

ROUTING CONSORTIUM

Internet Group Management Protocol
Conformance Test Suite

Technical Document

Revision 2.1



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MODIFICATION RECORD

Version 2.1	August 21, 2014	<ul style="list-style-type: none">• Updated incorrect observable results in 8.5B and 8.5D
Version 2.0	July 21, 2008	<ul style="list-style-type: none">• Changed Name to IGMP Conformance Test Suite• Added Sections 7, 8, and 9.
Version 1.2	May 28, 2008	<ul style="list-style-type: none">• Fixed Minor Typos
Version 1.1	April 11, 2008	<ul style="list-style-type: none">• Fixed Minor Typos
Draft Version Complete	October 26, 2007	<ul style="list-style-type: none">• Initial Release

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James Kistruck	Data Connections
Timothy Winters	University of New Hampshire

INTRODUCTION

Overview

The University of New Hampshire's InterOperability Laboratory (IOL) is an institution designed to improve the interoperability of standards based products by providing an environment where a product can be tested against other implementations of a standard. This suite of tests has been developed to help implementers evaluate the functioning of their Internet Group Management Protocol version 3 (IGMPv3) implementations. The tests do not determine if a product conforms to the specifications, nor are they purely interoperability tests. Rather, they provide a method to isolate problems within a device. Successful completion of all tests contained in this suite does not guarantee that the tested device will operate with other IGMPv3 devices. However, these tests provide a reasonable level of confidence that the Router Under Test will function well in most multi-vendor IGMPv3 environments.

Test Software

The UNH IOL Testing Software is not a full IGMPv3 implementation; it is simply a packet generator that can transmit and receive packets. This allows the Testing Node to generate invalid packets and to simulate parts of the Internet Group Management Protocol. The Testing Software is not currently available to the public.

Acronyms

Acronyms used in this Test Suite:

TR: Testing Router
TN: Testing Node

When several entities of the same type are present in a test configuration, a number is appended to the acronym to yield a label for each entity. For example, if there were three testing routers in the test configuration, they would be labeled TR1, TR2 and TR3.

Timers and Default Values:

IGMPv3 defines several timers and default values. For the purpose of testing, all configurable timers and values are set to their defaults, unless otherwise noted in the test description. These defaults are given here for reference, taken or calculated from RFC3376:

Robustness Variable:	2
Query Interval:	125 seconds
Query Response Interval:	100 tenths of a second (10 seconds)
Group Membership Interval:	260 seconds [Robustness * Query Interval + Query Response Interval]
Other Querier Present Interval:	255 seconds [Robustness * Query Interval + ½ * Query Response Interval]
Startup Query Interval:	31.25 seconds [1/4 Query Interval]
Startup Query Count:	2 [Robustness]
Last Member Query Interval:	10 tenths of a second (1 second)
Last Member Query Count:	2 [Robustness]
Unsolicited Report Interval:	1 seconds
Last Member Query Time:	2 seconds [Last Member Query Interval * Last Member Query Count]
Older Version Querier Present Timeout:	260 seconds [Robustness * Query Interval + Query Response Interval]
Older Host Present Interval:	260 seconds [Robustness * Query Interval + Query Response Interval]

TEST ORGANIZATION

This document organizes tests by group based on related test methodology or goals. Each group begins with a brief set of comments pertaining to all tests within that group. This is followed by a series of description blocks; each block describes a single test. The format of the description block is as follows:

- Test Label:** The test label and title comprise the first line of the test block. The test label is composed by concatenating the short test suite name, the group number, and the test number within the group, separated by periods. The **Test Number** is the group and test number, also separated by a period. So, test label IGMP.1.2 refers to the second test of the first test group in the IGMP Conformance suite. The test number is 1.2.
- Purpose:** The Purpose is a short statement describing what the test attempts to achieve. It is usually phrased as a simple assertion of the feature or capability to be tested.
- References:** The References section lists cross-references to the specifications and documentation that might be helpful in understanding and evaluating the test and results.
- Discussion:** The Discussion is a general discussion of the test and relevant section of the specification, including any assumptions made in the design or implementation of the test as well as known limitations.
- Test Setup:** The Test Setup section describes the configuration of all devices prior to the start of the test. Different parts of the procedure may involve configuration steps that deviate from what is given in the test setup. If a value is not provided for a protocol parameter, then the protocol's default is used for that parameter.
- Procedure:** This section of the test description contains the step-by-step instructions for carrying out the test. These steps include such things as enabling interfaces, unplugging devices from the network, or sending packet from a test station. The test procedure also cues the tester to make observations, which are interpreted in accordance with the observable results given for that test part.
- Observable Results:** This section lists observable results that can be examined by the tester to verify that the RUT is operating properly. When multiple observable results are possible, this section provides a short discussion on how to interpret them. The determination of a pass or fail for each test is usually based on how the RUT's behavior compares to the results described in this section.
- Possible Problems:** This section contains a description of known issues with the test procedure, which may affect test results in certain situations.

REFERENCES

The following documents are referenced in this text:

- Request for Comments 3376 – Internet Group Management Protocol, Version 3
- Request for Comments 4604 – Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific Multicast
- Request for Comments 2236 – Internet Group Management Protocol, Version 2
- Request for Comments 1112 – Host Extensions for IP Multicasting

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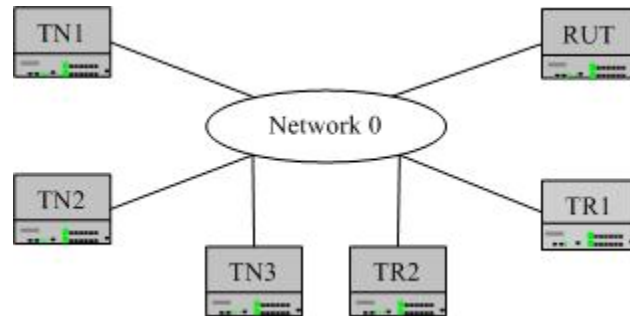
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Test IGMP.9.2: Forged IGMPv1 Report 131
Test IGMP.9.3: Forged IGMPv2 Leave Message 132

Common Test Setup

Test in this test suite may refer common test setup procedure defined for this section.

Common Topology



Common Test Setup

Summary: This basic setup procedure configures the routers with the base IGMPv3 setting for use with the Common Topology. Some tests may not utilize all nodes in the Common Test Setup. In those cases, disregard the un-used nodes.

1. Configure TR1, TR2, and TR3 Network 0 to have:
 - Robustness Variable of 2
 - Query Interval of 125
 - Query Response Interval of 100 $1/10^{\text{th}}$ of a second (10 seconds)
 - Last Member Query Interval of 10 $1/10^{\text{th}}$ of a second (1 second)

Common Test Cleanup

Summary: The cleanup procedure causes the devices to remove any IGMP information.

1. Disable IGMP on all devices.
2. Return all timers and variables to their defaults values.

GROUP 1: Basic Functionality

Scope:

The following tests are designed to verify basic IGMPv3 conformance on the RUT.

Overview:

These tests verify that the basic IGMPv3 router functionalities are performed correctly on the RUT. These functionalities include value configuration, Querier Election, Report reception, Query transmission, IGMPv3 security, and Router-Side Processing Suppression.

Test IGMP.1.1: Query Interval

Purpose: To verify that an IGMPv3 router properly accepts Query Interval configurations and to ensure an IGMPv3 router transmits General Queries as expected.

References:

- [RFC-3376] – 8.2

Discussion: The Query Interval is the interval between General Queries sent by the Querier. Default: 125 seconds. By varying the [Query Interval], an administrator may tune the number of IGMP messages on the network; larger values cause IGMP Queries to be sent less often.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Default Query Interval

1. Enable IGMPv3 on the RUT.
2. Observe the packets on all networks.

Part B: Query Interval 60

3. Configure a Query Interval of 60 on the RUT.
4. Enable IGMPv3 on the RUT.
5. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 2: The RUT must send a General Query every 125 seconds disregarding the startup queries.
- *Part B*
Step 5: The RUT must send a General Query every 60 seconds disregarding the startup queries.

Possible Problems:

- None

Test IGMP.1.2: Startup Query Interval Configuration

Purpose: To verify that an IGMPv3 router properly accepts Startup Query Interval configurations and to verify that Startup Queries are transmitted.

References:

- [RFC-3376] – 8.6

Discussion: The Startup Query Interval is the interval between General Queries sent by a Querier on startup. Default: 1/4 the Query Interval.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Default Startup Query Interval

1. Configure a Query Interval of 60 on the RUT.
2. Enable IGMPv3 on the RUT.
3. Observe the packets on all networks.

Part B: Startup Query Interval 30

4. Configure a Startup Query Interval of 30 on the RUT.
5. Enable IGMPv3 on the RUT.
6. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 3: The RUT must send two general queries 15 seconds apart.
- *Part B*
Step 6: The RUT must send two general queries 30 seconds apart.

Possible Problems:

- The RUT may not support configuration of the Startup Query Interval.

Test IGMP.1.3: Startup Query Count Configuration

Purpose: To verify that an IGMPv3 router properly accepts Startup Query Count configurations and to verify that Startup Queries are transmitted.

References:

- [RFC-3376] – 8.7

Discussion: The Startup Query Count is the number of Queries sent out on startup, separated by the Startup Query Interval. Default: the Robustness Variable.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Default Startup Query Count

1. Configure a Robustness Variable of 3 on the RUT.
2. Enable IGMPv3 on the RUT.
3. Observe the packets on all networks.

Part B: Startup Query Count 4

4. Configure a Startup Query Count of 4 on the RUT.
5. Enable IGMPv3 on the RUT.
6. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 3: The RUT must send 3 general queries 31.25 seconds apart.
- *Part B*
Step 6: The RUT must send 4 general queries 31.25 seconds apart.

Possible Problems:

- The RUT may not support configuration of the Startup Query Count.

Test IGMP.1.4: Querier Election

Purpose: To verify that an IGMPv3 router properly handles Querier Election.

References:

- [RFC 3376] – 6.6.2

Discussion: IGMPv3 elects a single querier per subnet using the same querier election mechanism as IGMPv2, namely by IP address. When a router receives a query with a lower IP address, it sets the Other-Querier-Present timer to Other Querier Present Interval and ceases to send queries on the network if it was the previously elected querier. After its Other-Querier Present timer expires, it should begin sending General Queries.

Test Setup: The [Common Test Setup](#) is performed on the RUT, TR1, and TR2. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: TR1 Elected Querier

1. Configure TR1 to have a lower IP address than the RUT on Network 0.
2. Enable IGMPv3 on the RUT.
3. Observe the packets on all networks.
4. Enable IGMPv3 on TR1. TR1 sends a General Query every Query Interval.
5. Observe the packets on all networks.

Part B: Other-Querier Present Timer Expires

6. Configure TR1 to have a lower IP address than the RUT on Network 0.
7. Enable IGMPv3 on the RUT.
8. Enable IGMPv3 on TR1.
9. Observe the packets on all networks.
10. IGMPv3 is disabled on TR1.
11. Observe the packets on all networks.

Part C: RUT Elected Querier

12. Configure the RUT to have a lower IP address than TR1 on Network 0.
13. Enable IGMPv3 on TR1.
14. Observe the packets on all networks.
15. Enable IGMPv3 on the RUT. The RUT sends a General Query every Query Interval.
16. Observe the packets on all networks.

