LeCroy

UWB*Tracer*™/*Trainer*™
WiMedia Platform Certification Test Scripts
User Guide

Introduction

This document describes the procedure for using LeCroy's WiMedia Platform Certification test suite. This test suite is performed using the UWBTrainer exerciser operating as the "stimulus" device. Specially designed test scripts are used to create specific traffic conditions the test proper protocol behavior.

LeCroy's UWBTracer analyzer is used as the "monitoring" device. It captures the real response from the DUT / INTD. LeCroy's UWBTracer also is used to verify compliance using the included Verification Script Engine post processing application to identify violations in the Protocol Background Observation tests defined in section 3.2. of the WiMedia Platform Test Specification. Violation of any of the protocol rules listed in the background checks is grounds for failing WiMedia certification.

The current release of the UWB*Trainer* based certification scripts functions as a "TX only" test system. TX only Test systems are defined as capable of transmitting pre-defined frames at specified intervals. The system does not acknowledge or process received packets. In TX only tests, the tester must begin transmitting first and the DUT / INTD must join the established beacon group.

In all of the test cases for a TX only system, the tester transmits beacons with an interval of 65538 microseconds to ensure that it is the slowest device in the beacon group. All test system beacons have a unique EUI-48 and DevAddr and do not have the movable bit set unless otherwise indicated. By default the WiMedia Certification test suite will operate on TFC 1.

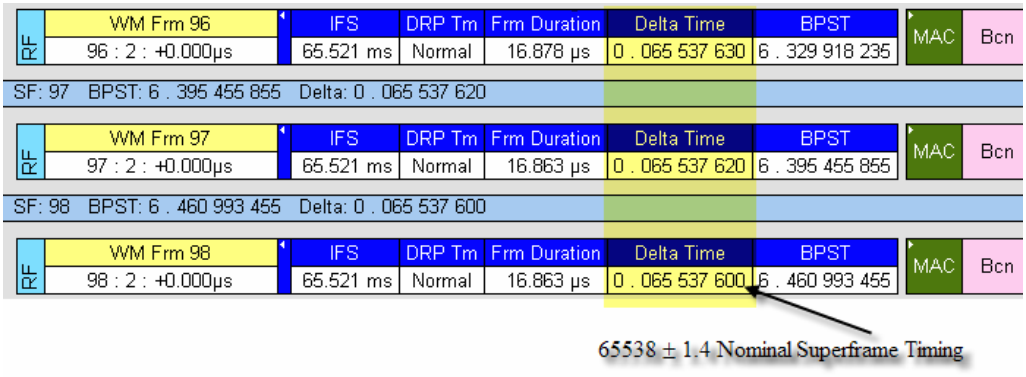
The UWBTrainer test system transmits all beacons with a compliant BP Length and a correctly formatted BPOIE. During the WiMedia Platform Certification workshops, each test is run against the submitted DUT or INTD device.

Test system calibration

This calibration procedure is run for the TX only test system before all other test cases are started. The calibrated beacon interval of 65538 $\pm$ 1.4 microseconds is used in all test cases unless otherwise specified.

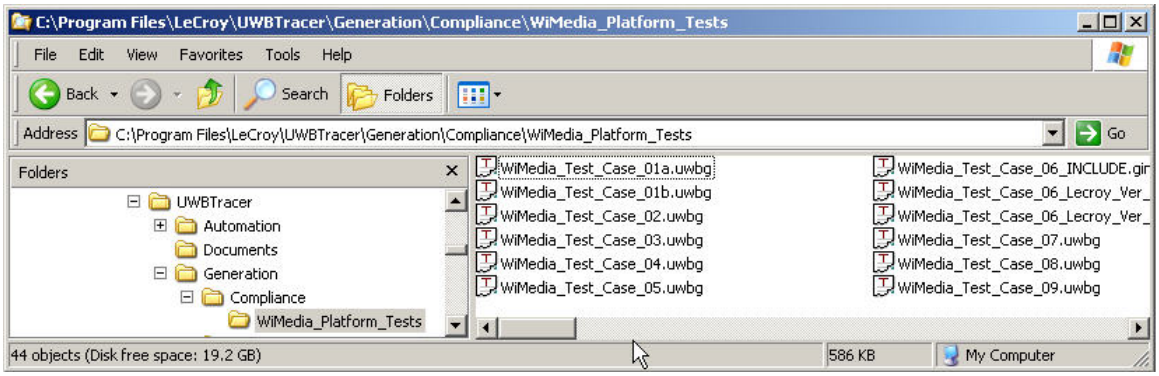
1. Start analyzer capture.
2. Standard test start-up sequence.
3. Stop analyzer capture and stop DUT and INTD. Observe nominal beacon interval.

4. Start analyzer capture.
5. Start test system beacon in slot 2 with a beacon interval of 65538 microseconds.
6. Stop analyzer capture. Check that analyzer interval is 65538 ± 1.4 microseconds. If not – adjust test system settings so the reported analyzer interval is 65538 microseconds.



Test Procedure Guide

The WiMedia Platform Test scripts for the UWBTrainer are available in the LeCroy>UWBTracer Program Directory called WiMedia_Platform_Tests:



The scripts may be opened and run from this directory for systems equipped with the UWBTrainer exerciser module.

Test Case 1a: TD.8.2.3.2 Beacon Join With BP Length Expansion

This test verifies that the DUT sets the slot states correctly in the Beacon Slot Info bitmap. Test system starts the beacon period and sends a beacon in slot 2 with a BP Length of 3. When the DUT powers on, it should join the beacon group in an available upper slot and signal (4 on – 4 off) in random signaling slot to extend the BP Length.

Test procedure

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2 with a BP Length of 3.
3. Standard test start-up sequence.
4. After 1 second, test system stops beaconing.
5. After at least 2 seconds, stop analyzer capture.

Notes:

- Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior.
- This test is repeated with the DUT/INTD on TFC's 1 through 7 during WiMedia Platform Certification tests.

Test Case 1b: TD.8.2.3.2 Beacon Join With BP Length Expansion

This test verifies that the DUT sets the BP length correctly and extends the length when the tester relocates to a higher slot. The tester begins beaconing in slot 9 with movable bit set. The DUT and INTD should join in a higher slot and set movable and contract to the lowest available slots.

Test procedure

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 9 with the movable bit not set and with a BP Length of 10.
3. Standard test start-up sequence.
4. After DUT and INTD join the test system expands its BP Length.
5. After 1 second, test system stops beaconing.
6. After at least 2 seconds, stop analyzer capture.

Notes:

- Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior
- It is allowable that the first DUT beacon can be marked movable without waiting 4 superframes (this is not required behavior). Both DUT and INTD must be marked movable by the 5th superframe after joining.

