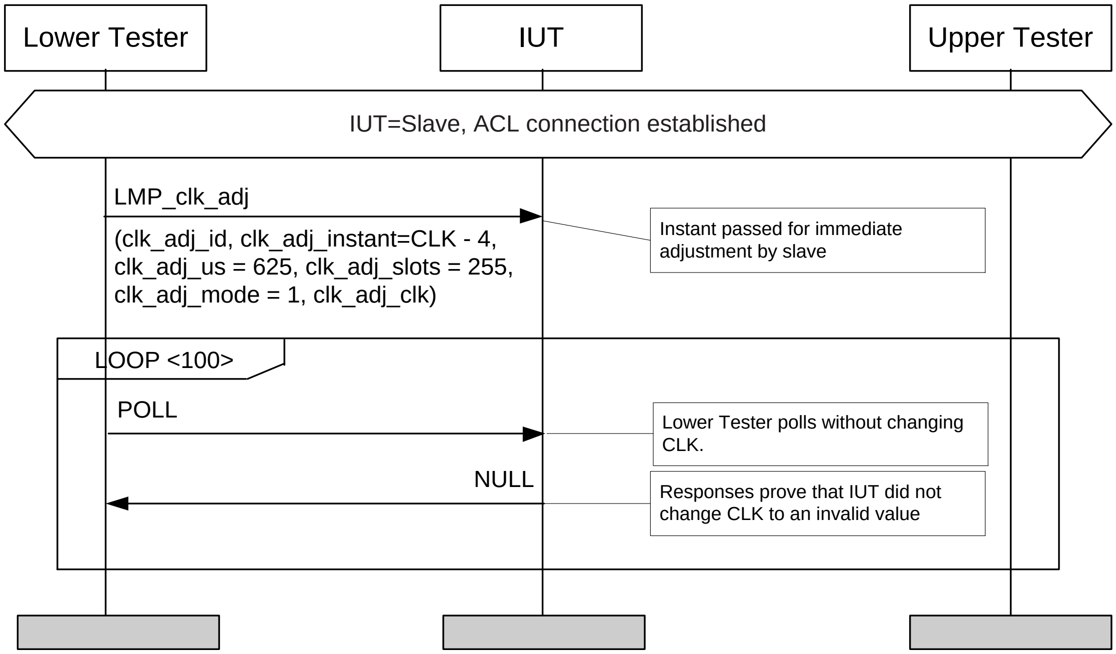

Figure 4.153: Coarse Clock Adjustment - Slave protection against invalid positive adjustment

a) Lower Tester sends LMP_clk_adj with clk_adj_instant = CLK[27:1] – 4 slots, clk_adj_us = 625, clk_adj_slots = 255 and clk_adj_mode = 1. (The instant has passed when IUT receives the command so an IUT that will fail this test would update slave_offset immediately).
b) Lower Tester sends a POLL packet in every Master slot for at least 100 times.
c) IUT responds to poll. IUT shall not have updated slave_offset to the invalid value.

- Expected Outcome

  Pass Verdict

  IUT responds to at least 95 percent of POLL packets with a NULL packet.

4.18.1.16 BB/XCB/BV-16-C [Master rejection of invalid adjustment requests]

- Test Purpose

  Verify that the IUT as Master rejects LMP_clk_adj_req with invalid adjustment parameters.

- Reference

  [1] 8.6.10.1

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  Upper Tester: Not involved after connection has been established.

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

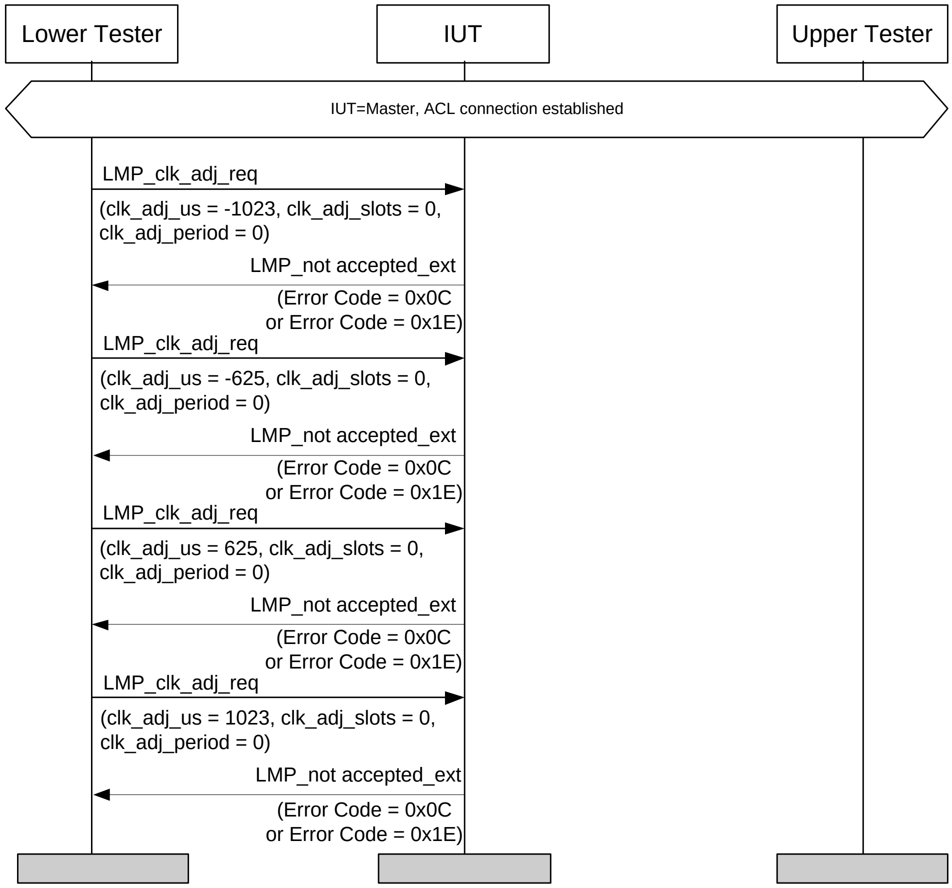

Figure 4.154: Coarse Clock Adjustment - Master rejection of invalid negative adjustment request

a) Lower Tester sends LMP_clk_adj_req with clk_adj_us = -1023, clk_adj_slots = 0.
b) IUT responds with LMP_not_accepted_ext with error code = COMMAND DISALLOWED (0x0C) OR IUT responds with LMP_not_accepted_ext with error code = Invalid LMP Parameters (0x1E).
c) Lower Tester sends LMP_clk_adj_req with clk_adj_us = -625, clk_adj_slots = 0.
d) IUT responds with LMP_not_accepted_ext with error code = COMMAND DISALLOWED (0x0C) OR IUT responds with LMP_not_accepted_ext with error code = Invalid LMP Parameters (0x1E).
e) Lower Tester sends LMP_clk_adj_req with clk_adj_us = 625, clk_adj_slots = 0.
f) IUT responds with LMP_not_accepted_ext with error code = COMMAND DISALLOWED (0x0C) OR IUT responds with LMP_not_accepted_ext with error code = Invalid LMP Parameters (0x1E).
g) Lower Tester sends LMP_clk_adj_req with clk_adj_us = 1023, clk_adj_slots = 0.
h) IUT responds with LMP_not_accepted_ext with error code = COMMAND DISALLOWED (0x0C) OR IUT responds with LMP_not_accepted_ext with error code = Invalid LMP Parameters (0x1E).

- Expected Outcome

<u>Pass Verdict</u>

IUT responds with LMP_not_accepted_ext with error code = COMMAND DISALLOWED (0x0C) OR IUT responds with LMP_not_accepted_ext with error code = Invalid LMP Parameters (0x1E) to all the requests with invalid parameters.