Part D: Three Routers, RUT Middle Address, TR1 Elected Querier

17. Configure TR1 to have a lower IP address than the RUT on Network 0.
18. Configure TR2 to have a higher IP address than the RUT on Network 0.
19. Enable IGMPv3 on the RUT.
20. Observe the packets on all networks.
21. Enable IGMPv3 on TR2. TR2 sends a General Query.
22. Observe the packets on all networks.
23. Enable IGMPv3 on TR1. TR1 sends a General Query every Query Interval.
24. Observe the packets on all networks.
25. Disable IGMPv3 on TR2.
26. Enable IGMPv3 on TR2. TR2 sends a General Query.
27. Observe the packets on all networks.

Observable Results:

- *Part A*

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Step 3: The RUT must transmit General Queries every Query Interval.

Step 5: The RUT must cease transmission of Queries for at least Other Querier Present Interval.

- *Part B*

Step 9: TR1 must be elected Querier and the RUT must not be sending Queries.

Step 11: After Other Querier Present Interval, the RUT must resume transmission of General Queries.

- *Part C*

Step 14: TR1 must transmit General Queries every Query Interval.

Step 16: TR1 must not cease transmission of Queries for at least Other Querier Present Interval.

- *Part D*

Step 20: The RUT must transmit General Queries every Query Interval.

Step 22: The RUT must transmit General Queries every Query Interval.

Step 24: The RUT must cease transmission of Queries for at least Other Querier Present Interval.

Step 27: The RUT must not resume transmission of General Queries.

Possible Problems:

- None

Test IGMP.1.5: Basic Report Reception

Purpose: To verify that an IGMPv3 router accepts IGMPv3 reports.

References:

- [RFC 3376] – 6.4.2

Discussion: When a change in the global state of a group occurs in a system, the system sends either a Source-List-Change Record or a Filter-Mode-Change Record for that group. As with Current-State Records, routers must act upon these records and possibly change their own state to reflect the new desired membership state of the network.

Routers must query sources that are requested to be no longer forwarded to a group. When a router queries or receives a query for a specific set of sources, it lowers its source timers for those sources to a small interval of Last Member Query Time seconds.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: RUT to Exclude Nothing Reception

1. IGMPv3 is enabled on the RUT.
2. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
3. Observe the Group Membership Status on the RUT.

Part B: RUT to Include Nothing Reception

4. IGMPv3 is enabled on the RUT.
5. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
6. TN1 sends a Report to include nothing for the multicast group 224.0.6.130 on Network 0.
7. Observe the packets transmitted on all networks and the Group Membership Status on the RUT.

Part C: RUT to Include A Reception

8. IGMPv3 is enabled on the RUT.
9. TN1 sends a Report to include 10.10.10.10 for the multicast group 224.0.6.130 on Network 0.
10. Observe the Group Membership Status on the RUT.

Part D: RUT Multiple Group Records Reception

11. IGMPv3 is enabled on the RUT.
12. TN1 sends a Report to exclude nothing for the multicast groups 224.0.6.130 and 224.0.6.131 on Network 0.
13. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must be excluding nothing for the multicast group 224.0.6.130.
- *Part B*
Step 7: At first the RUT must be excluding nothing for the multicast group 224.0.6.130. The RUT must send two Group Specific Query for multicast group 224.0.6.130. After there is no response for the Group Specific Query the RUT must not show members present for multicast group 224.0.6.130.
- *Part C*
Step 10: The RUT must be including 10.10.10.10 for the multicast group 224.0.6.130.
- *Part D*
Step 13: The RUT must be excluding nothing for the multicast groups 224.0.6.130 and

224.0.6.131.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.1.6: Multiple Hosts

Purpose: To verify that an IGMPv3 router handles Reports from multiple hosts correctly.

References:

- [RFC 3376] – 6.4.2

Discussion: When a change in the global state of a group occurs in a system, the system sends either a Source-List-Change Record or a Filter-Mode-Change Record for that group. As with Current-State Records, routers must act upon these records and possibly change their own state to reflect the new desired membership state of the network.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Multiple Host Include/Exclude

1. IGMPv3 is enabled on the RUT.
2. TN1 sends a Report to include 10.10.10.10 for the multicast group 224.0.6.130 on Network 0.
3. TN2 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
4. TN1 continues to send is including 10.10.10.10 for the multicast group 224.0.6.130 on Network 0.
5. TN2 continues to send is excluding nothing for the multicast group 224.0.6.130 on Network 0.
6. Observe the Group Membership Status on the RUT.

Part B: Multiple Host Include/Include

7. IGMPv3 is enabled on the RUT.
8. TN1 sends a Report to include 10.10.10.10 for the multicast group 224.0.6.130 on Network 0.
9. TN2 sends a Report to include 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130 on Network 0.
10. TN1 continues to send is including 10.10.10.10 for the multicast group 224.0.6.130 on Network 0.
11. TN2 continues to send is including 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130 on Network 0.
12. Observe the Group Membership Status on the RUT.

Part C: Multiple Host Exclude/Exclude

13. IGMPv3 is enabled on the RUT.
14. TN1 sends a Report to exclude 10.10.10.10 for the multicast group 224.0.6.130 on Network 0.
15. TN2 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
16. TN1 continues to send is excluding 10.10.10.10 for the multicast group 224.0.6.130 on Network 0.
17. TN2 continues to send is excluding nothing for the multicast group 224.0.6.130 on Network 0.
18. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 6: The RUT must be excluding nothing for the multicast group 224.0.6.130.
- *Part B*
Step 12: The RUT must be including 10.10.10.10 and 10.10.10.11 for the multicast group

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224.0.6.130.

- *Part C*
Step 18: The RUT must be excluding nothing for the multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.1.7: Multiple Networks

Purpose: To verify that an IGMPv3 router maintains separate Group Memberships for each interface.

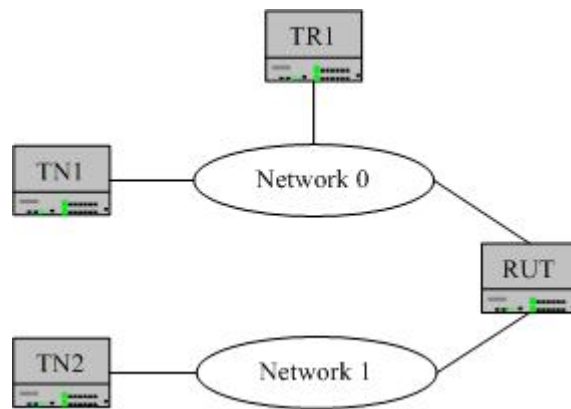
References:

- [RFC 3376] – 3.2

Discussion: In addition to the per-socket multicast reception state, a system must also maintain or compute multicast reception state for each of its interfaces.

IGMPv3 elects a single querier per subnet using the same querier election mechanism as IGMPv2, namely by IP address.

Test Setup: The devices are setup as seen below. The [Common Test Cleanup](#) is performed after each test.



Procedure:

Part A: Multiple Networks Include/Include

1. IGMPv3 is enabled on the RUT on Networks 0 and 1.
2. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
3. TN2 sends a Report to include 10.10.10.10 for the multicast group 224.0.6.130 on Network 1.
4. Observe the Group Membership Status on the RUT.
5. TN2 sends a Report to include nothing for the multicast group 224.0.6.130 on Network 1.
6. Observe the Group Membership Status on the RUT.

Part B: Multiple Networks Exclude/Exclude

7. IGMPv3 is enabled on the RUT on Networks 0 and 1.
8. TN1 sends a Report to exclude 10.10.10.10 for the multicast group 224.0.6.130 on Network 0.
9. TN2 sends a Report to include 10.10.10.10 for the multicast group 224.0.6.130 on Network 1.
10. Observe the Group Membership Status on the RUT.
11. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
12. Observe the Group Membership Status on the RUT.

Part C: Multiple Networks Include/Exclude

13. IGMPv3 is enabled on the RUT on Networks 0 and 1.
14. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
15. TN2 sends a Report to include 10.10.10.10 for the multicast group 224.0.6.130 on Network 1.
16. Observe the Group Membership Status on the RUT.
17. TN1 sends a Report to include nothing for the multicast group 224.0.6.130 on Network 0.
18. Observe the Group Membership Status on the RUT.

Part D: Multiple Networks Querier / Non-Querier

19. Configure TR1 to have a lower IP address than the RUT on Network 0.
20. Enable IGMPv3 on the RUT and TR1.
21. Observe the packets on all networks.

Observable Results:

- *Part A*
 - Step 4:** The RUT must be excluding nothing for the multicast group 224.0.6.130 on Network 0. The RUT must be including 10.10.10.10 for the multicast group 224.0.6.130 on Network 1.
 - Step 6:** After Last Member Query Time the RUT must be excluding nothing for the multicast group 224.0.6.130 on Network 0. The RUT must be including nothing for the multicast group 224.0.6.130 on Network 1.
- *Part B*
 - Step 10:** The RUT must be excluding 10.10.10.10 for the multicast group 224.0.6.130 on Network 0. The RUT must be including 10.10.10.10 for the multicast group 224.0.6.130 on Network 1.
 - Step 12:** After Last Member Query Time the RUT must be excluding nothing for the multicast group 224.0.6.130 on Network 0. The RUT must be including 10.10.10.10 for the multicast group 224.0.6.130 on Network 1.
- *Part C*
 - Step 16:** The RUT must be excluding nothing for the multicast group 224.0.6.130 on Network 0. The RUT must be including 10.10.10.10 for the multicast group 224.0.6.130 on Network 1.
 - Step 18:** After Last Member Query Time the RUT must be including nothing for the multicast group 224.0.6.130 on Network 0. The RUT must be including 10.10.10.10 for the multicast group 224.0.6.130 on Network 1.
- *Part D*
 - Step 21:** The RUT must be Non-Querier on Network 0 and Querier on Network 1.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.1.8: Router-Side Processing Suppression Flag Reception

Purpose: To verify that an IGMPv3 router suppresses Router Side Processing when a query with the S Flag set is received.

References:

- [RFC 3376] – 4.1.5, 6.6.3

Discussion: When set to one, the S Flag indicates to any receiving multicast routers that they are to suppress the normal timer updates they perform upon hearing a Query.

When building a group and source specific query for a group G, two separate query messages are sent for the group. The first one has the "Suppress Router-Side Processing" bit set and contains all the sources with retransmission state and timers greater than LMQT. The second has the "Suppress Router-Side Processing" bit clear and contains all the sources with retransmission state and timers lower or equal to LMQT. If either of the two calculated messages does not contain any sources, then its transmission is suppressed.

Test Setup: The [Common Test Setup](#) is performed on the RUT. TR1 has the lower IP address, a robustness variable of 7, a Query Interval of 125, Query Response Interval of 100 1/10th of a second, and a Last Member Query Interval of 30 1/10th of a second. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: The RUT suppresses Router-Side Processing

1. IGMPv3 is enabled on the RUT and TR1. TR1 is the Querier.
2. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.
3. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
4. TR1 sends one Group-and-Source Specific Query for the sources 10.10.10.10 and 10.10.10.11, multicast group 224.0.6.130 with the S Flag clear.
5. TN2 sends one Report including 10.10.10.10 for multicast group 224.0.6.130.
6. TR1 sends six additional Group-and-Source Specific Queries for the source 10.10.10.10, multicast group 224.0.6.130 with the S Flag set and six Group and Source Specific Queries for the source 10.10.10.11, multicast group 224.0.6.130 with the S Flag clear.
7. Observe the Group Membership Status on the RUT.