Test Case 2: TD.7.8.3 Beacon Slot Info Test

This test verifies that the DUT does not incorrectly change its BPOIE. The tester starts by beaconing normally as a single device in slot 2. It then skips beacon transmission in a single superframe X. The test system sends a beacon normally in superframe X+1 with the movable bit set to zero. The test system then sends a beacon in superframe X+2 with the movable bit set to one. Finally, the test system sends a beacon with an invalid FCS in superframe X+3. It repeats this sequence 100 times each time skipping after sending the 3rd beacon with an FCS error. The DUT and INTD should not change their current slot or movable status throughout this test.

Test procedure

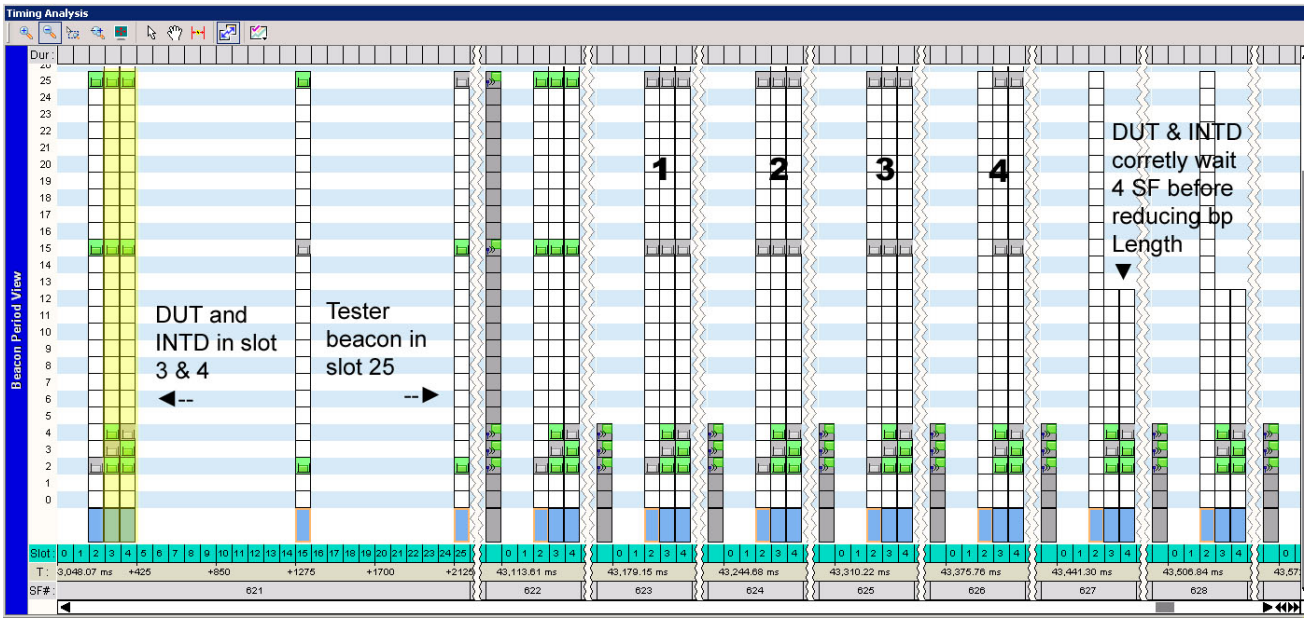
1. Start analyzer capture.
2. Standard test start-up sequence.
3. The test system creates the beacon group in slot 2 as a single device. The BP Length is set to 12.
4. The test system begins the 3 beacon + 1 skip cycle above indefinitely.
5. After 1 second, test system stops beaconing.
6. After at least 2 seconds, stop analyzer capture.

Notes:

- Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior**.** The DUT & INTD fail if they violate any checks defined in section 3.2. of the WiMedia Platform Test Specification.

Test Case 3: TD.8.2.3.4 Beacon Period Length Extension By Test System

This test verifies that the DUT correctly extends its BP length and properly operates after beacons are placed in upper slots. After a normal startup the tester starts sending additional beacons in signaling slot and slot 15 requiring the DUT & INTD to extend their BP length. The Tester then sends a beacon in a signaling slot with slot number 25. After 2 seconds, the test system stops sending the beacons in slots 15 and 25. The DUT and INTD should extend and then shorten their BP length appropriately while remaining in their current beacon slot.



In the UWBTracer Beacon Period Viewer, the height of the Columns represents the advertised BP length. The test system stops transmitting in SF 622 but the test beacon is still reported in slot 25 in prior superframe; At this point, the devices must wait until the next superframe to consider the slot 25 “unoccupied”. After waiting 4 more superframes, the devices correctly reduce their bp length in superframe 627.

Test procedure

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2 with a BP Length of 12.
3. Standard test start-up sequence. After 1 second, stop analyzer capture.
4. After 1 second, test system stops beaconing.
5. After at least 2 seconds, stop analyzer capture.

Notes:

- Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior. The DUT & INTD fail if they violate any checks defined in section 3.2. of the WiMedia Platform Test Specification.

Test Case 4: TD.8.2.3.5 Listen For Required Portion of a Slot Test

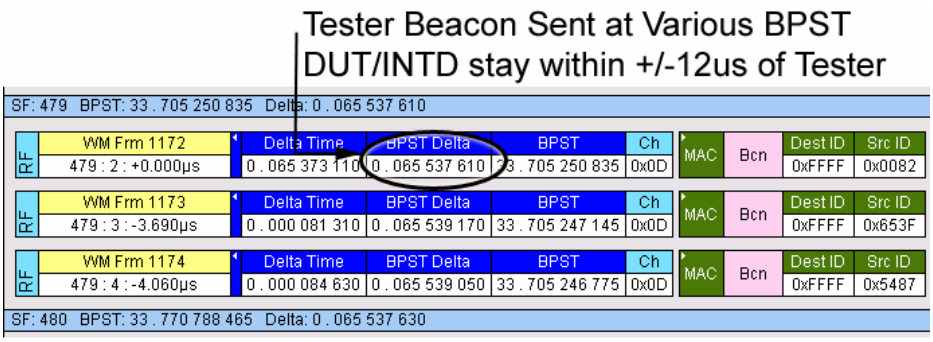
This test verifies that the DUT correctly synchronizes to beacons sent by tester with various beacon period start times (BPST). The test system begins by transmitting a beacon in slot 2 using the normal superframe interval of 65538 microseconds. After the DUT and INTD power up, the test system transmits every tenth beacon in slot 2 with a start time that is X microseconds early or later from the nominal location. Every tenth Superframe this is repeated with random values of X, from 12 to 0 microseconds early (-guardtime to +guardtime microseconds). The Test System repeats this sequence with beacons getting sent early and late for 4 superframes. The DUT and INTD must continue to stay synchronized with the tester without forming an Alien Beacon Group.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2 with a beacon interval of 65538 microseconds. The BP Length is set to 12.
3. Standard test start-up sequence.
4. The test system starts sending every 10th beacon early- from 12 to 0 microseconds. The tester continues beaconing but instead sends every 10th beacon late. The beacons are sent from 0 to 8 microseconds late in intervals of one microsecond. The sequence repeats 3 times.
5. Stop analyzer capture.