The IUT enabled AFH as part of the connection establishment and kept it enabled throughout the test. Throughout the test, channels 0, 24, and 78 were marked as unused in the AFH_channel_map.

4.18.1.17 BB/XCB/BV-17-C [Master rejection of invalid adjustment request greater than maximum]

- Test Purpose

Verify that the IUT as Master rejects LMP_clk_adj_req with invalid positive adjustment parameters that would cause a clock adjustment greater than allowed.

- Reference

[1] 8.6.10.1

- Initial Condition

Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

Upper Tester: Not involved after connection has been established.

IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

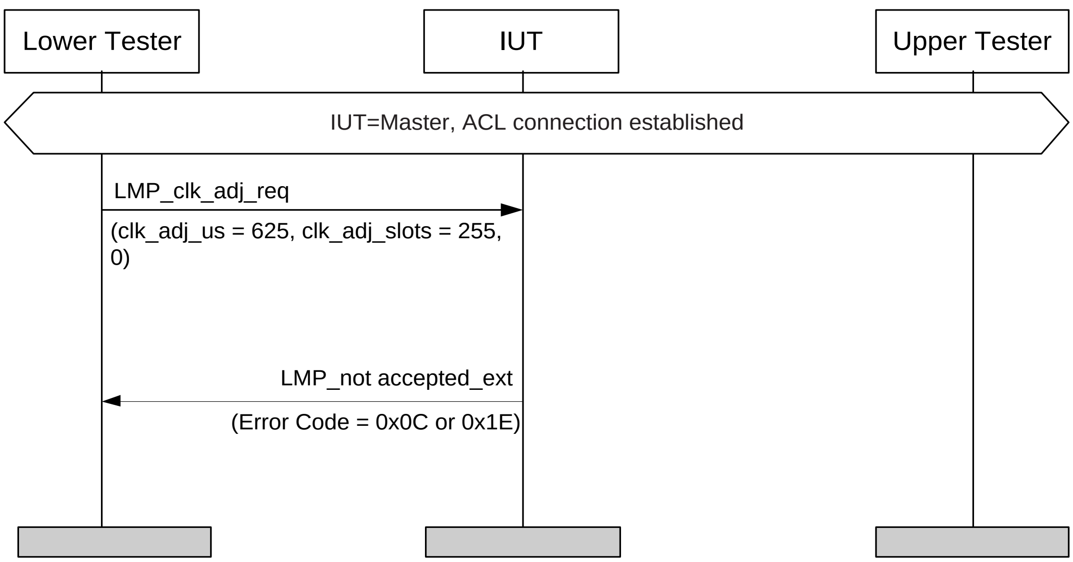

Figure 4.155: Coarse Clock Adjustment - Master rejection of invalid positive adjustment request

a) Lower Tester sends LMP_clk_adj_req with clk_adj_us = 625, clk_adj_slots = 255.
b) IUT responds with LMP_not_accepted_ext with error code = COMMAND DISALLOWED (0x0C) OR IUT responds with LMP_not_accepted_ext with error code = Invalid LMP Parameters (0x1E).

- Expected Outcome

Pass Verdict

IUT responds with LMP_not_accepted_ext with error code = COMMAND DISALLOWED (0x0C) OR IUT responds with LMP_not_accepted_ext with error code = Invalid LMP Parameters (0x1E) to all the requests with invalid parameters.

The IUT enabled AFH as part of the connection establishment and kept it enabled throughout the test. Throughout the test, channels 0, 24, and 78 were marked as unused in the AFH_channel_map.

4.18.1.18 BB/XCB/BV-18-C [Master handling of request for updating clk_adj_period only]

- Test Purpose

  Verify that the IUT as Master accepts a request to update only clk_adj_period without initiating any clock adjustment.

- Reference

  [10] 4.1.14.2

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  Upper Tester: Not involved after connection has been established.

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

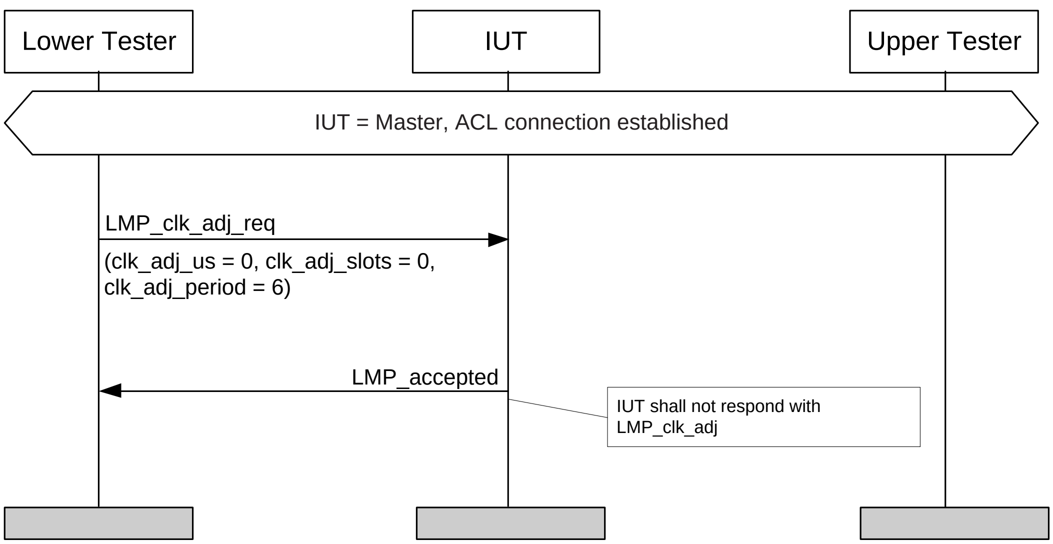

Figure 4.156: Coarse Clock Adjustment - Master handling request for updating clk_adj_period only

a) Lower Tester sends LMP_clk_adj_req to IUT with clk_adj_us = 0, clk_adj_slots = 0 and clk_adj_period = 6.
b) IUT responds with LMP_accepted.

- Expected Outcome

  <u>Pass Verdict</u>

  IUT responds with LMP_accepted.

  The IUT enabled AFH as part of the connection establishment and kept it enabled throughout the test. Throughout the test, channels 0, 24, and 78 were marked as unused in the AFH_channel_map.

4.18.1.19 BB/XCB/BV-19-C [Master rejection of LMP_clk_adj_req during Role Switch]

- Test Purpose

  Verify that the IUT as Master rejects a Coarse Clock Adjustment request during role switch before the instant.

- Reference

  [1] 8.6.10.1

  [10] 4.1.14.1

- Initial Condition

  Lower Tester: Configured as Slave in state CONNECTION (active mode, ACL link).

  Upper Tester: Not involved after connection has been established.

  IUT: Configured as Master in state CONNECTION (active mode, ACL link).