Part B: The RUT does not suppress Router-Side Processing

8. IGMPv3 is enabled on the RUT and TR1. TR1 is the Querier.
9. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.
10. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
11. TR1 sends seven Group-and-Source Specific Queries for the sources 10.10.10.10 and 10.10.10.11, multicast group 224.0.6.130 with the S Flag clear.
12. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 7: The RUT must be including 10.10.10.10 for the multicast group 224.0.6.130.
- *Part B*
Step 12: After Last Member Query Time, the RUT must not be including 10.10.10.10 or

10.10.10.11 for the multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.1.9: Router-Side Processing Suppression

Purpose: To verify that an IGMPv3 router suppresses Router Side Processing when a query with the S Flag set is received.

References:

- [RFC 3376] – 4.1.5, 6.6.3

Discussion: When set to one, the S Flag indicates to any receiving multicast routers that they are to suppress the normal timer updates they perform upon hearing a Query.

When building a group and source specific query for a group G, two separate query messages are sent for the group. The first one has the "Suppress Router-Side Processing" bit set and contains all the sources with retransmission state and timers greater than LMQT. The second has the "Suppress Router-Side Processing" bit clear and contains all the sources with retransmission state and timers lower or equal to LMQT. If either of the two calculated messages does not contain any sources, then its transmission is suppressed.

Test Setup: The RUT has a robustness variable of 7, a Query Interval of 125, Query Response Interval of 100 1/10th of a second, and a Last Member Query Interval of 30 1/10th of a second. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: The RUT suppresses Router-Side Processing

1. IGMPv3 is enabled on the RUT.
2. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.
3. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
4. Observe the packets on all networks.
5. TN2 sends one Report including 10.10.10.10 for multicast group 224.0.6.130.
6. Observe the packets on all networks.

Part B: The RUT does not suppress Router-Side Processing

7. IGMPv3 is enabled on the RUT.
8. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.
9. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
10. Observe the packets on all networks.

Observable Results:

- *Part A*
 - Step 4:** The RUT must send one Group-and-Source Specific Query for the sources 10.10.10.10 and 10.10.10.11, multicast group 224.0.6.130 with the S Flag clear.
 - Step 6:** The RUT must send six additional Group and Source Specific Queries for the source 10.10.10.10, multicast group 224.0.6.130 with the S Flag set and six Group and Source Specific Queries for the source 10.10.10.11, multicast group 224.0.6.130 with the S Flag clear.
- *Part B*
 - Step 10:** The RUT must send seven Group and Source Specific Query for the sources 10.10.10.10 and 10.10.10.11, multicast group 224.0.6.130 with the S Flag clear.

Possible Problems:

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- It may not be possible to view multicast group membership on the device.

Test IGMP.1.10: Robustness Variable

Purpose: To verify that an IGMPv3 router only allows certain Robustness Variables to be configured.

References:

- [RFC-3376] – 8.1

Discussion: The Robustness Variable allows tuning for the expected packet loss on a network. If a network is expected to be lossy, the Robustness Variable may be increased. IGMP is robust to (Robustness Variable - 1) packet losses. The Robustness Variable MUST NOT be zero, and SHOULD NOT be one. Default: 2

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Robustness Variable 0

1. Configure a Robustness Variable of 0 on the RUT.
2. Enable IGMPv3 on the RUT.
3. Observe the packets on all networks.

Part B: Robustness Variable 1

4. Configure a Robustness Variable of 1 on the RUT.
5. Enable IGMPv3 on the RUT.
6. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 3: The RUT must not allow a Robustness Variable of 0.
- *Part B*
Step 6: The RUT should not allow a Robustness Variable of 1.

Possible Problems:

- None

Test IGMP.1.11: Last Member Query Count

Purpose: To verify that an IGMPv3 router properly accepts Last Member Query Count configurations.

References:

- [RFC-3376] – 8.9

Discussion: The Last Member Query Count is the number of Group-Specific Queries sent before the router assumes there are no local members. The Last Member Query Count is also the number of Group-and-Source-Specific Queries sent before the router assumes there are no listeners for a particular source. Default: the Robustness Variable.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Default Last Member Query Count

1. Configure a Robustness Variable of 3 on the RUT.
2. Enable IGMPv3 on the RUT.
3. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.
4. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
5. Observe the packets on all networks.

Part B: Last Member Query Count 4

6. Configure a Last Member Query Count of 4 on the RUT.
7. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
8. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
9. Enable IGMPv3 on the RUT.
10. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 5: The RUT must send 3 Group-and-Source Specific Queries for the sources 10.10.10.10 and 10.10.10.11, multicast group 224.0.6.130.
- *Part B*
Step 10: The RUT must send 4 Group-Specific Queries for the multicast group 224.0.6.130.

Possible Problems:

- The RUT may not support configuration of the Last Member Query Count.
- The RUT may not default the last member query count to the robustness variable.

Test IGMP.1.12: Security

Purpose: To verify that an IGMPv3 router does not accept forwarded IGMPv3 messages.

References:

- [RFC-3376] – 9.1, 9.2, 9.3

Discussion: Routers SHOULD NOT forward Queries. This is easier for a router to accomplish if the Query carries the Router-Alert option.

Ignore the Report if you cannot identify the source address of the packet as belonging to a network assigned to the interface on which the packet was received. This solution means that Reports sent by mobile hosts without addresses on the local network will be ignored. Report messages with a source address of 0.0.0.0 SHOULD be accepted on any interface.

Ignore Report messages without Router Alert options [RFC-2113], and require that routers not forward Report messages. (The requirement is not a requirement of generalized filtering in the forwarding path, since the packets already have Router Alert options in them.) This solution breaks backwards compatibility with implementations of IGMPv1 or earlier versions of IGMPv2 which did not require Router Alert.

Ignore the State-Change Report message if you cannot identify the source address of the packet as belonging to a subnet assigned to the interface on which the packet was received. This solution means that State-Change Report messages sent by mobile hosts without addresses on the local subnet will be ignored. State-Change Report messages with a source address of 0.0.0.0 SHOULD be accepted on any interface.

Ignore State-Change Report messages without Router Alert options [RFC-2113], and require that routers not forward State-Change Report messages. (The requirement is not a requirement of generalized filtering in the forwarding path, since the packets already have Router Alert options in them.)

Test Setup: The [Common Test Setup](#) is performed on the RUT. The RUT is also connected on Network 1. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Query Not Forwarded

1. TR1 sends a General Query with a TTL of 2 and no Router Alert option onto Network 0 with a destination address on Network 1.
2. Observe the packets on all networks.

Part B: Non-Local Current-State Report Ignored

3. Enable IGMPv3 on the RUT.
4. TN1 sends a Report is excluding nothing for multicast group 224.0.6.130 on Network 0. The source address is from Network 1.
5. Observe the packets on all networks.

Part C: No Router Alert Option Current-State, Report Ignored

6. Enable IGMPv3 on the RUT
7. TN1 sends a Report is excluding nothing for multicast group 224.0.6.130 on Network 0. The Report does not have the Router Alert Option.
8. Observe the packets on all networks.

Part D: Non-Local State Change, Report Ignored

9. Enable IGMPv3 on the RUT.
10. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130 on Network 0. The source address is from Network 1.

11. Observe the packets on all networks.

Part E: No Router Alert Option State, Change Report Ignored

12. Enable IGMPv3 on the RUT.

13. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130 on Network 0. The Report does not have the Router Alert Option.

14. Observe the packets on all networks.

Part F: TN1 Report, Source 0.0.0.0, Accepted

15. Enable IGMPv3 on the RUT.

16. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 224.0.6.130 on Network 0 with a source address of 0.0.0.0.

17. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 2: The RUT must not forward the Query onto Network 1.
- *Part B*
Step 5: The RUT must not show members present for 224.0.6.130.
- *Part C*
Step 8: The RUT must not show members present for 224.0.6.130.
- *Part D*
Step 11: The RUT must not show members present for 224.0.6.130.
- *Part E*
Step 14: The RUT must not show members present for 224.0.6.130.
- *Part F*
Step 17: The RUT must be excluding nothing for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.1.13: Non-Querier Group Specific Query Reception

Purpose: To verify that an IGMPv3 router acts in response to Group Specific Queries properly.

References:

- [RFC 3376] – 6.6.1

Discussion: When a router sends or receives a query with a clear Suppress Router-Side Processing flag, it must update its timers to reflect the correct timeout values for the group or sources being queried. The following table describes the timer actions when sending or receiving a Group-Specific or Group-and-Source Specific Query with the Suppress Router-Side Processing flag not set.

<u>Query</u>	<u>Action</u>
Q(G,A)	Source Timer for sources in A are lowered to LMQT
Q(G)	Group Timer is lowered to LMQT

Test Setup: The [Common Test Setup](#) is performed on TR1 and the RUT. TR1 is configured to have the lower IP address. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Group Specific Query Reception, No Response

1. IGMPv3 is enabled on TR1 and the RUT. TR1 is Querier.
2. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
3. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
4. TR1 sends two Group Specific Queries, TN1 does not respond.
5. Observe the Group Membership Status on the RUT.

Part B: Group Specific Query Reception, Response

6. IGMPv3 is enabled on TR1 and the RUT. TR1 is Querier.
7. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
8. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
9. TR1 sends two Group Specific Queries, TN1 responds with a Report, is excluding nothing, for multicast group 224.0.6.130.
10. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 5: The RUT must not show members present for 224.0.6.130.
- *Part B*
Step 10: The RUT must show members present for 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.1.14: Non-Querier Group and Source Specific Query Reception

Purpose: To verify that an IGMPv3 router acts in response to Group and Source Specific Queries properly.

References:

- [RFC 3376] – 6.6.1

Discussion: When a router sends or receives a query with a clear Suppress Router-Side Processing flag, it must update its timers to reflect the correct timeout values for the group or sources being queried. The following table describes the timer actions when sending or receiving a Group-Specific or Group-and-Source Specific Query with the Suppress Router-Side Processing flag not set.

<u>Query</u>	<u>Action</u>
Q(G,A)	Source Timer for sources in A are lowered to LMQT
Q(G)	Group Timer is lowered to LMQT

Test Setup: The [Common Test Setup](#) is performed on TR1 and the RUT. TR1 is configured to have the lower IP address. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Group and Source Specific Query Reception, No Response

1. IGMPv3 is enabled on TR1 and the RUT. TR1 is Querier.
2. TN1 sends a Report to include 10.10.10.10 for multicast group 224.0.6.130.
3. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
4. TR1 sends two Group and Source Specific Queries, TN1 does not respond.
5. Observe the Group Membership Status on the RUT.

Part B: Group and Source Specific Query Reception, Response

6. IGMPv3 is enabled on TR1 and the RUT. TR1 is Querier.
7. TN1 sends a Report to include 10.10.10.10 for multicast group 224.0.6.130.
8. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
9. TR1 sends two Group and Source Specific Queries, TN1 responds with a Report is include 10.10.10.10 for multicast group 224.0.6.130.
10. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 5: The RUT must not show members present for 224.0.6.130.
- *Part B*
Step 10: The RUT must be including 10.10.10.10 for the multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.1.15: Router Group Membership

Purpose: To verify that an IGMPv3 router joins the appropriate multicast group.