Notes:

- Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior. The DUT & INTD fail if they violate any checks defined in section 3.2. of the WiMedia Platform Test Specification.



Test Case 5: TD.8.2.4.1 DevAddr Beacon Slot Collision

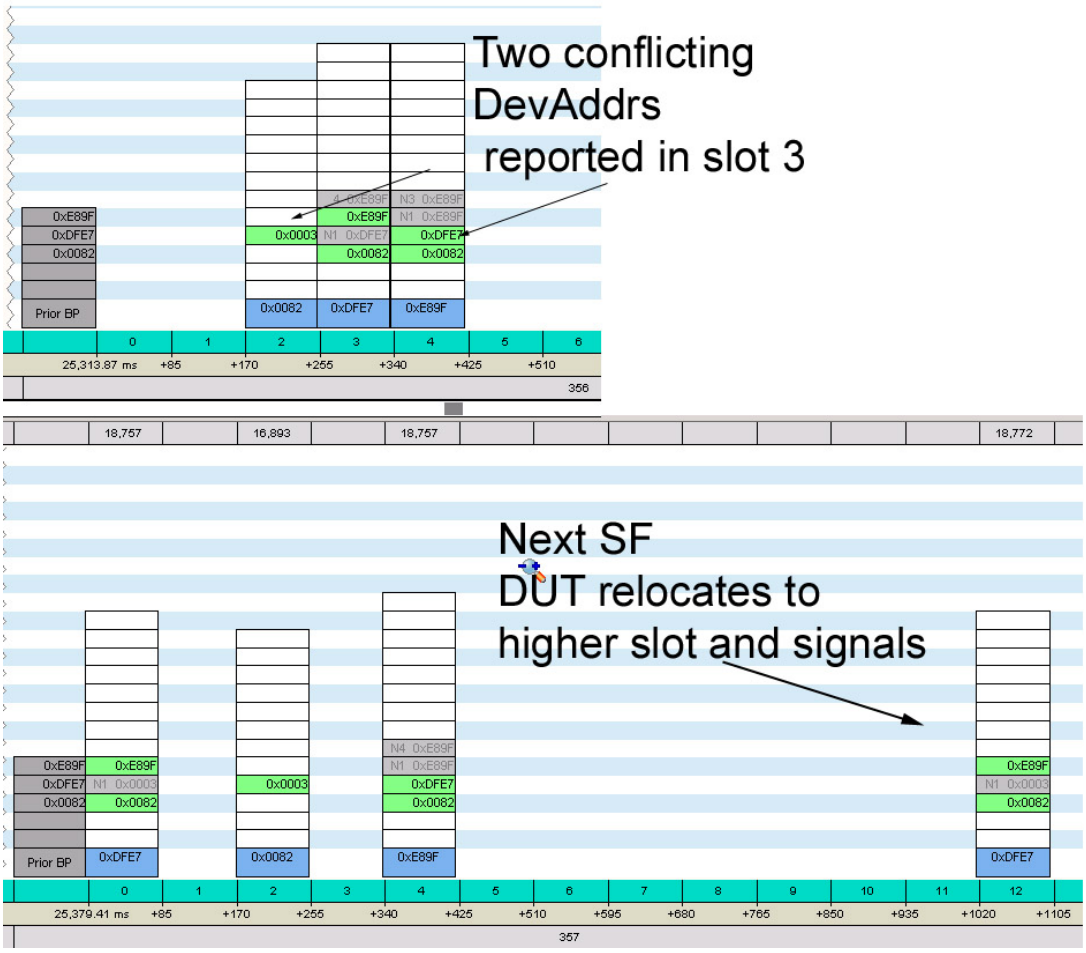
This test verifies that the DUT responds correctly when it receives a beacon that indicates a device with a different DevAddr is using its beacon slot. Per beacon protocol rules, the device should relocate to a higher available slot.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2. The BP Length is set to 12.
3. Standard test start-up sequence.
4. The test system starts sending its beacons with a BPOIE indicating a device with a DevAddr of 3 is occupying slot 3.
5. One second after step 4, the test system starts sending its beacons with a BPOIE indicating that a device with a DevAddr of 3 is occupying slot 3 and a device with a DevAddr of 4 is occupying slot 4.
6. One second after step 5, the test system stops indicating that devices occupy slot 3 and slot 4.
7. One second after step 6, the test system repeats steps 4-6.
8. Step 7 is repeated 10 times.
9. Wait 1 second and then stop analyzer capture.

Notes:

- Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior. The DUT & INTD fail if they violate any checks defined in section 3.2. of the WiMedia Platform Test Specification.



LeCroy UWBTracer Beacon Viewer shows BPOIE information for each superframe.

Test Case 6: TD.8.1.1.1 Generated DevAddr Conflict Test

This test verifies that the DUT responds correctly when it receives a beacon that indicates a device with the same DevAddr is using its beacon slot. The DUT or INTD must change its DevAddr by the superframe after it receives a beacon indicating a DevAddr conflict.

Test procedure:

1. Test system starts the beacon period and sends a beacon in slot 2. The BP Length is set to 12.
2. Start analyzer capture.

3. Standard test start-up sequence.
4. Find DevAddr for DUT and INTD.
5. The test system adds beacons in slot 5 and slot 6 with the beacon in slot 5 using the DUT DevAddr and the beacon in slot 6 using the INTD DevAddr. When the test system joins, it sends the beacon for slot 6 with the signaling slot bit set in a signaling slot 4 times.
6. Find the new DevAddr for the DUT and INTD.
7. The test system changes its BPOIE in the beacon in slot 5 to indicate that a device with the DUT DevAddr is in slot 6. The test system also changes its BPOIE in the beacon in slot 6 to indicate that a device with the INTD DevAddr is in slot 5.
8. After 2 seconds, test system stops beaconing.
9. After at least 2 seconds, stop analyzer capture.

Notes:

- When the DUT/INTD change their (generated) DevAddr, the Target/Owner DevAddr in their reservation should change accordingly. Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior. The DUT & INTD fail if they violate any checks defined in section 3.2. of the WiMedia Platform Test Specification.