- Test Procedure

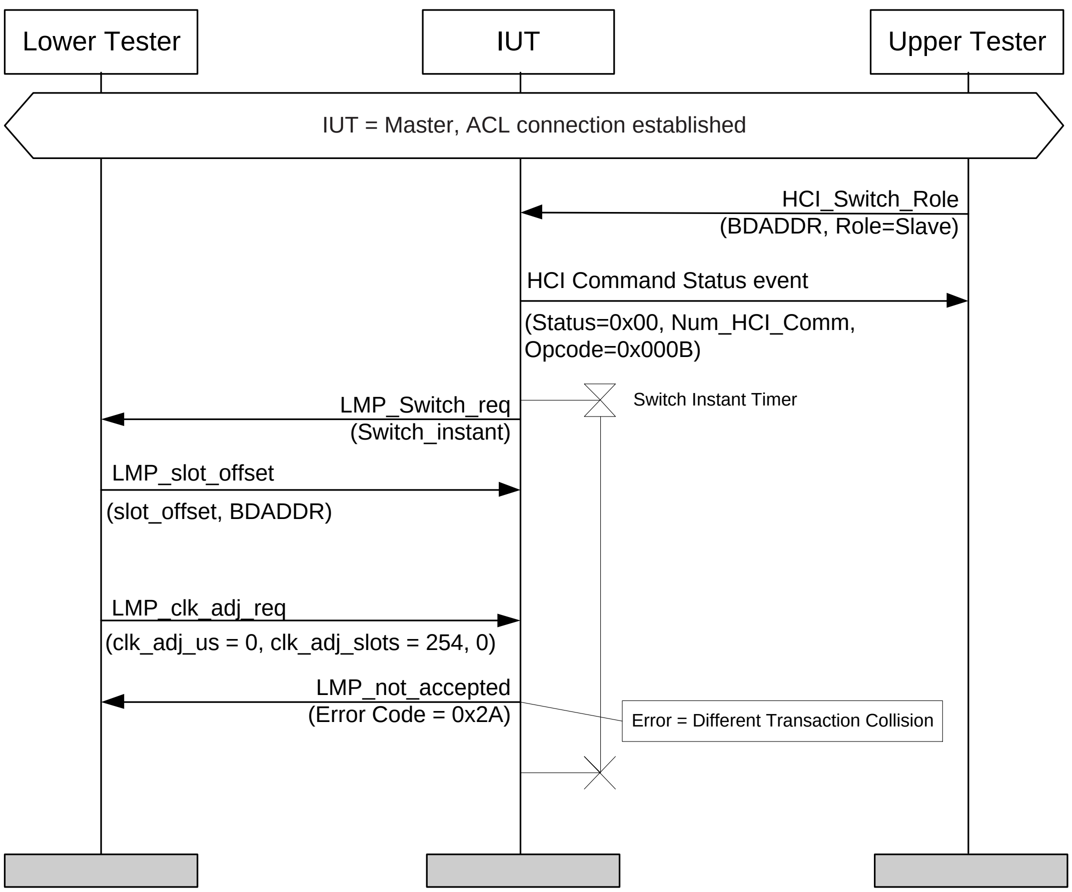

Figure 4.157: Coarse Clock Adjustment - Master rejection of LMP_clk_adj_req during Roll Switch

a) Upper Tester initiates a role switch.
b) Lower Tester waits for LMP_Switch_req.
c) Lower Tester sends LMP_slot_offset.

d) Before switch instant, Lower Tester sends LMP_clk_adj_req.
e) IUT rejects the request with error code = Different Transaction Collision (0x2A).

- Expected Outcome

  Pass Verdict

  IUT rejects LMP_clk_adj_req with error code = Different Transaction Collision (0x2A).

  The IUT enabled AFH as part of the connection establishment and kept it enabled throughout the test. Throughout the test, channels 0, 24, and 78 were marked as unused in the AFH_channel_map.

4.18.1.20 BB/XCB/BV-20-C [Rejection of procedures with time_control_flag during coarse adjust]

- Test Purpose

  Verify that the IUT as Master rejects procedures involving time_control_flag while performing a coarse clock adjustment.

- Reference

  [1] 8.6.10.1

  [10] 4.1.14.1

- Initial Condition

Lower Tester:	Configured as Master in state CONNECTION (active mode, ACL link).
Upper Tester:	Not involved after connection has been established.
IUT:	Configured as Master in state CONNECTION (active mode, ACL link). IUT shall be configured to accept PCA requests.

- Test Procedure

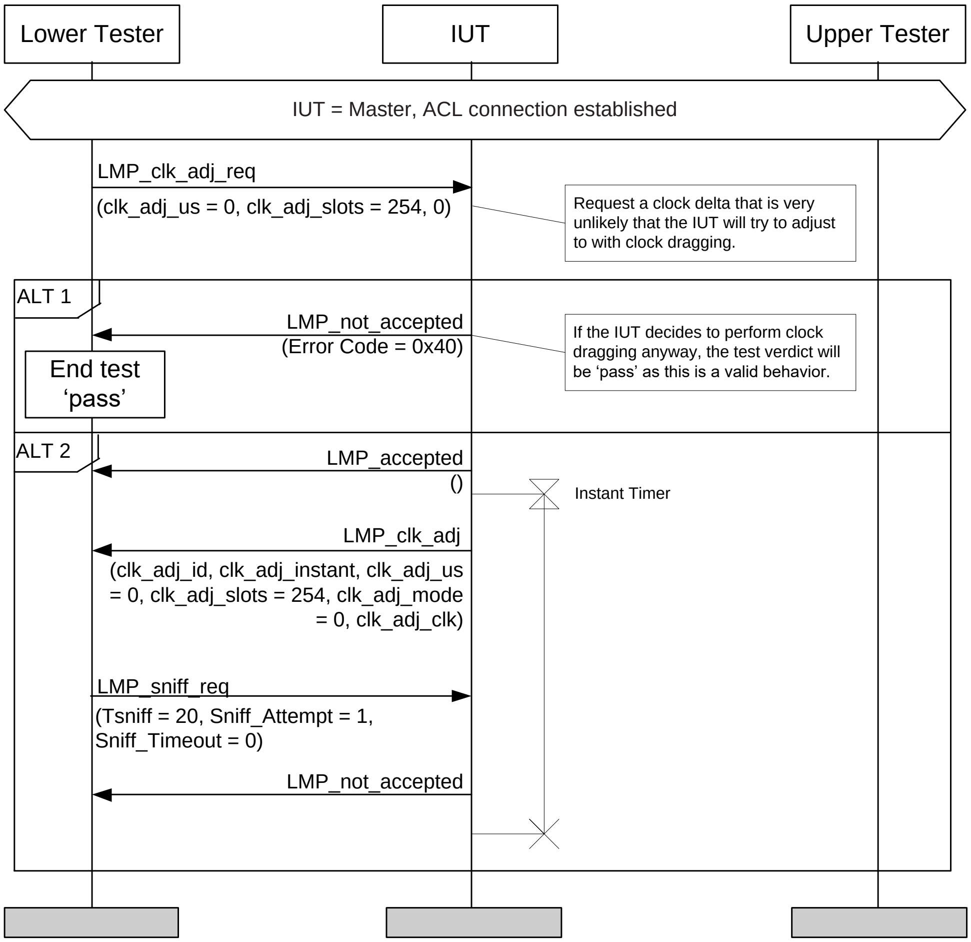

Figure 4.158: Coarse Clock Adjustment - Master rejection of LMP_sniff_req during Coarse Clock Adjustment

a) Lower Tester sends LMP_clk_adj_req to IUT.
b) IUT may accept the request or deny it and instead attempt to change CLK by dragging.
   i. If IUT accepts the coarse clock adjustment, it will send LMP_accepted to the Lower Tester.
   ii. If IUT rejects the coarse clock adjustment but indicates that it will perform clock dragging, this test is terminated with a 'pass' verdict.
   iii. If the IUT rejects the request with any other error code this test will fail.
c) Lower Tester waits for IUT to send LMP_clk_adj. This indicates that IUT has started a coarse clock adjustment.
d) Lower Tester sends LMP_sniff_req before the instant has passed.
e) IUT rejects the sniff request.

- Expected Outcome

<u>Pass Verdict</u>

Alternative 1: IUT responds to LMP_clk_adj_req with LMP_not_accepted with error code = Coarse Clock Adjustment Rejected but Will Try to Adjust Using Clock Dragging (0x40).

Alternative 2: IUT sends LMP_accepted followed by LMP_clk_adj and polls. IUT rejects a sniff request while performing a coarse clock adjustment.