References:

- [RFC 3376] – 6

Discussion: A multicast router performs the protocol described in this section over each of its directly-attached networks. If a multicast router has more than one interface to the same network, it only needs to operate this protocol over one of those interfaces. On each interface over which this protocol is being run, the router **MUST** enable reception of multicast address 224.0.0.22, from all sources (and **MUST** perform the group member part of IGMPv3 for that address on that interface).

Test Setup: The [Common Test Setup](#) is performed on the RUT, and TR1. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: RUT Non-Querier Joins multicast group 224.0.0.22

1. Configure TR1 to have a lower IP address than the RUT on Network 0.
2. Enable IGMPv3 on the RUT and TR1.
3. Observe the packets on all networks.

Part B: RUT Querier Joins multicast group 224.0.0.22

4. Enable IGMPv3 on the RUT.
5. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 3: The RUT must transmit an IGMPv3 Report is exclude nothing for multicast group 224.0.0.22.
- *Part B*
Step 5: The RUT must transmit an IGMPv3 Report to exclude nothing for multicast group 224.0.0.22.

Possible Problems:

- None

GROUP 2: Message Format

Scope:

The following tests are designed to verify that the IGMPv3 Router properly formats IGMPv3 Packets.

Overview:

These tests verify that the following IGMPv3 packet types are properly formatted: General Queries, Group-Specific Queries, and Group-and-Source Specific Queries. In particular these test check the formats of the Checksum, Group Address, Reserved, Max Response Code, and Querier's Query Interval Code fields. These tests also verify that the IGMPv3 Router validates the IP Destination, validates the checksum, and that the Router properly handles unrecognized codes. Finally, these test verify Additional Data, and Auxiliary Data report reception.

Test IGMP.2.1: General Query Message Format

Purpose: To verify that an IGMPv3 router properly formats its Query Messages.

References:

- [RFC-3376] – 4, 4.1.3, 4.1.8, 4.1.12

Discussion: IGMP messages are encapsulated in IPv4 datagrams, with an IP protocol number of 2. Every IGMP message described in this document is sent with an IP Time-to-Live of 1, IP Precedence of Internetwork Control (e.g., Type of Service 0xc0), and carries an IP Router Alert option [RFC-2113] in its IP header.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after the completion of all tests.

Procedure:

Part A: Time-to-Live

1. Enable IGMPv3 on the RUT.
2. Observe the packets on all networks.

Part B: TOS

3. Observe the packets on all networks.

Part C: Router Alert Option

4. Observe the packets on all networks.

Part D: Message Type

5. Observe the packets on all networks.

Part E: Number of Sources

6. Observe the packets on all networks.

Part F: Additional Data

7. Observe the packets on all networks.

Part G: IP Destination

8. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 2: The RUT's Query Message's IP Time-to-Live must be set to 1.
- *Part B*
Step 3: The RUT's Query Message's IP Type of Service must be set to 0xC0.
- *Part C*
Step 4: The RUT's Query Message must contain an IP Router Alert Option.
- *Part D*
Step 5: The RUT's Query Message's type must be set to 0x11.
- *Part E*
Step 6: The RUT's Query Message's Number of Sources must be set to 0.
- *Part F*
Step 7: The RUT's Query Message must not have additional data beyond the number of sources field.
- *Part G*
Step 8: The RUT's Query Message's IP Destination must be set to 224.0.0.1.

Possible Problems:

- None

Test IGMP.2.2: Group-Specific Query Message Format

Purpose: To verify that an IGMPv3 router properly formats its Query Messages.

References:

- [RFC-3376] – 4, 4.1.3, 4.1.8, 4.1.12

Discussion: IGMP messages are encapsulated in IPv4 datagrams, with an IP protocol number of 2. Every IGMP message described in this document is sent with an IP Time-to-Live of 1, IP Precedence of Internetwork Control (e.g., Type of Service 0xc0), and carries an IP Router Alert option [RFC-2113] in its IP header.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after the completion of all tests.

Procedure:

Part A: Time-to-Live

1. Enable IGMPv3 on the RUT.
2. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
3. TN1 sends a Report to include nothing for the multicast group 224.0.6.130 on Network 0.
4. The RUT sends a Group-Specific Query for 224.0.6.130 on Network 0.
5. Observe the packets on all networks.

Part B: TOS

6. Observe the packets on all networks.

Part C: Router Alert Option

7. Observe the packets on all networks.

Part D: Message Type

8. Observe the packets on all networks.

Part E: Number of Sources

9. Observe the packets on all networks.

Part F: Additional Data

10. Observe the packets on all networks.

Part G: IP Destination

11. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 5: The RUT's Group-Specific Query Message's IP Time-to-Live must be set to 1.
- *Part B*
Step 6: The RUT's Group-Specific Query Message's IP Type of Service must be set to 0xc0.
- *Part C*
Step 7: The RUT's Group-Specific Query Message must contain an IP Router Alert Option.
- *Part D*
Step 8: The RUT's Group-Specific Query Message's type must be set to 0x11.
- *Part E*
Step 9: The RUT's Group-Specific Query Message's Number of Sources must be set to 0.
- *Part F*
Step 10: The RUT's Group-Specific Query Message must not have additional data beyond the number of sources field.

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- *Part G*
Step 11: The RUT's Group-Specific Query Message's IP Destination must be set to 224.0.6.130.

Possible Problems:

- None

Test IGMP.2.3: Group-and-Source Specific Query Message Format

Purpose: To verify that an IGMPv3 router properly formats its Query Messages.

References:

- [RFC-3376] – 4, 4.1.3, 4.1.8, 4.1.12

Discussion: IGMP messages are encapsulated in IPv4 datagrams, with an IP protocol number of 2. Every IGMP message described in this document is sent with an IP Time-to-Live of 1, IP Precedence of Internetwork Control (e.g., Type of Service 0xc0), and carries an IP Router Alert option [RFC-2113] in its IP header.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after the completion of all tests.

Procedure:

Part A: Time-to-Live

1. Enable IGMPv3 on the RUT.
2. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.
3. TN1 sends a Report to include nothing for the multicast group 224.0.6.130 on Network 0.
4. The RUT sends a Group-and-Source Specific Query for the sources 10.10.10.10 and 10.10.10.11, multicast group 224.0.6.130 on Network 0.
5. Observe the packets on all networks.

Part B: TOS

6. Observe the packets on all networks.

Part C: Router Alert Option

7. Observe the packets on all networks.

Part D: Message Type

8. Observe the packets on all networks.

Part E: Number of Sources

9. Observe the packets on all networks.

Part F: Additional Data

10. Observe the packets on all networks.

Part G: IP Destination

11. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 5: The RUT's Group-and-Source Specific Query's IP Time-to-Live must be set to 1.
- *Part B*
Step 6: The RUT's Group-and-Source Specific Query's IP Type of Service must be set to 0xC0.
- *Part C*
Step 7: The RUT's Group-and-Source Specific Query must contain an IP Router Alert Option
- *Part D*
Step 8: The RUT's Group-and-Source Specific Query's type must be set to 0x11.
- *Part E*
Step 9: The RUT's Group-and-Source Specific Query Message's Number of Sources must be set to 2.

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- *Part F*
Step 10: The RUT's Group-and-Source Specific Query Message must not have additional data beyond the two source addresses.
- *Part G*
Step 11: The RUT's Group-and-Source Specific Query Message's IP Destination must be set to 224.0.6.130.

Possible Problems:

- None

Test IGMP.2.4: Unrecognized Codes

Purpose: To verify that an IGMPv3 router properly handles unrecognized message types and record types.

References:

- [RFC-3376] – 4, 4.2.12

Discussion: Unrecognized message types **MUST** be silently ignored. Other message types may be used by newer versions or extensions of IGMP, by multicast routing protocols, or for other uses.

Unrecognized Record Type values **MUST** be silently ignored.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Unrecognized Message Type

1. Enable IGMPv3 on the RUT.
2. TR1 sends an IGMP packet with the message type set to 0x83.
3. Observe the packets on all networks.

Part B: Unrecognized Record Type

4. Enable IGMPv3 on the RUT.
5. TN1 sends an IGMP report with the record type set to 7.
6. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 3: The RUT must not crash or generate invalid packets.
- *Part B*
Step 6: The RUT must not crash or generate invalid packets.

Possible Problems:

- None

Test IGMP.2.5: Checksum

Purpose: To verify that an IGMPv3 router properly sets and verifies the IGMPv3 Checksum.

References:

- [RFC-3376] – 4.1.2, 4.2.2

Discussion: The Checksum is the 16-bit one's complement of the one's complement sum of the whole IGMP message (the entire IP payload). For computing the checksum, the Checksum field is set to zero. When receiving packets, the checksum MUST be verified before processing a packet. [RFC-1071]

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. The [Common Test Cleanup](#) is performed after each test. Configure TR1 to have a lower IP address than the RUT on Network 0.

Procedure:

Part A: RUT Checksum

1. Enable IGMPv3 on the RUT.
2. Observe the packets on all networks.

Part B: TR1 Query Incorrect Checksum

3. Enable IGMPv3 on the RUT.
4. Enable IGMPv3 on TR1. TR1 sends a General Query every Query Interval with an incorrect Checksum.
5. Observe the packets on all networks.

Part C: TN1Report Incorrect Checksum

6. Enable IGMPv3 on the RUT.
7. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 224.0.6.130 on Network 0 with an Incorrect Checksum.
8. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 2: The checksum in the RUT's Queries must be the one's complement sum of the whole IGMP message.
- *Part D*
Step 5: The RUT must not cease transmission of General Queries.
- *Part C*
Step 8: The RUT must not show any members present for 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.2.6: Group Address Field

Purpose: To verify that an IGMPv3 router properly sets the group address field.

References:

- [RFC-3376] – 4.1.3

Discussion: The Group Address field is set to zero when sending a General Query, and set to the IP multicast address being queried when sending a Group-Specific Query or Group-and-Source-Specific Query (see section 4.1.9, below).

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: General Query Group Address Field

1. Enable IGMPv3 on the RUT.
2. Observe the packets on all networks.

Part B: Group-Specific Query Group Address Field

3. Enable IGMPv3 on the RUT.
4. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
5. TN1 sends a Report to include nothing for the multicast group 224.0.6.130 on Network 0.
6. The RUT sends a Group-Specific Query for 224.0.6.130 on Network 0.
7. Observe the packets on all networks.

Part C: Group-and-Source Specific Query Group Address Field

8. Enable IGMPv3 on the RUT.
9. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.
10. TN1 sends a Report to include nothing for the multicast group 224.0.6.130 on Network 0.
11. The RUT sends a Group-and-Source Specific Query for 224.0.6.130 on Network 0.
12. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 2: The RUT's Query Message's Group Address must be set to 0.0.0.0.
- *Part B*
Step 7: The RUT's Group-Specific Query's Group Address must be set to 224.0.6.130.
- *Part C*
Step 12: The RUT's Group-and-Source Specific Query's Group Address must be set to 224.0.6.130.