Test Case 7: TD.8.2.4.4 Beacon Slot Collision After Skipped Transmission

This test verifies that the DUT responds correctly when it receives a beacon that indicates its beacon slot is occupied the superframe after it skipped beacon transmission. The test verifies the DUT/INTD skip a superframe at least once every 128 SF and properly detect beacon slot collision when reported in Tester BPOIE.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2. The BP Length is set to 12.
3. Standard test start-up sequence.
4. The test system starts sending additional beacons in slot 3 and slot 4.
5. Wait 30 seconds or until the DUT and INTD have moved into beacon slots 5 and 6, whichever occurs first.
6. Test system stops beaconing.
7. After at least 2 seconds, stop analyzer capture.

Notes

- Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior. The DUT & INTD fail if they violate any checks defined in section 3.2. of the WiMedia Platform Test Specification.

Test Case 8: TD.8.2.4.2 BcstAddr Beacon Slot Collision (Optional)

This test verifies that the DUT responds correctly when it receives a beacon with a BPOIE with BcstAddr in its beacon slot. The test uses special address BcstAddr for the DevAddr in the BPOIE sent by the test system. This indicates a collision with the DUT beacon in slot 3. The DUT must properly relocate its beacon following the third consecutive superframe in which it receives a test system beacon with the BcstAddr conflict.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2. The BP Length is set to 12.
3. Standard test start-up sequence.
4. The test system starts sending its beacons with a BPOIE indicating a device with a DevAddr of BcstAddr is occupying slot 3.
5. One second after step 4, the test system starts sending beacons with a BPOIE indicating devices with a DevAddr of BcstAddr are occupying slots 3 and 4.
6. Stop analyzer capture.

Notes

- Background observation checks verify DUT & INTD follow correct slot relocation behavior. The DUT & INTD fail if they violate any checks defined in section 3.2. of the WiMedia Platform Test Specification.

Test Case 9: TD.8.4.1.2 Conflicting Reservation – Whole Superframe – Alien BP

This test verifies that a DUT will not transmit in reservations advertised by other devices when it receives beacons indicating reservations with conflicting types for the same MAS.

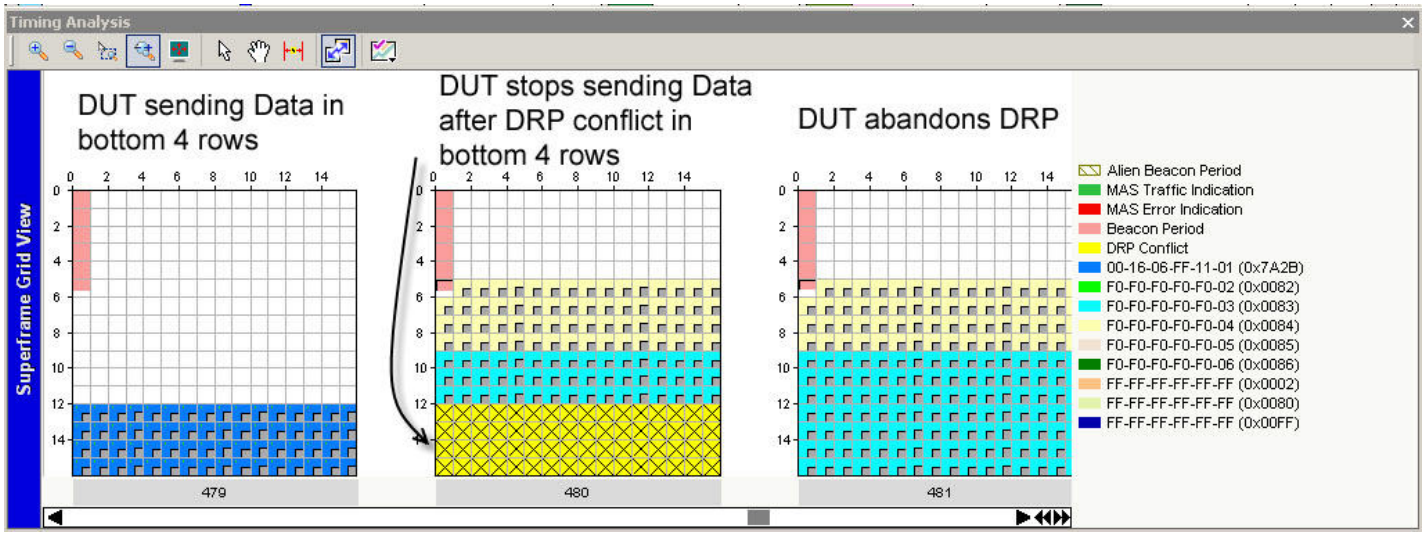
Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2 with a BPOIE that indicates that slots 3, 4, 5, and 6 are occupied. The BP Length is set to 16.
3. Standard test start-up sequence.
4. The test system begins to transmit beacons in slots 3, 4, 5, and 6 that contain DRP IEs that reserve the whole superframe except the first 5 MAS with reservation type Alien BP.
5. After 2 seconds, test system stops beaconing.
6. After at least 2 seconds, stop analyzer capture.

Notes:

In addition to passing the normal background checks, the following compliance points are manually verified:

- The DUT/INTD cease sending CTRL / DATA packets in the same SF in which the tester introduces its conflicting DRP IE
- Devices are allowed to keep their reservation as long as they don't transmit in a reserved MAS
- The DUT and INTD are allowed to stop demonstrating operation and/or beacon transmission once the conflict is created



LeCroy UWBTracer Superframe Grid View shows MAS slots reserved for each superframe.