The IUT enabled AFH as part of the connection establishment and kept it enabled throughout the test. Throughout the test, channels 0, 24, and 78 were marked as unused in the AFH_channel_map.

If IUT performed a Coarse Clock Adjustment, clk_adj_instant = CLKp + X, where CLKp is CLK of the first LMP_clk_adj packet, and X is ≥ 12 slots and < 12 hours.

4.19 Fragmented L2CAP Header

4.19.1 BB/PROT/FLH/BV-01-C [Transmit Fragmented L2CAP Header]

- Test Purpose

  Verify that the IUT correctly transmits packets with fragmented L2CAP headers.

- Reference

  [11] 5.4.2

  [15] 7.2.1

- Initial Condition

  IUT has a connection to the Lower Tester (active mode, ACL).

- Test Procedure

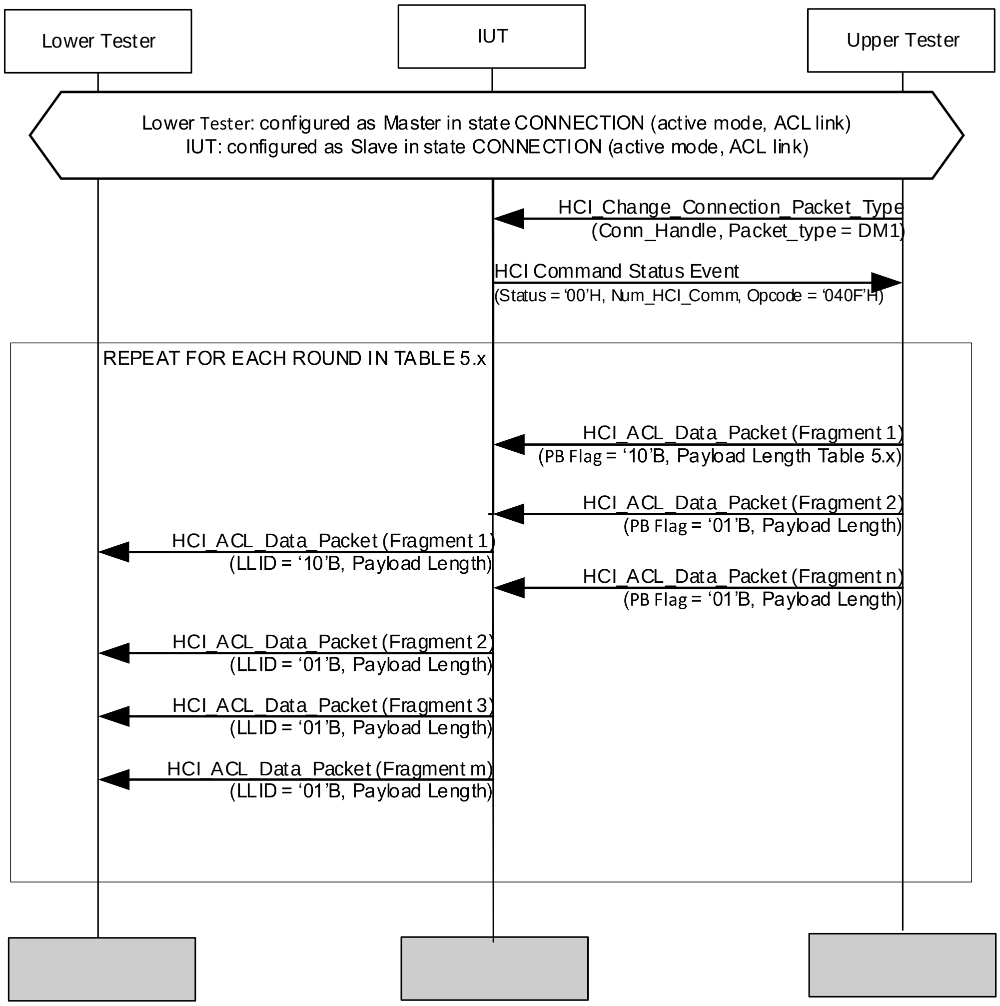

Figure 4.159: BB/PROT/FLH/BV-01-C

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DM1.

For each round 1–6 based on Table 4.5:

b) The Upper Tester sends a L2CAP frame to the IUT with the start fragment containing a Payload length according to Table 4.5 and the rest in a continue fragment.

Round	Payload Length (octets) (Step b)
1	0
2	1
3	2

Round	Payload Length (octets) (Step b)
4	3
5	4
6	5

Table 4.5: Payload length for each round

c) The Lower Tester receives the unaltered L2CAP start and zero or more continue fragments.

Note: The IUT can transmit packets at any time after the first packet it receives, provided that it transmits at least one after the last packet it receives.

- Expected Outcome

  Pass Verdict

  The Lower Tester receives the unaltered L2CAP frames, each with one start fragment followed by zero or more continue fragments.

4.19.2 BB/PROT/FLH/BV-02-C [Receive Fragmented L2CAP Header]

- Test Purpose

  Verify that the IUT correctly receives packets with fragmented L2CAP headers.

- Reference

  [11] 5.4.2

  [15] 7.2.1

- Initial Condition

  IUT has a connection to the Lower Tester (active mode, ACL).

- Test Procedure

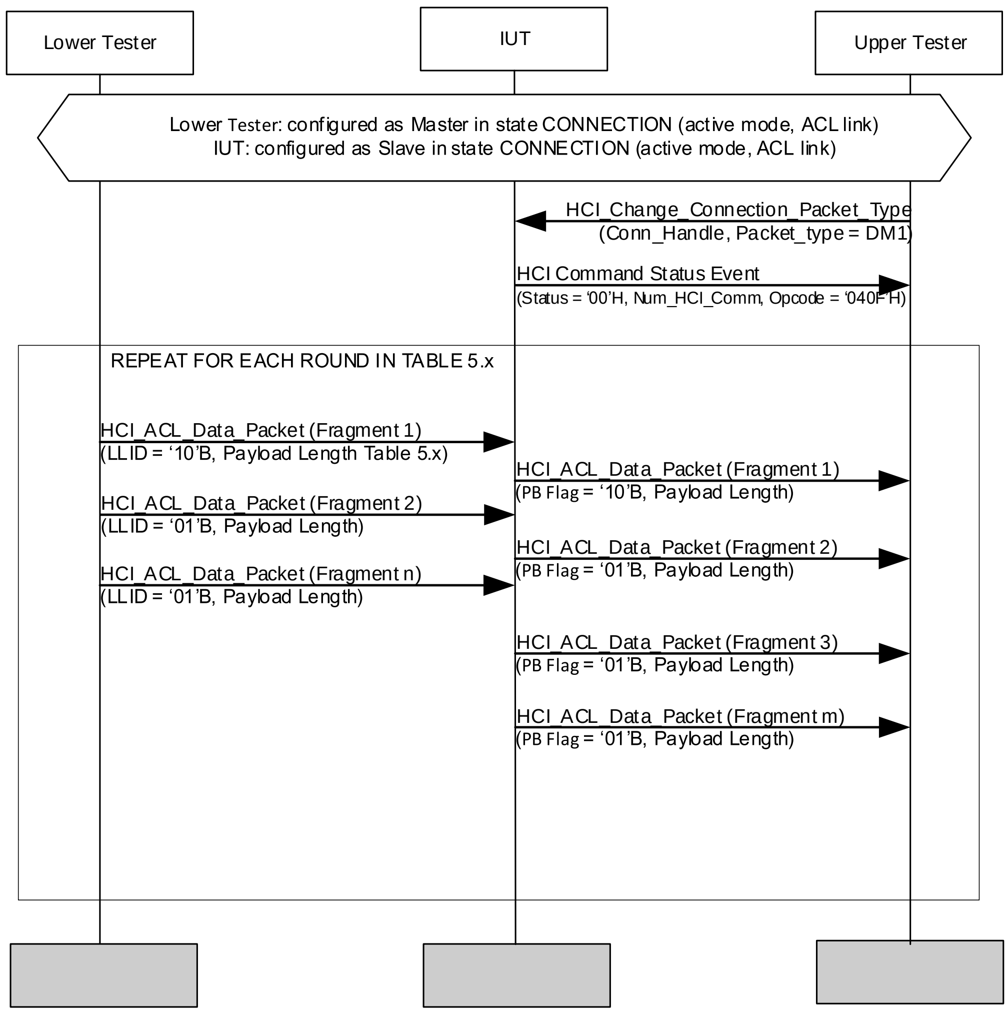

Figure 4.160: BB/PROT/FLH/BV-02-C

a) The Upper Tester sends HCI Change Connection Packet Type command to limit the packet types used by the IUT to DM1.