Possible Problems:

- None

Test IGMP.2.7: Reserved Field

Purpose: To verify that an IGMPv3 router properly sets and verifies the IGMPv3 Reserved Field.

References:

- [RFC-3376] – 4.1.4

Discussion: The Resv field is set to zero on transmission, and ignored on reception.

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. The [Common Test Cleanup](#) is performed after each test. Configure TR1 to have a lower IP address than the RUT on Network 0.

Procedure:

Part A: RUT Reserved Field Format

1. Enable IGMPv3 on the RUT.
2. Observe the packets on all networks.

Part B: TR1 Query with Data in the Reserved Field

3. Enable IGMPv3 on the RUT.
4. Enable IGMPv3 on TR1. TR1 sends a General Query every Query Interval with data in the Reserved Field.
5. Observe the packets on all networks.

Part C: TN1 Report with Data in the Reserved Field

6. Enable IGMPv3 on the RUT.
7. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 224.0.6.130 on Network 0 with data in the reserved field.
8. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 2: The Reserved Field on the Query Message must be sent to 0.
- *Part B*
Step 5: The RUT must cease transmission of General Queries.
- *Part C*
Step 7: The RUT must be in exclude nothing for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.2.8: Max Response Code Format

Purpose: To verify that an IGMPv3 router properly formats its Max Response Code.

References:

- [RFC-3376] – 4.1.1, 8.8

Discussion: The Max Resp Code field specifies the maximum time allowed before sending a responding report. The actual time allowed, called the Max Resp Time, is represented in units of 1/10 second and is derived from the Max Resp Code as follows: If Max Resp Code < 128, Max Resp Time = Max Resp Code, If Max Resp Code >= 128, Max Resp Code represents a floating-point value as follows:

$$\text{Max Resp Time} = (\text{mant} \mid 0x10) \ll (\text{exp} + 3)$$

The Last Member Query Interval is the Max Response Time used to calculate the Max Resp Code inserted into Group-Specific Queries sent in response to Leave Group messages. It is also the Max Response Time used in calculating the Max Resp Code for Group-and-Source-Specific Query messages. Default: 10 (1 second)

Note that for values of LMQUI greater than 12.8 seconds, a limited set of values can be represented, corresponding to sequential values of Max Resp Code. When converting a configured time to a Max Resp Code value, it is recommended to use the exact value if possible, or the next lower value if the requested value is not exactly representable.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Default Max Response Time

1. Enable IGMPv3 on the RUT.
2. Observe the packets on all networks.

Part B: Max Response Time 31744, Max Value

3. Configure the RUT to have a Query Response Interval of 31744 tenth of a second and a Query Interval of 1000 seconds.
4. Enable IGMPv3 on the RUT.
5. Observe the packets on all networks.

Part C: Max Response Time 136, Above Boundary

6. Configure the RUT to have a Query Response Interval of 136 tenths of a second.
7. Enable IGMPv3 on the RUT.
8. Observe the packets on all networks.

Part D: Max Response Time 128, At Boundary

9. Configure the RUT to have a Query Response Interval of 128 tenths of a second.
10. Enable IGMPv3 on the RUT.
11. Observe the packets on all networks.

Part E: Max Response Time 127, Below Boundary

12. Configure the RUT to have a Query Response Interval of 127 tenths of a second.
13. Enable IGMPv3 on the RUT.
14. Observe the packets on all networks.

Part F: Max Response Time 140, Non-Exact Value

15. Configure the RUT to have a Query Response Interval of 140 tenths of a second.
16. Enable IGMPv3 on the RUT.
17. Observe the packets on all networks.

Observable Results:

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- *Part A*
Step 2: The RUT must set the Max Response Code in its Queries to 100.
- *Part B*
Step 5: The RUT must set the Max Response Code in its Queries to 255, 0xFF.
- *Part C*
Step 8: The RUT must set the Max Response Code in its Queries to 129, 0x81.
- *Part D*
Step 11: The RUT must set the Max Response Code in its Queries to 128, 0x80.
- *Part E*
Step 14: The RUT must set the Max Response Code in its Queries to 127, 0x7F.
- *Part F*
Step 17: The RUT must set the Max Response Code in its Queries to 129 or 130. If the Max Response Code is 130 this is a non-recommended value and is therefore a warning.

Possible Problems:

- None

Test IGMP.2.9: Querier's Query Interval Code Format

Purpose: To verify that an IGMPv3 router properly formats its Querier's Query Interval Code.

References:

- [RFC-3376] – 4.1.7

Discussion: The Querier's Query Interval Code field specifies the [Query Interval] used by the querier. The actual interval, called the Querier's Query Interval (QQI), is represented in units of seconds and is derived from the Querier's Query Interval Code as follows: If $QQIC < 128$, $QQI = QQIC$ If $QQIC \geq 128$, $QQIC$ represents a floating-point value as follows:

$$QQI = (\text{mant} \mid 0x10) \ll (\text{exp} + 3)$$

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: QQI 31744, Max Value

1. Configure the RUT to have a Query Interval of 31744 seconds.
2. Enable IGMPv3 on the RUT.
3. Observe the packets on all networks.

Part B: QQI 136, Above Boundary

4. Configure the RUT to have a Query Interval of 136 seconds.
5. Enable IGMPv3 on the RUT.
6. Observe the packets on all networks.

Part C: QQI 128, At Boundary

7. Configure the RUT to have a Query Interval of 128 seconds.
8. Enable IGMPv3 on the RUT.
9. Observe the packets on all networks.

Part D: QQI 127, Below Boundary

10. Configure the RUT to have a Query Interval of 127 seconds.
11. Enable IGMPv3 on the RUT.
12. Observe the packets on all networks.

Part E: QQI 140, Non-Exact Value

13. Configure the RUT to have a Query Interval of 140 seconds.
14. Enable IGMPv3 on the RUT.
15. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 3: The RUT must set the Querier's Query Interval Code in its Queries to 255.
- *Part B*
Step 6: The RUT must set the Querier's Query Interval Code in its Queries to 129.
- *Part C*
Step 9: The RUT must set the Querier's Query Interval Code in its Queries to 128.
- *Part D*
Step 12: The RUT must set the Querier's Query Interval Code in its Queries to 127.
- *Part E*
Step 15: The RUT must set the Querier's Query Interval Code in its Queries to 129 or 130.

Possible Problems:

- None

Test IGMP.2.10: Additional Data Reception

Purpose: To verify that an IGMPv3 router properly handles IGMPv3 messages with data in the additional data field.

References:

- [RFC-3376] – 4.1.10

Discussion: If the Packet Length field in the IP header of a received Query indicates that there are additional octets of data present, beyond the fields described here, IGMPv3 implementations **MUST** include those octets in the computation to verify the received IGMP Checksum, but **MUST** otherwise ignore those additional octets. When sending a Query, an IGMPv3 implementation **MUST NOT** include additional octets beyond the fields described here.

If the Packet Length field in the IP header of a received Report indicates that there are additional octets of data present, beyond the last Group Record, IGMPv3 implementations **MUST** include those octets in the computation to verify the received IGMP Checksum, but **MUST** otherwise ignore those additional octets. When sending a Report, an IGMPv3 implementation **MUST NOT** include additional octets beyond the last Group Record.

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. The [Common Test Cleanup](#) is performed after each test. Configure TR1 to have a lower IP address than the RUT on Network 0.

Procedure:

Part A: TR1 Query with Additional Data

1. Enable IGMPv3 on the RUT.
2. Enable IGMPv3 on TR1. TR1 sends a General Query every Query Interval with additional data beyond the number of sources field.
3. Observe the packets on all networks.

Part B: TN1 Report with Additional Data

4. Enable IGMPv3 on the RUT.
5. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 224.0.6.130 on Network 0 with additional data beyond the last Group Record.
6. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must cease transmission of General Queries.
- *Part B*
Step 6: The RUT must be in exclude nothing for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.2.11: Auxiliary Data Reception

Purpose: To verify that an IGMPv3 router accepts IGMPv3 Reports with auxiliary data.

References:

- [RFC-3376] – 4.2.10

Discussion: The Auxiliary Data field, if present, contains additional information pertaining to this Group Record. The protocol specified in this document, IGMPv3, does not define any auxiliary data. Therefore, implementations of IGMPv3 MUST NOT include any auxiliary data (i.e., MUST set the Aux Data Len field to zero) in any transmitted Group Record, and MUST ignore any auxiliary data present in any received Group Record. The semantics and internal encoding of the Auxiliary Data field are to be defined by any future version or extension of IGMP that uses this field.

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. The [Common Test Cleanup](#) is performed after each test. Configure TR1 to have a lower IP address than the RUT on Network 0.

Procedure:

Part A: TN1 Report with Auxiliary Data

1. Enable IGMPv3 on the RUT.
2. TN1 sends an IGMPv3 Report to include 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130 on Network 0 with Auxiliary Data. The Auxiliary Data appears to be a unicast source address.
3. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must be including 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.2.12: IP Destination Validation

Purpose: To verify that an IGMPv3 router processes query messages destined to itself.

References:

- [RFC-3376] – 4.1.12

Discussion: In IGMPv3, General Queries are sent with an IP destination address of 224.0.0.1, the all-systems multicast address. Group-Specific and Group-and-Source-Specific Queries are sent with an IP destination address equal to the multicast address of interest. *However*, a system **MUST** accept and process any Query whose IP Destination Address field contains *any* of the addresses (unicast or multicast) assigned to the interface on which the Query arrives.

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: TR1 General Queries with IP Destination RUT

1. Configure TR1 to have a lower IP address than the RUT on Network 0.
2. Enable IGMPv3 on the RUT and TR1. TR1 sends a General Query every Query Interval with the IP Destination Field set to the RUT.
3. Observe the packets on all networks.

Part B: TN1 Report with IP Destination RUT

4. Enable IGMPv3 on the RUT.
5. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 224.0.6.130 on Network 0 with the IP Destination Field set to the RUT.
6. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: TR1 must be elected Querier.
- *Part B*
Step 6: The RUT must be in exclude nothing for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.2.13: Invalid Sources or Groups Lists

Purpose: To verify that an IGMPv3 router gracefully handles a mismatch in the number of sources or groups fields with the actual packet structure.

References:

- [RFC-3376] – 4.1.8, 4.2.3

Discussion: The Number of Sources (N) field specifies how many source addresses are present in the Query. This number is zero in a General Query or a Group-Specific Query, and non-zero in a Group-and-Source-Specific Query. This number is limited by the MTU of the network over which the Query is transmitted. For example, on an Ethernet with an MTU of 1500 octets, the IP header including the Router Alert option consumes 24 octets, and the IGMP fields up to including the Number of Sources (N) field consume 12 octets, leaving 1464 octets for source addresses, which limits the number of source addresses to 366 (1464/4).

The Number of Group Records (M) field specifies how many Group Records are present in this Report.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: TN1 sends a Report with less than the specified number of Group Records

1. IGMPv3 is enabled on the RUT.
2. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0 with the number of Group Records field set to 2.
3. Observe the Group Membership Status on the RUT.

Part B: TN1 sends a Report with more than the specified number of Group Records

4. IGMPv3 is enabled on the RUT.
5. TN1 sends a Report to exclude nothing for the multicast groups 224.0.6.130 and 224.0.6.131 on Network 0 with the number of Group Records field set to 1.
6. Observe the Group Membership Status on the RUT.