Test Case 10: TD.8.2.5.1 Beacon Period Contraction In Move Cases

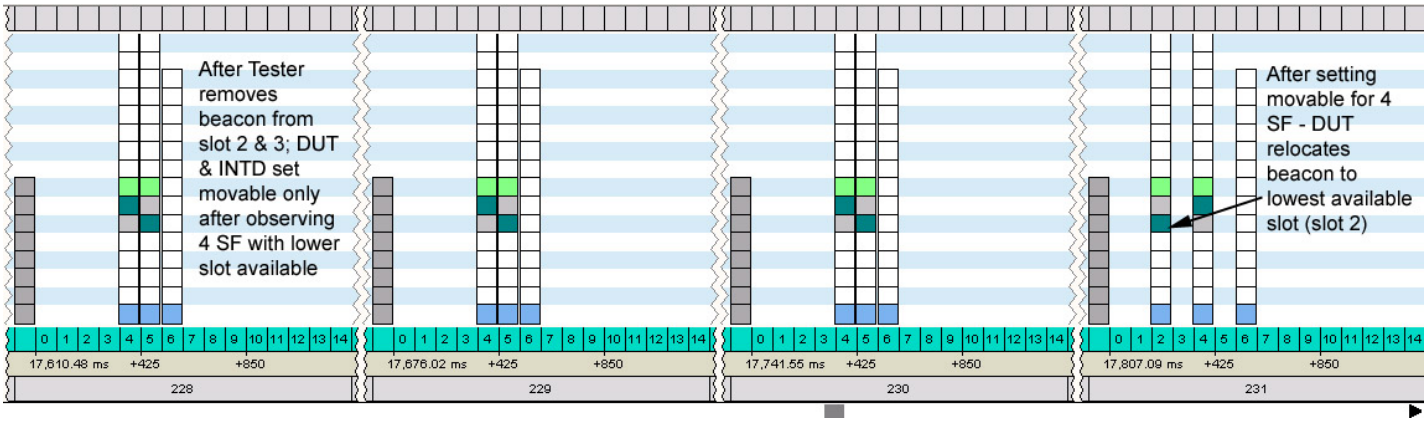
This test verifies that the DUT will relocate its beacon to a lower slot when required by the beacon protocol. The tester occupies slots 2 and 3 then begins sending beacon in slot 6 (non-movable). Test makes slot 2 & 3 available and after 4 superframes, DUT & INTD should set movable and contract after 4 additional superframes.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slots 2 and 3. The BP Length is set to 13.
3. Standard test start-up sequence.
4. The test system starts transmitting an additional beacon in slot 6 and a signaling slot without the movable bit set.
5. The test system stops sending the beacons in slot 2 and 3.
6. After 2 seconds, test system stops beaconing.
7. After at least 2 seconds, stop analyzer capture.

Notes:

• Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior.



Test Case 11: TD.8.1.4.2 Conflicting Reservation – DUT Reservation Only – Alien DRP

This test verifies that the DUT follows reservation size and location rules when it operates on an empty channel.

Test procedure:

1. Start analyzer capture.
2. Test system starts transmitting a beacon with no reservations in slot 2. The BP Length is set to 12.
3. Standard test start-up sequence.
4. The test system begins to transmit a beacon in slot 5 that contains DRP IEs that reserve the top and bottom rows in the superframe. The reservation is of type Alien DRP.
5. After 2 seconds, test system stops beaconing.
6. After at least 2 seconds, stop analyzer capture.

Notes:

In addition to passing the normal background checks, the following points are manually verified:

- The DUT/INTD should stop sending ctrl/data in the superframe where the reservation conflict is introduced

- The DUT/INTD should relocate its reservation and continue transmitting in the new reservation.
- The DUT and INTD are allowed to temporarily cease demonstrating operation during this test case. Operation must automatically restart without manual intervention if it ceases and sufficient bandwidth remains on the channel.

Test Case 12: BPST Adjustment Limit

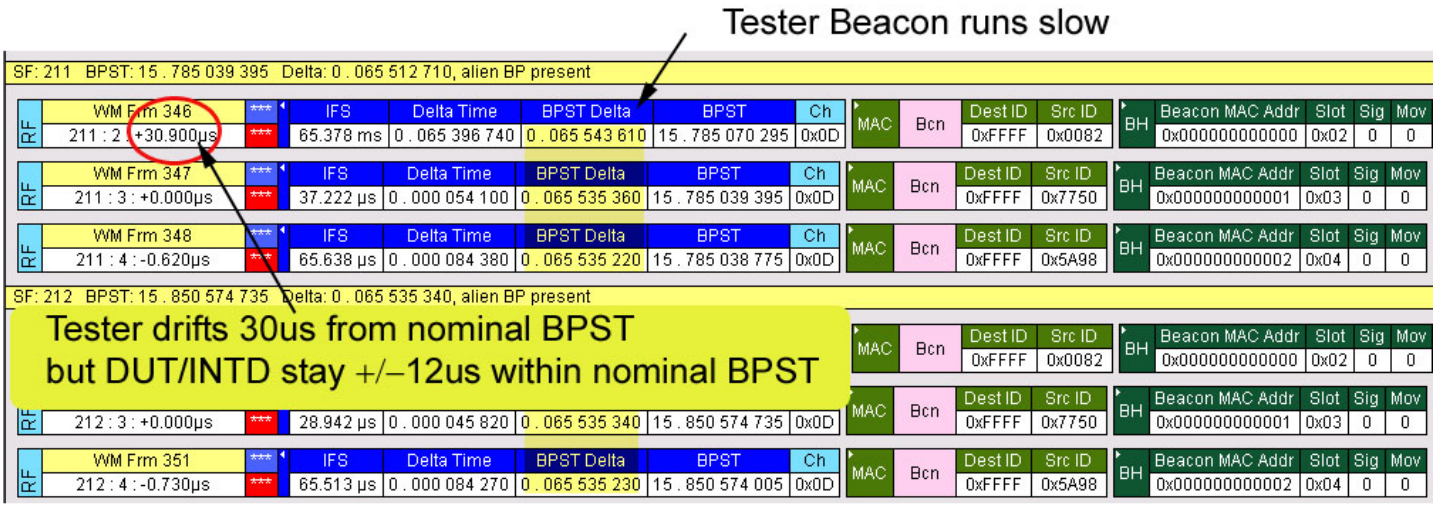
This test case verifies that the DUT & INTD do not adjust more than ±12us from the nominal slot boundary as the Test system beacon drifts out of sync.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2. The BP Length is set to 12.
3. Standard test start-up sequence.
4. The test system starts transmitting its beacons with an interval of 65544 microseconds.
5. After 2 seconds, test system stops beaconing.
6. After DUT and INTD are beaconing in slots 2 and 3 or at least 10 seconds (whichever occurs first), stop analyzer capture.

Notes:

- The DUT fails if it is not transmitting beacons at least 12 microseconds faster than the test system beacons at any point within 20 superframes of the test system beacon interval increase.



- The DUT and INTD are allowed to cease demonstrating operation and/or beacon transmission during this test case once synchronization with the test system has been lost. Beacon transmission must automatically restart without manual intervention if it ceases.

Test Case 13: TD.8.2.5.2 Beacon Period Contraction Where Move Is Not Allowed

This test verifies that the DUT will not relocate its beacon to a lower slot when a beacon in a higher indexed slot is movable. The tester occupies slots 2 and 3 then begins sending a movable beacon in slot 6 and makes slot 3 available. DUT/INTD should not contract while Tester beacon in slot 6 is movable.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slots 2 and 3. The BP Length is set to 13.
3. Standard test start-up sequence.
4. The test system starts transmitting an additional beacon in slot 6 and a signaling slot without the movable bit set.
5. The test system stops sending the beacon in slot 2 and simultaneously starts sending the beacon in slot 6 with the movable bit set.
6. After 2 seconds, test system stops beaconing.
7. After at least 2 seconds, stop analyzer capture.