For each round 1–6 based on Table 4.5:

b) The Lower Tester sends a L2CAP frame to the IUT with the start fragment containing a Payload length according to Table 4.5 and the rest in a continue fragment.

c) The Upper Tester receives the unaltered L2CAP start and zero or more continue fragments.

Note: The IUT can transmit packets at any time after the first packet it receives, provided that it transmits at least one after the last packet it receives.

- Expected Outcome

<u>Pass Verdict</u>

The Upper Tester receives the unaltered L2CAP frames, each with one start fragment followed by zero or more continue fragments.

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. For products which support more than one role, a separate TCMT shall be filled out for each role, and separate tests shall be conducted for each role.

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 BB [6]. 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 [6]/IXIT [14] proforma and instructions for completing the ICS [6]/IXIT [14] proforma refer to the Bluetooth ICS [6] and IXIT [14] proforma document.

Item	Feature	Test Case(s)
BB 1/1		BB/PHYS/FRE/BV-01-C BB/PHYS/TRX/BV-01-C BB/PHYS/TRX/BV-03-C BB/PHYS/TRX/BV-04-C BB/PROT/COD/BV-11-C BB/PROT/COD/BV-12-C BB/PROT/COD/BV-16-C BB/PROT/ARQ/BV-01-C BB/PROT/ARQ/BV-02-C BB/PROT/ARQ/BV-03-C BB/PROT/ARQ/BV-04-C BB/PROT/ARQ/BV-05-C BB/PROT/ARQ/BV-06-C BB/PROT/ARQ/BV-08-C BB/PROT/ARQ/BV-10-C BB/PROT/ARQ/BV-14-C BB/PROT/ARQ/BV-15-C BB/PROT/ARQ/BV-16-C

Item	Feature	Test Case(s)
		BB/PROT/ARQ/BV-18-C BB/PROT/ARQ/BV-19-C BB/PROT/ARQ/BV-23-C BB/PROT/CON/BV-01-C BB/PROT/CON/BV-02-C BB/PROT/CON/BV-03-C BB/PROT/CON/BV-05-C BB/PROT/CON/BV-08-C BB/PROT/FLH/BV-01-C BB/PROT/FLH/BV-02-C
BB 1/2	Adaptive frequency hopping	BB/PHYS/FRE/BV-02-C
BB 1/2 AND LM 2/6 AND LM 26/1	AFH and M/S switch	BB/PHYS/FRE/BV-03-C
BB 2/2	Support of SCO link	BB/PROT/COD/BV-01-C BB/PROT/COD/BV-04-C BB/PROT/COD/BV-14-C BB/PROT/ARQ/BV-25-C BB/PROT/ARQ/BV-26-C BB/PROT/CON/BV-04-C BB/PROT/CON/BV-09-C
BB 5/1	Support of DH1 packet type	BB/PROT/COD/BV-05-C
BB 5/2	Support of DM3 packet type	BB/PROT/COD/BV-06-C
BB 5/3	Support of DH3 packet type	BB/PROT/COD/BV-07-C
BB 5/4	Support of DM5 packet type	BB/PROT/COD/BV-08-C
BB 5/5	Support of DH5 packet type	BB/PROT/COD/BV-09-C
BB 5/6	Support of AUX1 packet type	BB/PROT/COD/BV-10-C
BB 6/2 AND BB 2/2	Support of HV2 packet type	BB/PROT/COD/BV-02-C
BB 6/3 AND BB 2/2	Support of HV3 packet type	BB/PROT/COD/BV-03-C

Item	Feature	Test Case(s)
BB 6/5	EV3 packet	BB/PROT/COD/BV-17-C BB/PROT/ARQ/BV-27-C BB/PROT/ARQ/BV-28-C BB/PROT/ARQ/BV-29-C BB/PROT/ARQ/BV-30-C BB/PROT/ARQ/BV-31-C BB/PROT/ARQ/BV-32-C
BB 6/6	EV4 packet	BB/PROT/COD/BV-18-C
BB 6/7	EV5 packet	BB/PROT/COD/BV-19-C
BB 7/1	Supports paging	BB/PHYS/PAG/BV-01-C BB/PHYS/PAG/BV-03-C BB/PHYS/PAG/BV-05-C
BB 7/2	Supports page scan	BB/PHYS/PAG/BV-10-C BB/PHYS/PAG/BV-12-C
BB 9/2 AND BB 7/5	Page scan interval R1 with interlaced scan	BB/PHYS/PAG/BV-17-C
BB 9/3 AND BB 7/5	Page scan interval R2 and interlaced scan	BB/PHYS/PAG/BV-19-C
BB 9/1	Supports paging mode R0	BB/PHYS/PAG/BV-14-C
BB 9/2	Supports paging mode R1	BB/PHYS/PAG/BV-16-C
BB 9/3	Supports paging mode R2	BB/PHYS/PAG/BV-18-C
BB 7/8	Supports Train Nudging During Page	BB/PHYS/PAG/BV-20-C
BB 7/9	Support Generalized Interlaced Page Scan	BB/PHYS/PAG/BV-21-C
BB 10/1	Supports inquiry	BB/PHYS/INQ/BV-03-C
BB 10/2	Supports inquiry scan	BB/PHYS/INQ/BV-10-C BB/PHYS/INQ/BV-14-C
BB 10/2 AND BB 10/6	Interlaced inquiry scan	BB/PHYS/INQ/BV-15-C
BB 10/5 AND BB 10/1	Supports the dedicated inquiry access code	BB/PHYS/INQ/BV-01-C
BB 10/7	Reception of Extended Inquiry Response	BB/PHYS/INQ/BV-16-C BB/PHYS/INQ/BV-17-C BB/PHYS/INQ/BV-18-C
BB 10/8	Supports Train Nudging During Inquiry	BB/PHYS/INQ/BV-19-C