Part C: TN1 sends a Report with less than the specified number of Sources

7. IGMPv3 is enabled on the RUT.
8. TN1 sends a Report to exclude 10.10.10.10 for the multicast group 224.0.6.130 on Network 0 with the number of Sources field set to 2.
9. Observe the Group Membership Status on the RUT.

Part D: TN1 sends a Report with more than the specified number of Sources

10. IGMPv3 is enabled on the RUT.
11. TN1 sends a Report to exclude 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130 on Network 0 with the number of Sources field set to 1.
12. Observe the Group Membership Status on the RUT.

Part E: TR1 sends a Query with less than the specified number of Sources

13. IGMPv3 is enabled on the RUT.
14. TR1 sends a Group and Source Specific Query for the source 10.10.10.10 and the multicast group 224.0.6.130 on Network 0 with the number of Sources field set to 2.
15. Observe the Group Membership Status on the RUT.

Part F: TR1 sends a Query with more than the specified number of Sources

16. IGMPv3 is enabled on the RUT.
17. TN1 sends a Group and Source Specific Query for the sources 10.10.10.10 and 10.10.10.11 and the multicast group 224.0.6.130 on Network 0 with the number of Sources field set to 1.
18. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must not crash or generate invalid packets.
- *Part B*
Step 6: The RUT must not crash or generate invalid packets.
- *Part C*
Step 9: The RUT must not crash or generate invalid packets.
- *Part D*
Step 12: The RUT must not crash or generate invalid packets.
- *Part E*
Step 15: The RUT must not crash or generate invalid packets.
- *Part F*
Step 18: The RUT must not crash or generate invalid packets.

Possible Problems:

- None

GROUP 3: Value Adoption and Timers

Scope:

The following tests are designed to verify an IGMPv3 Router's value adoption and timer expiration.

Overview:

These tests verify that an IGMPv3 Router will adopt the appropriate values for certain timers when non-querier. These values include the Robustness Variable, the Other Querier Present Interval, the Group Membership Interval, Querier's Query Interval Code Adoption, and Older Host Present Interval. These tests also verify that timer expiration is handled correctly.

Test IGMP.3.1: Querier's Robustness Variable Adoption

Purpose: To verify that an IGMPv3 router adopts the appropriate QRV from the Querier on a network.

References:

- [RFC 3376] – 4.1.6

Discussion: Routers adopt the QRV value from the most recently received Query as their own [Robustness Variable] value, unless that most recently received QRV was zero, in which case the receivers use the default [Robustness Variable] value specified in section 8.1 or a statically configured value.

Test Setup: The [Common Test Setup](#) is performed on the RUT. TR1 has the lower IP address, a robustness variable of 4, a Query Interval of 125, Query Response Interval of 100 1/10th of a second, and a Last Member Query Interval of 10 1/10th of a second. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: The RUT adopts TR1's Querier's Robustness Variable

1. IGMPv3 is enabled on TR1 and the RUT. TR1 is the Querier.
2. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
3. TN1 ceases transmission on Network 0.
4. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must show multicast group 224.0.6.130 members present for Group Membership Interval. The Robustness Variable must be adopted from TR1.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.3.2: Other Querier Present Interval

Purpose: To verify that an IGMPv3 router properly handles the Other Querier Present Interval.

References:

- [RFC 3376] – 8.4

Discussion: The Other Querier Present Interval is the length of time that must pass before a multicast router decides that there is no longer another multicast router which should be the querier. This value MUST be ((the Robustness Variable) times (the Query Interval)) plus (one half of one Query Response Interval).

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Default Other-Querier Present Timer Expires

1. Configure TR1 to have a lower IP address than the RUT on Network 0.
2. Enable IGMPv3 on the RUT.
3. Enable IGMPv3 on TR1.
4. Observe the packets on all networks.
5. IGMPv3 is disabled on TR1.
6. Observe the packets on all networks.

Part B: Adopted Other-Querier Present Timer Expires

7. Configure TR1 to have a lower IP address than the RUT on Network 0.
8. Configure TR1 to have a Query Interval of 30.
9. Enable IGMPv3 on the RUT.
10. Enable IGMPv3 on TR1.
11. Observe the packets on all networks.
12. IGMPv3 is disabled on TR1.
13. Observe the packets on all networks.

Observable Results:

- *Part A*
 - Step 4:** TR1 must be elected Querier and the RUT must not be sending Queries.
 - Step 6:** After Other Querier Present Interval, the RUT must resume transmission of General Queries.
- *Part B*
 - Step 10:** TR1 must be elected Querier and the RUT must not be sending Queries.
 - Step 12:** After Other Querier Present Interval, the RUT must resume transmission of General Queries. This value must reflect the adopted query interval.

Possible Problems:

- None

Test IGMP.3.3: Group Membership Interval

Purpose: To verify that an IGMPv3 router properly handles the Group Membership Interval.

References:

- [RFC 3376] – 8.4

Discussion: The Group Membership Interval is the amount of time that must pass before a multicast router decides there are no more members of a group or a particular source on a network. This value MUST be ((the Robustness Variable) times (the Query Interval)) plus (one Query Response Interval).

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Default Group Membership Timer Expires

1. Enable IGMPv3 on the RUT.
2. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
3. TN1 ceases transmission of Reports.
4. Observe the Group Membership Status on the RUT.

Part B: Default Group Membership Timer Extended

5. Enable IGMPv3 on the RUT.
6. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
7. TN1 continues to send is excluding nothing for the multicast group 224.0.6.130 on Network 0.
8. Observe the Group Membership Status on the RUT.

Part C: Default Source-Group Membership Timer Expires

9. Enable IGMPv3 on the RUT.
10. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130 on Network 0.
11. TN1 ceases transmission of Reports for 10.10.10.11. TN1 is including 10.10.10.10 for multicast group 224.0.6.130.
12. Observe the Group Membership Status on the RUT.

Part D: Adopted Group Membership Timer Expires

13. Configure TR1 to have a lower IP address than the RUT on Network 0.
14. Configure TR1 to have a Query Interval of 30.
15. Enable IGMPv3 on the RUT and TR1. TR1 is elected Querier.
16. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
17. TN1 ceases transmission of Reports.
18. Observe the Group Membership Status on the RUT.

Part E: Adopted Group Membership Timer Expires

19. Configure TR1 to have a lower IP address than the RUT on Network 0.
20. Configure TR1 to have a Query Interval of 30.
21. Enable IGMPv3 on the RUT and TR1. TR1 is elected Querier.
22. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130 on Network 0.
23. TN1 ceases transmission of Reports for 10.10.10.11. TN1 is including 10.10.10.10 for multicast group 224.0.6.130.
24. Observe the Group Membership Status on the RUT.

Observable Results:

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- *Part A*
Step 4: After Group Membership Interval the RUT must no long show members present for 224.0.6.130.
- *Part B*
Step 8: After Group Membership Interval the RUT must continue to show members present for 224.0.6.130.
- *Part C*
Step 12: After Group Membership Interval the RUT must no long show members present for source 10.10.10.11, multicast group 224.0.6.130. The RUT must still be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part D*
Step 18: After Group Membership Interval the RUT must no long show members present for 224.0.6.130. This value must reflex the adopted query interval.
- *Part E*
Step 24: After Group Membership Interval the RUT must no long show members present for source 10.10.10.11, multicast group 224.0.6.130. The RUT must still be including 10.10.10.10 for multicast group 224.0.6.130. This value must reflect the adopted query interval.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.3.4: Querier's Query Interval Code Adoption

Purpose: To verify that an IGMPv3 router adopts the appropriate QQI from the Querier on a network.

References:

- [RFC 3376] – 4.1.7

Discussion: Multicast routers that are not the current querier adopt the QQI value from the most recently received Query as their own [Query Interval] value, unless that most recently received QQI was zero, in which case the receiving routers use the default [Query Interval] value specified in section 8.2.

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. TR1 has the lower IP address. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: The RUT adopts TR1's Querier's Query Interval Code, QQIC 30

1. TR1's Query Interval is sent to 30.
2. IGMPv3 is enabled on TR1 and the RUT. TR1 is the Querier.
3. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
4. TN1 ceases transmission on Network 0.
5. Observe the Group Membership Status on the RUT.

Part B: TR2 adopts TR1's Querier's Query Interval Code, QQIC 130

6. TR1's Query Interval is sent to 144.
7. IGMPv3 is enabled on TR1 and the RUT. TR1 is the Querier.
8. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
9. TN1 ceases transmission on Network 0.
10. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 5: The RUT must show multicast group 224.0.6.130 members present for Group Membership Interval. The Query Interval must be adopted from TR1.
- *Part B*
Step 10: The RUT must show multicast group 224.0.6.130 members present for Group Membership Interval. The Query Interval must be adopted from TR1.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.3.5: Older Host Present Interval

Purpose: To verify that an IGMPv3 router properly calculates the Older Host Present Interval.

References:

- [RFC 3376] – 7.3.2, 8.13

Discussion: When Group Compatibility Mode is IGMPv1, a router internally translates the following IGMPv1 and IGMPv2 messages for that group to their IGMPv3 equivalents:

<u>IGMP Message</u>	<u>IGMPv3 Equivalent</u>
v1 Report	IS_EX({})
v2 Report	IS_EX({})

In addition to ignoring IGMPv3 BLOCK messages and source-lists in TO_EX() messages as in IGMPv2 Group Compatibility Mode, IGMPv2 Leave messages and IGMPv3 TO_IN() messages are also ignored.

The Older Host Present Interval is the time-out for transitioning a group back to IGMPv3 mode once an older version report is sent for that group. When an older version report is received, routers set their Older Host Present Timer to Older Host Present Interval. This value MUST be ((the Robustness Variable) times (the Query Interval)) plus (one Query Response Interval).

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. TR1 is configured to have a lower IP address than the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Default Older Host Present Interval Expires

1. IGMPv3 is enabled on the RUT.
2. TN2 sends an IGMPv1 Report on Network 0 for multicast group 224.0.6.130.
3. TN2 ceases transmission on Network 0.
4. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
5. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
6. Observe Group Membership Status on the RUT.
7. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
8. Observe when Older Host Present Interval Expires.
9. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
10. Observe Group Membership Status on the RUT.

Part B: Non-Default Older Host Present Interval Expires

11. The RUT's Query Interval is sent to 30.
12. IGMPv3 is enabled on the RUT.
13. TN2 sends an IGMPv1 Report on Network 0 for multicast group 224.0.6.130.
14. TN2 ceases transmission on Network 0.
15. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
16. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
17. Observe Group Membership Status on the RUT.
18. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
19. Observe when Older Host Present Interval Expires.
20. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
21. Observe Group Membership Status on the RUT.

Part C: Adopted Older Host Present Interval Expires, QQIC 30

22. TR1's Query Interval is sent to 30.
23. IGMPv3 is enabled on TR1 and the RUT.
24. TN2 sends an IGMPv1 Report on Network 0 for multicast group 224.0.6.130.

25. TN2 ceases transmission on Network 0.
26. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
27. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
28. Observe Group Membership Status on the RUT.
29. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
30. Observe when Older Host Present Interval Expires.
31. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
32. Observe Group Membership Status on the RUT.