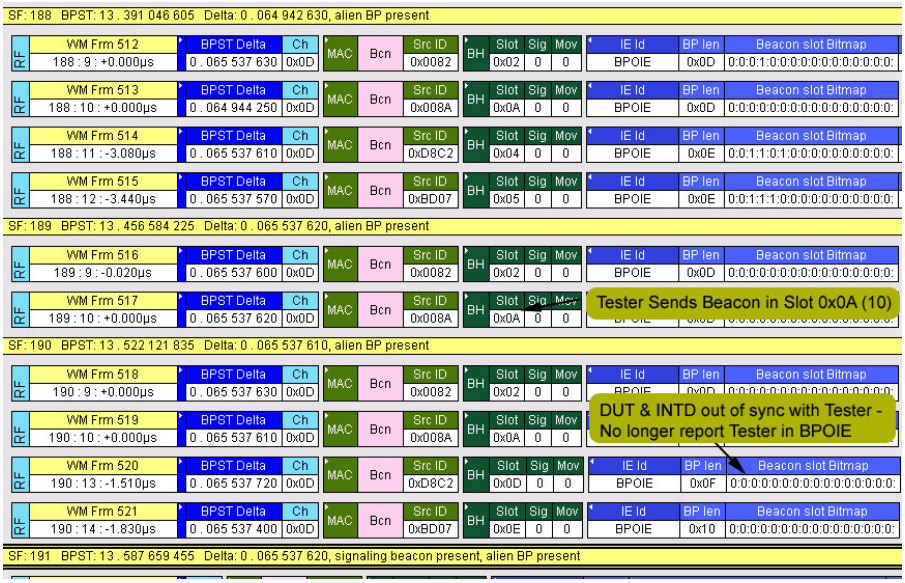
Test Case 14: TD.8.2.6.1 Overlapping Alien BP Requires BPST Realignment

This test verifies that the DUT will realign its BPST when it overlaps with an alien BPST.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slots 2 and 3. The BP Length is set to 13.
3. Standard test start-up sequence.
4. The test system changes the slot number in its beacon in slot 3 to 10, but continues to send it in slot 3.
5. In the following superframe, the test system stops transmitting the beacon in slot 2 and starts sending a beacon in the beacon slot immediately following the ‘slot 10’ beacon with the slot number set to 11.
6. After 10 seconds, test system stops beaconing.
7. After DUT and INTD are beaconing in slots 2 and 3 or at least 10 seconds (whichever occurs first), stop analyzer capture.

Notes:



- The DUT and INTD are allowed to cease demonstrating operation and/or beacon transmission during this test case once the alien beacon is detected. Beacon transmission must automatically restart without manual intervention if it ceases.

Test Case 15: TD.8.2.6.3 Updating BP Switch IE

This test verifies that the DUT will update its BP switch IE correctly when requested by the tester. After synchronizing with the DUT, the test system includes a BP Switch IE in one of its beacons with the following parameters:

a. Bp Move Countdown = 9 superframes.
b. Bp Offset = 8 slots.

The test system continues to send beacons with a BP Switch IE with Move Countdown value decrementing by one each superframe. The DUT must also include BPswitch and move countdown. Once the DUT correctly includes and updates a BP Switch IE it must follow the protocol rules by switching channel based on BP offset.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends beacons in slots 2 and 3. The BP Length is set to 13.
3. Standard test start-up sequence.
4. The test system adds a BP Switch IE to the beacon in slot 2 and starts the countdown value at 9 with a beacon slot offset value of 8.

5. When the countdown values in the BP Switch IE of the beacon in slot 2 reaches 5 the test system also sends a BP Switch IE in slot 3 with a countdown value of 9 and a beacon slot offset of 12.
6. The superframe following step 5, the BP Switch IE of the beacon in slot 2 is sent with a countdown value of 9 and a beacon slot offset value of 12. The BP Switch IE of the beacon in slot 3 begins to countdown normally.
7. After the countdown value for either BP Switch IE reaches zero, the test system ceases to send that beacon in any future superframes.
8. Stop analyzer capture.

Notes:

In addition to passing the normal background checks, the following points are manually verified:

- After receiving the tester's beacon with a BP Switch IE, the DUT/INTD should include a similar BP Switch IE in their own beacon and start counting down.
- Verify the countdown field of the DUT/INTD's BP Switch IE should be one greater than that of the test system.
- Verify that the SF after a device's countdown hits 0, the DUT beacon should be in its new slot (if its BP Switch IE had a non-zero Beacon Slot Offset) or should rejoin "normally" if its Beacon Slot Offset was 0.
- The DUT and INTD are allowed to cease demonstrating operation and/or beacon transmission during this test case once the BP Switch IE appears. Beacon transmission and demonstrated operation must automatically restart without manual intervention if either ceases.

Test Case 16: Conflicting Reservation – Whole Superframe – Hard DRP

This test verifies that the DUT follows reservation size and location rules when it operates on a channel with existing row reservation(s). The tester reserves the entire SF with a "hard" DRP. It transmits this reservation with the tiebreaker bit set to zero and a second time with it set to one. In one of these cases, the tester should "win", forcing the DUT/INTD to resolve the conflict by canceling the reservation or changing reservation status to zero.

Once the tester wins the tie-breaker, the DUT behavior should be verified against the protocol rules below. This test is only performed on devices that have a row reservation component when they operate on an empty channel.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2 with a BPOIE that indicates that slots 3, 4, 5, and 6 are occupied. The BP Length is set to 16.
3. Standard test start-up sequence.
4. The test system begins to transmit beacons in slots 3, 4, 5, and 6 that contain DRP IEs that reserve the whole superframe except the first 4 MAS with reservation type Hard DRP. The tiebreaker bit is set to one initially. After one second the tiebreaker bit is set to zero.
5. After 2 seconds, test system stops beaconing.
6. After at least 2 seconds, stop analyzer capture.

Notes:

In addition to passing the normal background checks, the following points are manually verified:

1. The DUT/INTD should stop sending ctrl/data in the superframe where the tiebreaker is lost.

   In addition - the DUT/INTD should perform one of the following:

   (a) Abandon the reservation
   (b) Change the status of its reservation to zero.

- If the DUT loses the tie-breaker in the first conflicting superframe (with tester's tiebreaker bit set to zero) and stops sending ctl/data, it should resume operation when the tester gives up its initial reservation.
- The DUT and INTD are allowed to stop demonstrating operation and/or beacon transmission once the conflict is created.