Item	Feature	Test Case(s)
BB 10/9	Support Generalized Interlaced Inquiry Scan	BB/PHYS/ INQ/BV-20-C
BB 11/1	Broadcast messages	BB/PROT/PIC/BV-03-C BB/PROT/PIC/BV-04-C
BB 6a/1	Support of 2-EV3 packet type	BB/PROT/COD/BV-20-C
BB 6a/2	Support of 2-EV5 packet type	BB/PROT/COD/BV-21-C
BB 6a/3	Support of 3-EV3 packet type	BB/PROT/COD/BV-22-C
BB 6a/4	Support of 3-EV5 packet type	BB/PROT/COD/BV-23-C
BB 5a/1	Support of 2-DH1 packet type	BB/PROT/COD/BV-24-C
BB 5a/2	Support of 2-DH3 packet type	BB/PROT/COD/BV-25-C
BB 5a/3	Support of 2-DH5 packet type	BB/PROT/COD/BV-26-C
BB 5a/4	Support of 3-DH1 packet type	BB/PROT/COD/BV-27-C
BB 5a/5	Support of 3-DH3 packet type	BB/PROT/COD/BV-28-C
BB 5a/6	Support of 3-DH5 packet type	BB/PROT/COD/BV-29-C
BB 14/1	Erroneous Data Reporting for SCO	BB/PROT/ED/BV-04-C
BB 14/2	Erroneous Data Reporting for eSCO	BB/PROT/ED/BV-01-C BB/PROT/ED/BV-02-C BB/PROT/ED/BV-03-C
BB 16/1	Non-flushable Packet Boundary Flag	BB/PROT/ARQ/BV-33-C BB/PROT/ARQ/BV-34-C BB/PROT/ARQ/BV-35-C BB/PROT/ARQ/BV-36-C BB/PROT/ARQ/BV-37-C
BB 17/1	Sniff subrating	BB/PROT/SSR/BV-01-C BB/PROT/SSR/BV-02-C BB/PROT/SSR/BV-03-C BB/PROT/SSR/BV-04-C BB/PROT/SSR/BV-05-C BB/PROT/SSR/BV-06-C BB/PROT/SSR/BV-07-C

Item	Feature	Test Case(s)
BB 3a/1	Connectionless Slave Broadcast Transmitter	BB/PROT/CB/BV-01-C BB/PROT/CB/BV-02-C BB/PROT/CB/BV-04-C BB/PROT/CB/BV-06-C BB/PROT/CB/BV-07-C
BB 3a/2	Connectionless Slave Broadcast Receiver	BB/PROT/CB/BV-03-C BB/PROT/CB/BV-05-C BB/PROT/CB/BV-08-C BB/PROT/CB/BV-09-C BB/PROT/CB/BV-10-C BB/PROT/CB/BV-11-C
BB 7/6	Truncated Paging	BB/PHYS/TP/BV-01-C
BB 7/7	Slave Page Response Timeout Detection	BB/PHYS/TP/BV-02-C
BB 9c/1	Synchronization Train	BB/PHYS/ST/BV-01-C BB/PHYS/ST/BV-04-C BB/PHYS/ST/BV-05-C BB/PHYS/ST/BV-06-C
BB 9c/2	Synchronization Scan	BB/PHYS/ST/BV-02-C BB/PHYS/ST/BV-03-C
BB 4/5 AND BB 2/7	Support of DM1 packet type with Secure Connections	BB/PROT/COD/BV-30-C
BB 5/1 AND BB 2/7	Support of DH1 packet type with Secure Connections	BB/PROT/COD/BV-31-C
BB 5/2 AND BB 2/7	Support of DM3 packet type with Secure Connections	BB/PROT/COD/BV-32-C
BB 5/3 AND BB 2/7	Support of DH3 packet type with Secure Connections	BB/PROT/COD/BV-33-C
BB 5/4 AND BB 2/7	Support of DM5 packet type with Secure Connections	BB/PROT/COD/BV-34-C
BB 5/5 AND BB 2/7	Support of DH5 packet type with Secure Connections	BB/PROT/COD/BV-35-C
BB 6/5 AND BB 2/8	EV3 Packet Type with Secure Connections	BB/PROT/COD/BV-42-C
BB 6/6 AND BB 2/8	EV4 Packet Type with Secure Connections	BB/PROT/COD/BV-43-C

Item	**Feature**	**Test Case(s)**
BB 6/7 AND BB 2/8	EV5 Packet Type with Secure Connections	BB/PROT/COD/BV-44-C
BB 6a/1 AND BB 2/8	2-EV3 Packet Type with Secure Connections	BB/PROT/COD/BV-45-C
BB 6a/2 AND BB 2/8	2-EV5 Packet Type with Secure Connections	BB/PROT/COD/BV-46-C
BB 6a/3 AND BB 2/8	3-EV3 Packet Type with Secure Connections	BB/PROT/COD/BV-47-C
BB 6a/4 AND BB 2/8	3-EV5 Packet Type with Secure Connections	BB/PROT/COD/BV-48-C
BB 5a/1 AND BB 2/7	2-DH1 Packet Type with Secure Connections	BB/PROT/COD/BV-36-C
BB 5a/2 AND BB 2/7	2-DH3 Packet Type with Secure Connections	BB/PROT/COD/BV-37-C
BB 5a/3 AND BB 2/7	2-DH5 Packet Type with Secure Connections	BB/PROT/COD/BV-38-C
BB 5a/4 AND BB 2/7	3-DH1 Packet Type with Secure Connections	BB/PROT/COD/BV-39-C
BB 5a/5 AND BB 2/7	3-DH3 Packet Type with Secure Connections	BB/PROT/COD/BV-40-C
BB 5a/6 AND BB 2/7	3-DH5 Packet Type with Secure Connections	BB/PROT/COD/BV-41-C
BB 1/1 AND BB 2/7 (AND LMP 2/26)	Basic requirements including Secure Connections	BB/PROT/ARQ/BV-48-C BB/PROT/ARQ/BV-49-C BB/PROT/ARQ/BV-38-C BB/PROT/ARQ/BV-39-C BB/PROT/ARQ/BV-42-C BB/PROT/ARQ/BV-43-C BB/PROT/ARQ/BV-44-C BB/PROT/ARQ/BV-45-C BB/PROT/ARQ/BV-46-C BB/PROT/ARQ/BV-47-C
BB 1/1 AND BB 2/7 AND BB 2/8 (AND LMP 2/26)	Basic requirements including Secure Connections and support for eSCO	BB/PROT/ARQ/BV-40-C BB/PROT/ARQ/BV-41-C

Item	Feature	Test Case(s)
BB 1/1 AND BB 2/7 AND BB 2/8 (AND LMP 2/26)	Basic requirements including Secure Connections and support for eSCO	BB/PROT/CON/BV-10-C BB/PROT/CON/BV-11-C BB/PROT/CON/BV-13-C BB/PROT/CON/BV-14-C
BB 1/1 AND BB 2/7 AND BB 2/8 (AND LMP 2/26)	Basic requirements including Secure Connections and support for eSCO and support for Role Switch	BB/PROT/CON/BV-12-C
BB 18/1	Coarse Clock Adjustment	BB/XCB/BV-01-C BB/XCB/BV-02-C BB/XCB/BV-03-C BB/XCB/BV-04-C BB/XCB/BV-05-C BB/XCB/BV-06-C BB/XCB/BV-07-C BB/XCB/BV-08-C BB/XCB/BV-09-C BB/XCB/BV-10-C BB/XCB/BV-11-C BB/XCB/BV-12-C BB/XCB/BV-13-C BB/XCB/BV-14-C BB/XCB/BV-15-C BB/XCB/BV-16-C BB/XCB/BV-17-C BB/XCB/BV-18-C BB/XCB/BV-19-C BB/XCB/BV-20-C

Table 5.1 Test Case Mapping

6 Revision History and Contributors

Revision History

Publication Number	Revision History	Date	Comments
	D5r3	2003-11-05	Original Release
	D10R00	2004-03-03	Re-partitioned to match Main Specification Volume/Part partitioning. TSE 479, 487, 495, 496, 497, 498, 501, 509, 510, 513, 527, 535, 536, and 556 incorporated
	D10R01	2004-03-15	Editorial changes
	D12r02	2004-03-18	Editorial changes. Changed reference and document numbering to D12 to reflect applicable Bluetooth version.
	1.2.1	2004-03-25	Editorial changes. Changed document numbering and revision number to conform with legacy system.
	1.2.2	2004-07-01	Changed page numbering to begin part with page 1 and made editorial changes to accommodate Vol. 1, Part A.
	2.0.E.0	2004-10-19	Incorporated changes for V2.0 + EDR Incorporated TSE 581 for TP/PROT/PIC/BV-03-C Incorporated TSE 645 for TP/PROT/ARQ/BV-06-C. Incorporated TSE 666 for TP/PROT/COD/BV-18-C and TP/PROT/COD/BV-19-C
	2.0.E.1	2004-10-20	Editorial change to TP/PHYS/TRX/BV
	2.0.E.2	2004-11-01	Add EDR Guard Time Measurement procedure to TP/PHYS/TRX/BV-06-E
10	2.0.E.3	2004-11-04	Editorial change and repagination. First version for 1.2/2.0/2.0 + EDR available for qualification
	2.0.E.4r0	2005-08-03	Incorporate TSE 723 to TP/PROT/CON/BV-01-C Incorporate TSE 735 for TP/PHYS/TRX/BV-06-E
	2.0.E.4r1	2005-09-19	Removed spec version 1.2 from title cover page Corrected version #, revision number #, & file name, Replaced outer parens in TP/PHYS/TRX/BV-06-E for start of symbol$_0$
11	2.0.E.4	2005-10-14	Prepare for publication.