Part D: Adopted Older Host Present Interval Expires, QQIC 130

33. TR1's Query Interval is sent to 144.
34. IGMPv3 is enabled on TR1 and the RUT.
35. TN2 sends an IGMPv1 Report on Network 0 for multicast group 224.0.6.130.
36. TN2 ceases transmission on Network 0.
37. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
38. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
39. Observe Group Membership Status on the RUT.
40. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
41. Observe when Older Host Present Interval Expires.
42. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
43. Observe Group Membership Status on the RUT.

Observable Results:

- *Part A*
 - Step 6:** The RUT must continue to exclude nothing for multicast group 224.0.6.130.
 - Step 8:** Older Host Present Interval must expire after 260 seconds.
 - Step 10:** The RUT must not show members present for multicast group 224.0.6.130.
- *Part B*
 - Step 17:** The RUT must continue to exclude nothing for multicast group 224.0.6.130.
 - Step 19:** Older Host Present Interval must expire after 70 seconds.
 - Step 21:** The RUT must not show members present for multicast group 224.0.6.130.
- *Part C*
 - Step 28:** The RUT must continue to exclude nothing for multicast group 224.0.6.130.
 - Step 30:** Older Host Present Interval must expire after 70 seconds using the Query Interval adopted from the QQIC field in TR1's query.
 - Step 32:** The RUT must not show members present for multicast group 224.0.6.130.
- *Part D*
 - Step 39:** The RUT must continue to exclude nothing for multicast group 224.0.6.130.
 - Step 41:** Older Host Present Interval must expire after 298 seconds using the Query Interval adopted from the QQIC field in TR1's query.
 - Step 43:** The RUT must not show members present for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

GROUP 4: Report Reception

Scope:

The following tests are designed to verify an IGMPv3 Router executes the proper actions upon the reception of an IGMPv3 Report.

Overview:

These tests verify that when and IGMPv3 Router receives a IGMPv3 Report the router switches to the appropriate state, updates times, and transmits queries as required. These specifically test the charts found in RFC 3376 Sections 6.4.1 and 6.4.2 reproduced below for convenience.

Router State	Report Rec'd	New Router State	Action(s)
INCLUDE (A)	IS_IN (B)	INCLUDE (A+B)	(B)=GMI
INCLUDE (A)	IS_EX (B)	EXCLUDE (A*B,B-A)	(B-A)=0 Delete (A-B) Group Timer=GMI
EXCLUDE (X,Y)	IS_IN (A)	EXCLUDE (X+A,Y-A)	(A)=GMI
EXCLUDE (X,Y)	IS_EX (A)	EXCLUDE (A-Y,Y*A)	(A-X-Y)=GMI Delete (X-A) Delete (Y-A) Group Timer=GMI

Router State	Report Rec'd	New Router State	Action(s)
INCLUDE (A)	ALLOW (B)	INCLUDE (A+B)	(B)=GMI
INCLUDE (A)	BLOCK (B)	INCLUDE (A)	Send Q(G,A*B)
INCLUDE (A)	TO_EX (B)	EXCLUDE (A*B,B-A)	(B-A)=0 Delete (A-B) Send Q(G,A*B) Group Timer=GMI
INCLUDE (A)	TO_IN (B)	INCLUDE (A+B)	(B)=GMI Send Q(G,A-B)
EXCLUDE (X,Y)	ALLOW (A)	EXCLUDE (X+A,Y-A)	(A)=GMI
EXCLUDE (X,Y)	BLOCK (A)	EXCLUDE (X+(A-Y),Y)	(A-X-Y)=Group Timer Send Q(G,A-Y)
EXCLUDE (X,Y)	TO_EX (A)	EXCLUDE (A-Y,Y*A)	(A-X-Y)=Group Timer Delete (X-A) Delete (Y-A) Send Q(G,A-Y) Group Timer=GMI
EXCLUDE (X,Y)	TO_IN (A)	EXCLUDE (X+A,Y-A)	(A)=GMI Send Q(G,X-A) Send Q(G)

Test IGMP.4.1: Is Including - Receives Allow

Purpose: To verify that an IGMPv3 router properly transitions from include state when an Allow is received.

References:

- [RFC-3376] – 6.4.2

Discussion: Referring to the charts given above. When in INCLUDE (A) and an ALLOW (B) is received the new router state should be INCLUDE (A+B) and the action performed should be (B)=GMI.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is including nothing, receives allow A

1. Enable IGMPv3 on the RUT.
2. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
3. Observe the Group Membership Status on the RUT

Part B: Is including A, receives allow A

4. Enable IGMPv3 on the RUT.
5. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
6. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
7. Observe the Group Membership Status on the RUT

Part C: Is including A, receives allow A, B

8. Enable IGMPv3 on the RUT.
9. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
10. TN1 sends an IGMPv3 Report allow 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
11. Observe the Group Membership Status on the RUT

Part D: Is including A, B, receives allow A

12. Enable IGMPv3 on the RUT.
13. TN2 sends an IGMPv3 Report is including 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
14. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
15. Observe the Group Membership Status on the RUT

Observable Results:

- *Part A*
Step 3: The RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part B*
Step 7: The RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part C*
Step 11: The RUT must be including 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.
- *Part D*
Step 15: The RUT must be including 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.

Possible Problems:

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- It may not be possible to view multicast group membership on the device.

Test IGMP.4.2: Is Including - Receives Block

Purpose: To verify that an IGMPv3 router properly transitions from include state when a Block is received.

References:

- [RFC-3376] – 6.4.2

Discussion: Referring to the charts given above. When in INCLUDE (A) and a BLOCK (B) is received the new router state should be INCLUDE (A) and the action performed should be Send Q(G,A*B).

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is including nothing, receives block A

1. Enable IGMPv3 on the RUT.
2. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
3. Observe the Group Membership Status on the RUT.

Part B: Is including A, receives block A, Response

4. Enable IGMPv3 on the RUT.
5. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
6. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
7. Observe the packets on all networks and the Group Membership Status on the RUT.
8. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
9. Observe the Group Membership Status on the RUT.

Part C: Is including A, receives block A, No Response

10. Enable IGMPv3 on the RUT.
11. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
12. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
13. Observe the packets on all networks and the Group Membership Status on the RUT.

Part D: Is including A, receives block A, B, Response

14. Enable IGMPv3 on the RUT.
15. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
16. TN1 sends an IGMPv3 Report block 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
17. Observe the packets on all networks and the Group Membership Status on the RUT.
18. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
19. Observe the Group Membership Status on the RUT.

Part E: Is including A, receives block A, B, No Response

20. Enable IGMPv3 on the RUT.
21. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
22. TN1 sends an IGMPv3 Report block 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
23. Observe the packets on all networks and the Group Membership Status on the RUT.

Part F: Is including A, B, receives block A, Response

24. Enable IGMPv3 on the RUT.
25. TN2 sends an IGMPv3 Report is including 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
26. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
27. Observe the packets on all networks and the Group Membership Status on the RUT.

28. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.

29. Observe the Group Membership Status on the RUT.

Part G: Is including A, B, receives block A, No Response

30. Enable IGMPv3 on the RUT.

31. TN2 sends an IGMPv3 Report is including 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.

32. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.

33. Observe the packets on all networks and the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must be including nothing for multicast group 224.0.6.130.
- *Part B*
Step 7: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
Step 9: The RUT must remain in the previous state.
- *Part C*
Step 13: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be including 10.10.10.10 for multicast group 224.0.6.130. After last member query time the RUT must transition to no members present for multicast group 224.0.6.130.
- *Part D*
Step 17: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
Step 19: The RUT must remain in the previous state.
- *Part E*
Step 22: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be including 10.10.10.10 for multicast group 224.0.6.130. After last member query time the RUT must transition to no members present for multicast group 224.0.6.130.
- *Part F*
Step 27: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be including 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.
Step 29: The RUT must remain in the previous state.
- *Part G*
Step 33: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be including 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130. After last member query time the RUT must transition to include 10.10.10.11 for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.4.3: Is Including - Receives Is Include

Purpose: To verify that an IGMPv3 router properly transitions from include state when an Is Include is received.

References:

- [RFC-3376] – 6.4.1

Discussion: Referring to the charts given above. When in INCLUDE (A) and an IS_IN (B) is received the new router state should be INCLUDE (A+B) and the action performed should be (B)=GMI.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is including nothing, receives is include nothing

1. Enable IGMPv3 on the RUT.
2. TN1 sends an IGMPv3 Report is including nothing for the multicast group 224.0.6.130.
3. Observe the Group Membership Status on the RUT.

Part B: Is including nothing, receives is include A

4. Enable IGMPv3 on the RUT.
5. TN1 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
6. Observe the Group Membership Status on the RUT.

Part C: Is including A, receives is include nothing

7. Enable IGMPv3 on the RUT.
8. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
9. TN1 sends an IGMPv3 Report is including nothing for the multicast group 224.0.6.130.
10. Observe the Group Membership Status on the RUT.

Part D: Is including A, receives is include A

11. Enable IGMPv3 on the RUT.
12. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
13. TN1 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
14. Observe the Group Membership Status on the RUT.

Part E: Is including A,B, receives is include A

15. Enable IGMPv3 on the RUT.
16. TN2 sends an IGMPv3 Report is including 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
17. TN1 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
18. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must be including nothing for multicast group 224.0.6.130.
- *Part B*
Step 6: The RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part C*
Step 10: The RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part D*
Step 14: The RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part E*

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Step 18: The RUT must be including 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.4.4: Is Including - Receives Is Exclude

Purpose: To verify that an IGMPv3 router properly transitions from include state when an Is Exclude is received.

References:

- [RFC-3376] – 6.4.1

Discussion: Referring to the charts given above. When in INCLUDE (A) and an IS_EX (B) is received the new router state should be EXCLUDE (A*B,B-A) and the actions performed should be (B-A)=0, Delete (A-B), and Group Timer=GMI.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is including nothing, receives is exclude nothing

1. Enable IGMPv3 on the RUT.
2. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
3. Observe the Group Membership Status on the RUT.

Part B: Is including nothing, receives is exclude A

4. Enable IGMPv3 on the RUT.
5. TN1 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
6. Observe the Group Membership Status on the RUT.

Part C: Is including A, receives is exclude nothing

7. Enable IGMPv3 on the RUT.
8. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
9. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
10. Observe the Group Membership Status on the RUT.

Part D: Is including A, receives is exclude A

11. Enable IGMPv3 on the RUT.
12. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
13. TN1 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
14. Observe the Group Membership Status on the RUT.

Part E: Is including A, receives is exclude A, B

15. Enable IGMPv3 on the RUT.
16. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
17. TN1 sends an IGMPv3 Report is excluding 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
18. Observe the Group Membership Status on the RUT.

Part F: Is including A, B, receives is exclude A

19. Enable IGMPv3 on the RUT.
20. TN2 sends an IGMPv3 Report is including 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
21. TN1 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
22. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must be excluding nothing for multicast group 224.0.6.130.
- *Part B*

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- **Step 6:** The RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130.
- *Part C*
Step 10: The RUT must be excluding nothing for multicast group 224.0.6.130.
- *Part D*
Step 14: The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part E*
Step 18: The RUT must be excluding 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part F*
Step 22: The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.4.5: Is Including - Receives To Include

Purpose: To verify that an IGMPv3 router properly transitions from include state when a To Include is received.