Test Case 17: Conflicting Hard DRP Reservation – DUT/INTD Reservation Only

This test verifies that a DUT will not transmit in reservations advertised by other devices when it receives beacons indicating reservations with conflicting types for the same MAS. The tester reserves several rows of the SF that conflicts with the DUT/INTD reservation. It transmits this reservation with the tiebreaker bit set to zero and a second time with it set to one. In one of these cases the tester should "win", forcing the DUT/INTD to relocate its reservation.

Test procedure:

1. Start analyzer capture.
2. Test system starts transmitting a beacon with no reservations in slot 2. The BP Length is set to 13.
3. Standard test start-up sequence.
4. The test system begins to transmit a beacon in slot 5 that contains DRP IEs that reserve the top and bottom rows in the superframe. The reservation is of type Hard DRP and the tiebreak bit is set to zero. When the test system joins, it sends the beacon for slot 5 with the signaling slot bit set in a signaling slot 4 times.
5. One second later the test system stops sending a beacon in slot 5.
6. After 5 seconds the test system begins to transmit a beacon in slot 5 that contains DRP IEs that reserve the top and bottom rows in the superframe. The reservation is of type Hard DRP and the tiebreak bit is set to one. When the test system joins, it sends the beacon for slot 5 with the signaling slot bit set in a signaling slot 4 times.
7. After 2 seconds, test system stops beaconing.
8. After at least 2 seconds, stop analyzer capture.

Notes:

In addition to passing the normal background checks, the following compliance points are manually verified:

1. The DUT/INTD should stop sending ctrl/data in the superframe where the tiebreaker is lost.

   In addition, the DUT/INTD should perform one of the following:

   a) Relocate the reservation to a different row
   b) Abandon the reservation
   c) Change the status of its reservation to zero.

- If the DUT loses the tie-breaker in the first conflicting superframe (with tester's tiebreaker bit set to zero) and stops sending ctl/data, it should resume operation when the tester gives up its initial reservation.
- The DUT is allowed to keep its reservation as long as it doesn't transmit in a reserved MAS
- The DUT and INTD are allowed to temporarily cease demonstrating operation during this test case. Operation must automatically restart without manual intervention if it ceases and sufficient bandwidth remains on the channel.

Test Case 18: Existing Reservation

This test verifies that the DUT follows reservation size and location rules when it operates on a channel with existing row reservation(s). Tester transmits with conflicting reservation in top and bottom rows of DRP. After DUT/INTD synchronize, they should avoid conflicting with existing reservation. This test is only performed on devices that have a row reservation capability when they operate on an empty channel.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2 with a DRP IE that reserves the first row and low row in the superframe with reservation type Hard DRP. The BP Length is set to 12.
3. Standard test start-up sequence.
4. The test system stops sending beacons.
5. After at least 2 seconds, stop analyzer capture.

Notes:

In addition to passing the normal background checks, the DUT/INTD should detect the existing reservation and establish its own reservation in non-conflicting MAS.

Test Case 19: TD.8.5.1.3 Synchronization with 10 Long Beacons

This test verifies that the DUT synchronizes correctly in the presence of multiple beacons in slots 2–11 with nominal intervals of 65538 microseconds and with 300 byte beacon payloads. Each beacon is sent a random number of microseconds early (0 to 4us) to verify the DUT tracks to the slower tester BPST.

Test procedure:

1. Start analyzer capture with filter set to only capture beacon frames.
2. Start test system transmitting beacons in slots 2–10 with nominal intervals of 65538 microseconds (as reported by the analyzer). Each beacon is sent a random number of microseconds from 0 to 4 earlier than the scheduled location based on the nominal interval. The BP Length is set to 21. Each test system beacon includes enough minimum length test mode IEs (with the subtype set to zero) to

increase the beacon payload length to at least 290 bytes, but not more than 300 bytes.

3. Standard test start-up sequence.
4. After 5 minutes, test system stops beaconing.
5. After at least 2 seconds, stop the analyzer capture.

Notes:

- Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior

Test Case 20: TD.8.5.1.1 Clock Accuracy

This test verifies that a DUT beacon interval indicates the minimum required clock accuracy.

Test procedure:

1. Start analyzer capture.
2. Standard test start-up sequence.
3. Stop analyzer capture.

Notes:

- Individual DUT beacon period intervals must be between 65536-1.4 to 65536+1.4 microseconds. For intervals longer than 1 superframe, the interval is divided by the number of superframes. The result must be between 65536-1.4 to 65536+1.4.

Test Case 21: Synchronization with 10 Beacons with the NULL EUI-48 (FF-FF-FF-FF-FF-FF) and the same DevAddr

This test verifies that a DUT will join an existing beacon group with 10 beacon slot occupied and slightly skewed BPST. Each beacon is transmitted earlier than the scheduled location (from 0 to 4us). The BP Length is set to 21. The EUI 48 in all the test system beacons is set to NULL and the DevAddr is set to 2.

Test procedure:

1. Start analyzer capture with filter set to only capture beacon frames.
2. Start test system transmitting beacons in slots 2–10 with nominal intervals of 65538 microseconds (as reported by the analyzer). Each beacon is sent a random number of microseconds from 0 to 4 earlier than the scheduled location based on the nominal interval. The BP Length is set to 21. The EUI-48 in all the test system beacons is set to NULL and the DevAddr is set to 2.
3. Standard test start-up sequence.
4. After 1 minute, test system stops beaconing.
5. After at least 2 seconds, stop the analyzer capture.

Notes:

- Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior.

Test Case 22: Maximum Beacon Slot Usage

This test verifies the DUT & INTD do not exceed the maximum beacon slot number of 96. The tester sends beacons sequentially incrementing the BPOIE to indicate fictitious devices are occupying slots 3 – 95 forcing the DUT & INTD to relocate their beacons to higher slots. It is allowed for devices to discontinue beaconing after occupying slot 20 or higher.

Test procedure:

1. Start analyzer capture
2. Test system starts transmitting a beacon in slot 2. The BP Length is set to 12.
3. Standard test start-up sequence.
4. The test system modifies the beacons in slot 2 with a BPOIE indicating a device with a DevAddr of 3 is occupying slot 3 and modifies the BP Length to 13.
5. One second after step 4, the test system modifies the beacons in slot 2 with a BPOIE indicating that device with a DevAddr of 3 is occupying slot 3 and a device with a DevAddr of 4 is occupying slot 4 and modifies the BP Length to 14.
6. Steps 4-5 are repeated with additional beacons slots occupied each time until the test system is occupying slots 3-95.
7. Note: Once the BP Length reaches 96 it is no longer incremented.
8. After 1 second, test system stops beaconing.