Publication Number	**Revision History**	**Date**	**Comments**
12	2.0.E.5r0	2006-10	TSE 1889: Remove “Applicable if” clauses from all TSEs Add TP/PROT/ARQ/BV-33-C to TP/PROT/ARQ/BV-37-C for Packet Boundary Flag Add TP/PROT/ED/BV-01-C to TP/PROT/ED/BV-04-C for Erroneous Data Reporting Add TP/PROT/SSR/BV-01-C to TP/PROT/SSR/BV-07-C for Sniff Subrating Add TP/PHYS/INQ/BV-16|17|18-C for Extended Inquiry Response
	2.1.E.0r0 – 2.1.E.0r4	2006-11-01 2006-12-20	Rename document to 2.1.E.0 TSE 1889: Remove “Only for IUT …” statements TCMT add row for Sniff subrating Moved Uncertainties text to Notes sections Spec errata 1997: Erroneous data test cases (TP/PROT/ED/BV-01 to TP/PROT/ED/BV-04. Changes to EIR (TP/PHYS/INQ/BV-16,17,18) MSCs Removal of BI Test Purposes sections TCMT: TP/PROT/ARQ/BV-33, 34, 35, 36, 37: Change Features Baseband field and PICS reference to refer to Packet boundary flag information.
13	2.1.E.0	2006-12-27	Prepare for publication.
14	2.1.E.1	2007-05-01	TSE 2071: TP/PROT/ED/BV-03-C: correct MSC TSE 2148: TP/PROT/PIC/BV-04-C: correct MSC TSE 2127: TP/PROT/ARQ/BV-37-C TSE 2087: TP/PROT/SSR/BV-03-C, TP/PROT/SSR/BV-04-C TSE 2046: TP/PHYS/INQ/BV-16, TP/PIYS/INI/IV-1
	2.1.E.2r0-1	2008-02	TSE 2268: TP/PROT/COD/BV-21-C, TP/PROT/COD/BV-23-C: Change packet size to 80 Fixed text for TSE 2127 and 2087 changes (conditionalized deleted text had not been deleted).
15	2.1.E.2	2008-04	Prepare for publication.
16	4.0.0r0	2011-10-10	TSE 3481 TP/PHYS/TRX/BV-01-C. Remove test case.
	4.0.1r0	2012-12-20	Converted from FrameMaker file to Word file.

Publication Number	Revision History	Date	Comments
	4.0.1r1	2012-12-21	Connectionless Broadcast Change Request
	4.0.1r2	2013-01-03	Connectionless Broadcast Review: Removed test cases CB/BV-09 and CB/BV-10. Renumbered following test case to be -09 instead of -11.
	4.0.1r3	2013-01-07	Connectionless Broadcast Review: Editorial Changes (formatting and numbering issues, cross-references)
	4.0.1r4	2013-01-17	Connectionless Broadcast Review. Reinstated the test cases TP/PROT/CB/BV-09-C and TP/PROT/CB/BV-10-C to the test case (which made Slave Broadcast Timeout BV-11-C again). Edited per WG.
	4.0.1r5	2013-01-17	Review for formatting inconsistencies.
	4.0.1r6 –r7	2013-01-21, -24	Connectionless Broadcast BTI Review, Replaced conformance text with latest version Updated references in TP/PROT/CB/BV-01-C and TP/PROT/CB/BV-03-C. Update to TP/PROT/CB/BV-02-C Updated MSCs that read 4.X…. Deleted Section 6, Provisional Baseband Testing (EDR) Editorial update to references section and reference in test cases to reference CSA4 TCMT update: change BB 31/1 to 3a/1 Ensure consistent Synchronization Train capitalization
	4.0.1r8	2013-01-25	Connectionless Broadcast Review (Farooq) TP/PROT/CB/BV-02-C: Added to the initial condition, added steps f and g to the test procedure and edited the pass verdict.
	4.0.1r9	2013-01-28	Connectionless Broadcast Review (Magnus) Updated references in new test cases for CSA4 sections.
17	4.0.1	2013-02-19	Prepare for Publication

Publication Number	**Revision History**	**Date**	**Comments**
	4.0.2rT to Tr4	2013-07-02 to 2013-09-05	Template Conversion a) Fail Verdicts Removed b) New Pass/Fail Verdict Criteria section added **c)** Definitions/Abbreviations sections removed, added to References preamble.
	4.0.2r01	2013-09-05	TSE 5259: Updated TP/PHYS/TRX/BV-06-E and TP/PHYS/TRX/BV-07-E to TP/PHYS/TRX/BV-06-C and TP/PHYS/TRX/BV-07-C.
	4.1.0r01	2013-09-05	BR/EDR Secure Connections CR
	4.1.0r02	2013-09-25	Train Nudging and Generalized Interlaced Scan CR
	4.1.0r03	2013-10-09	Piconet Clock Adjust CR
	4.1.0r05	2013-10-27	TSE 5341: Update to MSC and Test Procedure for TP/PROT/ARQ/BV-37-C
	4.1.0r07	2013-10-31	Clarification of wording: The nonce used for AES-CCM encryption depends on the former transmissions and follows the same rules as normal conditions → The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal ACL connection. The nonce used for AES-CCM encryption is derived from the current master clock and follows the same rules as in a normal connection → The nonce used for AES-CCM encryption is derived using the same rules as applicable in a normal eSCO connection.
	4.1.0r10	2013-11-05	Comment resolution between Josselin and Magnus
	4.1.0r11	2013-11-06	Incorporation of Knut Odman's review
	4.1.0r12	2013-11-06	Re-incorporated Section 4.1.10
	4.1.0r13	2013-11-06	Editorial fixes to Section 4.1.10
	4.1.0r14	2013-11-07	Added TP/PHYS/ST/BV-01-C to the TCMT for Syncronization Train
18	4.1.0	2013-12-03	Prepare for Publication