9. After at least 2 seconds, stop the analyzer capture.

Notes:

- The DUT or INTD are allowed to cease demonstrating operation and/or beacon transmission at any point after beacon slot relocation would place them in a beacon slot higher than slot 20.

Test Case 23: Slowly Drifting Alien BP Requires Repeated BPST Realignment

This test verifies that DUT/INTD adjust to the changing BPST or to cease operation and/or beaconing once synchronization has been lost. The DUT/INTD are also allowed to stop if adjusting to the "new" BPST would put place them in a slot higher than 20. The Tester runs “fast “. The DUT/INTD generally become unsynchronized with the Tester very quickly.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2 with calibrated intervals of 65538 microseconds. The BP Length is set to 12.
3. Standard test start-up sequence.
4. The test system changes its beacon period interval to 65533 microseconds.
5. After two minutes, the test system stops beaconing.
6. Once the DUT and INTD are beaconing in slots 2 and 3 or at least 10 seconds have elapsed (whichever occurs first), stop analyzer capture.

Notes:

The normal background checks are not valid for this test case. Manual review of captured trace is performed for the following:

- The BPST of the DUT and INTD must be no greater that 12 usec earlier or 85 usec later than the test system’s BPST.
- The DUT and INTD are allowed to cease demonstrating operation and/or beacon transmission during this test case once synchronization with the test system has been lost. However, beacon transmission must automatically restart without manual intervention if it ceases. The DUT or INTD are allowed to cease beacon transmission if a BPST realignment would place them in a beacon slot higher than slot 20.

- Overlapping Aliens cause large number of beacon period occupancy errors which is expected behavior in this test case.

Test Case 24: Lots of Small Traffic Join Test

This test verifies that a DUT will join an existing beacon group with 7 rows MAS reserved and lots of small frames under transmission.

Test procedure:

1. Start analyzer capture.
2. Test system starts the beacon period and sends a beacon in slot 2 with a DRP IE that reserves the lowest 7 rows in the superframe with Reservation Type set to Hard. The target of the reservation is the test system DevAddr. The BP Length is set to 12.
3. The test system begins to transmit data frames with a one byte payload at 200 Mbps with SIFS separation throughout the 7 row reservation. The destination address for the data frames is the test system DevAddr.
4. Standard test start-up sequence.
5. After 1 minute, test system stops beaconing.
6. After at least 2 seconds, stop analyzer capture.

Notes:

- Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior

- In the case where a device joins the beacon group in a slot not covered by the shortest BP Length in the group, that device is required to send a beacon in random signaling slot (for up to 4 SFs).

Test Case 25: Lots of Large Traffic Join Test

This test verifies that a DUT will join an existing beacon group with 7 rows MAS reserved with a hard DRP. Tester transmits multiple data frames with 4k byte transfers during reserved MAS slots.

Test procedure:

1. Start analyzer capture.

2. Test system starts the beacon period and sends a beacon in slot 2 with a DRP IE that reserves the lowest 7 rows in the superframe with reservation type Hard DRP. The target of the reservation is the test system DevAddr. The BP Length is set to 12.
3. The test system begins to transmit data frames with a 4095 byte payload at 200 Mbps with SIFS separation throughout the 7 row reservation. The destination address for the data frames is the test system DevAddr.
4. Standard test start-up sequence.
5. After 1 minute, test system stops beaconing.
6. After at least 2 seconds, stop analyzer capture.

Notes:

- Background observation checks verify DUT & INTD follow correct signaling and slot contraction behavior

Test Case 26: Shutdown Test

This test verifies device properly stops beaconing in shutdown / standby mode. Tester starts by transmitting beacons in slots 2–10 with each beacon sent earlier or later than the scheduled BPST (from 0 +/- 4us). After 30 seconds power is removed from DUT & INTD device and trace is reviewed verify proper beacon behavior.

Test procedure:

1. Start analyzer capture with filter set to only capture beacon frames.
2. Start test system transmitting beacons in slots 2–10 with nominal intervals of 65538 microseconds (as reported by the analyzer). Each beacon is sent a random number of microseconds from 0 to 4 earlier than the scheduled location based on the nominal interval. The BP Length is set to 21. The EUI-48 in all the test system beacons is set to NULL and the DevAddr is set to 2.
3. Standard test start-up sequence.
4. After 30 seconds, the DUT and INTD are shut down by using a power control on the device or by unplugging the power cable (if no control is present).
5. After 1 minute, test system stops beaconing.
6. Stop the analyzer capture.

Notes:

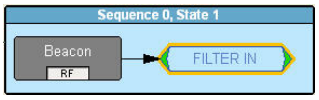
- Background observation checks verify DUT & INTD follow correct beacon group join behavior.

- If the DUT or INTD are connected to a PC the test is repeated with PC placed into standby or hibernation during step 4.

Test Case 27: Bad Link Test

This test verifies that a DUT will join and stay synchronized with the tester under faulty link conditions.

Test procedure:



1. Start analyzer capture with filter set to only capture beacon frames.
2. Start test system transmitting beacons in slots 2–10 with nominal intervals of 65538 microseconds (as reported by the analyzer). Each beacon is sent a random number of microseconds from 0 to 4 earlier than the scheduled location based on the nominal interval. The BP Length is set to 21. The beacons each contain a BPOIE that properly indicates the presence of the other test system beacons. In addition: Each of the test system beacons have the following behavior.
   a) Randomly transmit FCS errors 10% of the time.
   b) Randomly do not transmit 10% of the time.
   c) Randomly indicate that other test system beacons are received with an HCS error 10% of the time.
   d) Randomly indicate that other test system beacons are not received 10% of the time.
   e) Randomly indicate that the other test system beacons are received with FCS errors 10% of the time.
3. Standard test start-up sequence.
4. Once step 3 is complete a test system beacon behaves as if there is a collision if its slot is reported with an HCS error three consecutive times by another test system beacon. This test system beacon is relocated to a random slot between slot 13 and 20 and then marks itself moveable and contracts back following normal protocol rules. If multiple collisions are detected at the same time – the test system chooses unique slots between 13 and 20 for relocation.
5. After 3 minutes, the test system beacons stop relocating due to collisions. At this point each test system beacon randomly reports HCS errors for slot 11 and slot 12 50% of the time.
6. After 2 minutes, test system stops beaconing.
7. After at least 2 seconds, stop the analyzer capture.

Notes:

- In addition to the normal background observation checks, verify DUT & INTD do not lose sync with tester through multiple slot contractions and expansions.