Publication Number	Revision History	Date	Comments
	4.1.1r00	2014-04-08	TSE 5411: Corrected universally instances of “the Tester” to specify Upper or Lower where necessary. TSE 5581: Revised Test Procedure and Pass verdict for TP/XCB/BV-16-C and TP/XCB/BV-17-C. TSE 5585: Revised Pass verdict of TP/XCB/BV-05-C and TP/XCB/BV-06-C.
	4.1.1r01	2014-04-10	TSE 5584: Updated Test Procedure for TP/PHYS/INQ/BV-20-C and TP/PHYS/PAG/BV-21-C to correct the ms time to not transmit messages.
19	4.1.1	2014-07-07	TCRL 2014-1 Publication
	4.1.2r00	2014-10-16	TSE 5916: Corrected “Lower T” to “Lower Tester” in the pass verdict for TP/PROT/ARQ/BV-48-C and in the test procedures for TP/XCB/BV-06-C. TSE 5766: Clarified “Tester” in MSC and Test Procedure of TP/PROT/ARQ/BV-27-C, TP/PROT/ARQ/BV-28-C and TP/PROT/ARQ/BV-30-C. TSE 5767: Clarified steps outlined in the Pass verdict of TP/PHYS/INQ/BV-01-C, TP/PHYS/INQ/BV-03-C, TP/PHYS/INQ/BV-10-C, TP/PHYS/PAG.BV-01-C, TP/PHYS/PAG/BV-03-C, TP/PHYS/PAG/BV-05-C, TP/PHYS/PAG/BV-10-C and TP/PHYS/PAG/BV-12-C. TSE 5793: Correction for TP/PHYS/PAG/BV-21-C and TP/PHYS/INQ/BV-20-C to correctly implement TSE 5584. Updated Master and Slave to be capitalized. Updated BT clock to Bluetooth Clock.
	4.1.2r01	2014-10-28	Correction of a typo in TP/PHYS/INQ/BV-01-C.
	4.2.0r00	2014-11-17	Revved version to align with Core Specification Version 4.2 Release.
20	4.2.0	2014-12-03	Prepare for TCRL 2014-2 publication
	4.2.1r00	2015-10-07	TSE 6347: Corrected eSCO connection in test case notes for TP/PROT/ARQ/BV-40-C, TP/PROT/ARQ/BV-41-C, TP/PROT/CON/BV-10-C, TP/PROT/CON/BV-11-C, TP/PROT/CON/BV-12-C, TP/PROT/CON/BV-13-C, and TP/PROT/CON/BV-14-C.
21	4.2.1	2015-12-22	Prepared for TCRL 2015-2 publication
	4.2.2r00	2016-02-04	TSE 6792: Channel range restricted to 40–77.

Publication Number	Revision History	Date	Comments
	4.2.2r01	2016-02-29	TSE 6952: Deleted last initial condition from test cases TP/PROT/ED/BV-01-C through 04-C. Figure updated for TP/PROT/ED/BV-03-C: All IUT EV3 packets made optional.
	4.2.2r02	2016-04-21	Completed changes required for TSE 6952.
22	4.2.2	2016-07-13	Prepared for TCRL 2016-1 publication.
	5.0.0r00	2016-08-16	TSE 7327: Updated step 3 and 4, Pass Verdict, and Notes section for test case TP/PROT/ARQ/BV-30-C.
	5.0.0r01	2016-10-12	TSE 7660: Updated Connectionless Slave Broadcast Parameters: changed the names of the two “Timeout” parameters and added new “Sync scan window” and “Sync scan interval” parameters.
	5.0.0r02	2016-11-17	TSE 8111: Removed test case TP/PHYS/TRX/BV-05-C (Symbol Rate) from test spec body and TCMT.
23	5.0.0	2016-12-13	Approved by BTI. Prepared for TCRL 2016-2 publication.
	5.01r00	2017-03-08	TSE 8138: Moved TP/PHYS/TRX/BV-06-C EDR Guard Time TP/PHYS/TRX/BV-07-C EDR Synchronization Sequence and Trailer to RF.TS from the BB.TS to the RF.TS and removed from Table of Contents.
	5.0.1r01	2017-05-16	TSE 8138: In Section 3.2.1.2 TX/RX Timing, deleted Enhanced Data Rate Guard Time and Enhanced Data Rate Synchronization Sequence and Trailer. Test Case Mapping: Deleted the entire Enhanced Data Rate section that includes TP/PHYS/TRX/BV-06 and TP/PHYS/TRX/BV-07.
	5.01r02	2017-05-17	Converted to new Test Case ID conventions as defined in TSTO v4.1.
	5.0.1r03	2017-06-04	Converted to current test spec template.
24	5.0.1	2017-07-05	Approved by BTI. Prepared for TCRL 2017-1 publication.
	5.0.2r00	2017-10-13	TSE 9880: Revised BB/PHYS/PAG/BV-01-C test procedure and expected outcome; revised BB/PHYS/PAG/BV-20-C test purpose, test procedure, and expected outcome.

Publication Number	Revision History	Date	Comments
	5.0.2r01	2017-10-30	TSE 9940: Updated BB/PROT/ED/BV-02-C and 03-C test procedures and MSCs per the clarification from Erratum 7304. Errata 7304 clarifies the definition of valid eSCO packet headers to include "an allowed TYPE for the connection".
25	5.0.2	2017-12-07	Approved by BTI. Prepared for TCRL 2017-2 publication.
	5.0.3r00-02	2018-03-23 – 2018-05-14	TSE 10404 (rating 4): Added Bluetooth Core Vol 3 Part A to References. Added new Section 5.15 (Fragmented L2CAP Header) and test cases BB/PROT/FLH/BV-01-C and 02-C and their corresponding TCMT entries. TSE 10498 (rating 3): Added 95% tolerance to pass conditions in the Pass Verdict for test case BB/PROT/CON/BV-02-C and deleted the test note. TSE 7303 (rating 4): Updated test procedure, MSC, and added table for max sniff subrate parameters for test cases BB/PROT/SSR/BV-06-C and 07-C. Updated pass verdict and Notes.
26	5.0.3	2018-07-02	Approved by BTI. Prepared for TCRL 2018-1 publication.
	5.0.4r00-r01	2018-10-05 - 2018-10-08	TSE 10519 (rating 3): Updated MSC and test procedure steps for test cases BB/XCB/BV-16-C and BB/XCB/BV-17-C. TSE 10870 (rating 3): Updated test procedure step 7 for test cases BB/PROT/SSR/BV-06-C and 07-C. TSE 10931 (rating 1): Fixed typo in initial condition lower tester for test cases BB/XCB/BV-01-C to 04-C. TSE 10876 (rating 1): Updated initial condition and MSC for test case BB/PROT/SSR/BV-03-C. TSE 11043 (rating 2): Updated initial condition for test case BB/PROT/SSR/BV-04-C. TSE 11086 (rating 3): Updated MSC for sections "IUT as a Slave Entering Sniff Mode" and "IUT as a Master Entering Sniff Mode".
	5.1.0r00	2018-11-13	Updated revision number from 5.0.4 to 5.1.0 to align with the adoption of Core Specification version 5.1
27	5.1.0	2018-12-07	Approved by BTI. Prepared for TCRL 2018-2 publication.

Publication Number	Revision History	Date	Comments
	5.1.1r00–r03	2019-04-01–2019-05-15	TSE 11363 (rating 1): Replaced MSC for test case BB/PROT/ED/BV-03-C with revised Visio diagram included in the CR. TSE 11563 (rating 2): Updated MSC and steps d and e of test procedure BB/PROT/ARQ/BV-33-C and added notes after Pass Verdict. TSE 11439 (rating 3): Updated MSC, test procedure steps, and Notes for test case BB/PROT/ED/BV-02-C. TSE 11440 (rating 3): Updated sniff_subrating_instant for test case BB/PROT/SSR/BV-01-C.
28	5.1.1	2019-08-01	Approved by BTI. Prepared for TCRL 2019-1 publication.
	p29r00–r03	2019-09-18 – 2019-12-03	TSE 12110 (rating 1): Fixed references to align with changes made in erratum 11876. TSE 12512 (rating 2): Updated pass verdict for test case BB/PROT/COD/BV-16-C to support a delayed loopback behavior. Revised document numbering convention, setting last release publication of 5.1.1 as p28; added Publication Number column to Revision History. Added names to the Contributors list.
29	p29	2020-01-07	Approved by BTI on 2019-12-22. Prepared for TCRL 2019-2 publication.

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