References:

- [RFC-3376] – 6.4.2

Discussion: Referring to the charts given above. When in INCLUDE (A) and a TO_IN (B) is received the new router state should be INCLUDE (A+B) and the actions performed should be (B)=GMI, and Send Q(G,A-B).

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is including nothing, receives to include nothing

1. Enable IGMPv3 on the RUT.
2. TN1 sends an IGMPv3 Report to include nothing for the multicast group 224.0.6.130.
3. Observe the Group Membership Status on the RUT.

Part B: Is including nothing, receives to include A

4. Enable IGMPv3 on the RUT.
5. TN1 sends an IGMPv3 Report to include 10.10.10.10 for the multicast group 224.0.6.130.
6. Observe the Group Membership Status on the RUT.

Part C: Is including A, receives to include nothing, Response

7. Enable IGMPv3 on the RUT.
8. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
9. TN1 sends an IGMPv3 Report to include nothing for the multicast group 224.0.6.130.
10. Observe the packets on all networks and the Group Membership Status on the RUT.
11. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
12. Observe the Group Membership Status on the RUT.

Part D: Is including A, receives to include nothing, No Response

13. Enable IGMPv3 on the RUT.
14. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
15. TN1 sends an IGMPv3 Report to include nothing for the multicast group 224.0.6.130.
16. Observe the packets on all networks and the Group Membership Status on the RUT.

Part E: Is including A, receives to include A

17. Enable IGMPv3 on the RUT.
18. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
19. TN1 sends an IGMPv3 Report to include 10.10.10.10 for the multicast group 224.0.6.130.
20. Observe the Group Membership Status on the RUT.

Part F: Is including A, receives to include A, B

21. Enable IGMPv3 on the RUT.
22. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
23. TN1 sends an IGMPv3 Report to include 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
24. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*

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- **Step 3:** The RUT must be including nothing for multicast group 224.0.6.130.
- *Part B*
 - **Step 6:** The RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part C*
 - **Step 10:** The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
 - **Step 12:** The RUT must remain in the previous state.
- *Part D*
 - **Step 16:** The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be including 10.10.10.10 for multicast group 224.0.6.130. After last member query time the RUT must transition to state no members present for multicast group 224.0.6.130.
- *Part E*
 - **Step 20:** The RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part F*
 - **Step 24:** The RUT must be including 10.10.10.10, 10.10.10.11 for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.4.6: Is Including - Receives To Exclude

Purpose: To verify that an IGMPv3 router properly transitions from include state when a To Exclude is received.

References:

- [RFC-3376] – 6.4.2

Discussion: Referring to the charts given above. When in INCLUDE (A) and a TO_EX (B) is received the new router state should be EXCLUDE (A*B,B-A) and the actions performed should be (B-A)=0, Delete (A-B), Send Q(G,A*B), and Group Timer=GMI.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is including nothing, receives to exclude nothing

1. Enable IGMPv3 on the RUT.
2. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 224.0.6.130.
3. Observe the Group Membership Status on the RUT.

Part B: Is including nothing, receives to exclude A

4. Enable IGMPv3 on the RUT.
5. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
6. Observe the Group Membership Status on the RUT.

Part C: Is including A, receives to exclude nothing

7. Enable IGMPv3 on the RUT.
8. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
9. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 224.0.6.130.
10. Observe the Group Membership Status on the RUT.

Part D: Is including A, receives to exclude A, Response

11. Enable IGMPv3 on the RUT.
12. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
13. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
14. Observe the packets on all networks and the Group Membership Status on the RUT.
15. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
16. Observe the Group Membership Status on the RUT.

Part E: Is including A, receives to exclude A, No Response

17. Enable IGMPv3 on the RUT.
18. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
19. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
20. Observe the packets on all networks and the Group Membership Status on the RUT.

Part F: Is including A, receives to exclude A, B, Response

21. Enable IGMPv3 on the RUT.
22. TN2 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
23. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
24. Observe the packets on all networks and the Group Membership Status on the RUT.
25. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
26. Observe the Group Membership Status on the RUT.

Part G: Is including A, receives to exclude A, B, No Response

27. Enable IGMPv3 on the RUT.

28. TN2 sends an IGMPv3 Report including 10.10.10.10 for the multicast group 224.0.6.130.
29. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
30. Observe the packets on all networks and the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must be in exclude nothing for multicast group 224.0.6.130.
- *Part B*
Step 6: The RUT must be in exclude 10.10.10.10 for multicast group 224.0.6.130.
- *Part C*
Step 10: The RUT must be in exclude nothing for multicast group 224.0.6.130.
- *Part D*
Step 14: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
Step 16: The RUT must remain in the previous state.
- *Part E*
Step 20: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must transition to state exclude 10.10.10.10 for multicast group 224.0.6.130.
- *Part F*
Step 24: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
Step 26: The RUT must remain in the previous state.
- *Part G*
Step 30: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must transition to state exclude 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.4.7: Is Excluding - Receives Allow

Purpose: To verify that an IGMPv3 router properly transitions from exclude state when an Allow is received.

References:

- [RFC-3376] – 6.4.2

Discussion: Referring to the charts given above. When in EXCLUDE (X,Y) and an ALLOW (A) is received the new router state should be EXCLUDE (X+A,Y-A) and the action performed should be (A)=GMI.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is excluding nothing, receives allow A

1. Enable IGMPv3 on the RUT.
2. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
3. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
4. Observe the Group Membership Status on the RUT.

Part B: Is excluding A, receives allow A

5. Enable IGMPv3 on the RUT.
6. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
7. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
8. Observe the Group Membership Status on the RUT.

Part C: Is excluding A, receives allow A, B

9. Enable IGMPv3 on the RUT.
10. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
11. TN1 sends an IGMPv3 Report allow 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
12. Observe the Group Membership Status on the RUT.

Part D: Is excluding A, B, receives allow A

13. Enable IGMPv3 on the RUT.
14. TN2 sends an IGMPv3 Report is excluding 10.10.10.10, 10.10.10.11 for the multicast group 224.0.6.130.
15. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
16. Observe the Group Membership Status on the RUT.

Part E: Is excluding nothing but requesting A, receives allow A

17. Enable IGMPv3 on the RUT.
18. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
19. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
20. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
21. Observe the Group Membership Status on the RUT.

Part F: Is excluding nothing but requesting B, receives allow A

22. Enable IGMPv3 on the RUT.
23. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
24. TN2 sends an IGMPv3 Report allow 10.10.10.11 for the multicast group 224.0.6.130.
25. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
26. Observe the Group Membership Status on the RUT.

Part G: Is excluding A but requesting B, receives allow A

27. Enable IGMPv3 on the RUT.
28. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.

29. TN2 sends an IGMPv3 Report allow 10.10.10.11 for the multicast group 224.0.6.130.

30. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.

31. Observe the Group Membership Status on the RUT.

Part H: Is excluding A, B but requesting C, receives allow A

32. Enable IGMPv3 on the RUT.

33. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.

34. TN2 sends an IGMPv3 Report allow 10.10.10.12 for the multicast group 224.0.6.130.

35. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.

36. Observe the Group Membership Status on the RUT.

Part I: Is excluding B but requesting A, receives allow A

37. Enable IGMPv3 on the RUT.

38. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.

39. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.

40. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.

41. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part B*
Step 8: The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part C*
Step 12: The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 and 10.10.10.11 requested for forwarding.
- *Part D*
Step 16: The RUT must be in exclude 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part E*
Step 21: The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part F*
Step 26: The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 and 10.10.10.11 requested for forwarding.
- *Part G*
Step 31: The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 and 10.10.10.11 requested for forwarding.
- *Part H*
Step 36: The RUT must be in exclude 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 and 10.10.10.12 requested for forwarding.
- *Part I*
Step 41: The RUT must be in exclude 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.4.8: Is Excluding - Receives Block, No Response

Purpose: To verify that an IGMPv3 router properly transitions from exclude state when a Block is received and no response to the resulting Group Specific Query is received.

References:

- [RFC-3376] – 6.4.2

Discussion: Referring to the charts given above. When in EXCLUDE (X,Y) and an ALLOW (A) is received the new router state should be EXCLUDE (X+A,Y-A) and the action performed should be (A)=GMI.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is excluding nothing, receives block A

1. Enable IGMPv3 on the RUT.
2. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
3. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
4. Observe the packets on all networks and the Group Membership Status on the RUT.

Part B: Is excluding A, receives block A

5. Enable IGMPv3 on the RUT.
6. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
7. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
8. Observe the Group Membership Status on the RUT.

Part C: Is excluding A, receives block A, B

9. Enable IGMPv3 on the RUT.
10. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
11. TN1 sends an IGMPv3 Report block 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
12. Observe the packets on all networks and the Group Membership Status on the RUT.

Part D: Is excluding nothing but requesting B, receives block A

13. Enable IGMPv3 on the RUT.
14. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
15. TN2 sends an IGMPv3 Report allow 10.10.10.11 for the multicast group 224.0.6.130.
16. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
17. Observe the packets on all networks and the Group Membership Status on the RUT.

Part E: Is excluding A but requesting B, receives block A

18. Enable IGMPv3 on the RUT.
19. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
20. TN2 sends an IGMPv3 Report allow 10.10.10.11 for the multicast group 224.0.6.130.
21. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
22. Observe the packets on all networks and the Group Membership Status on the RUT.

Part F: Is excluding nothing but requesting A, receives block A

23. Enable IGMPv3 on the RUT.
24. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
25. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
26. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
27. Observe the packets on all networks and the Group Membership Status on the RUT.

Part G: Is excluding B but requesting A, receives block A

28. Enable IGMPv3 on the RUT.
29. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.

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30. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
31. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
32. Observe the packets on all networks and the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must transition to exclude 10.10.10.10 for multicast group 224.0.6.130.
- *Part B*
Step 8: The RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130.
- *Part C*
Step 12: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.11, multicast group 224.0.6.130. The RUT must be in exclude 10.10.10.10 for multicast group 224.0.6.130 with 10.10.10.11 requested for forwarding. After last member query time the RUT must transition to exclude 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.
- *Part D*
Step 17: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 and 10.10.10.11 requested for forwarding. After last member query time the RUT must transition to exclude 10.10.10.10 for multicast group 224.0.6.130 but requesting 10.10.10.11 for forwarding.
- *Part E*
Step 22: The RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130 but requesting 10.10.10.11 for forwarding.
- *Part F*
Step 27: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must transition to exclude 10.10.10.10 for multicast group 224.0.6.130.
- *Part G*
Step 32: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must transition to exclude 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.4.9: Is Excluding - Receives Block, Response

Purpose: To verify that an IGMPv3 router properly transitions from exclude state when a Block is received and a response to the resulting Group Specific Query is received.

References:

- [RFC-3376] – 6.4.2

Discussion: Referring to the charts given above. When in EXCLUDE (X,Y) and an ALLOW (A) is received the new router state should be EXCLUDE (X+A,Y-A) and the action performed should be (A)=GMI.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is excluding nothing, receives block A

1. Enable IGMPv3 on the RUT.
2. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
3. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
4. Observe the packets on all networks and the Group Membership Status on the RUT.
5. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
6. Observe the Group Membership Status on the RUT.

Part B: Is excluding A, receives block A, B

7. Enable IGMPv3 on the RUT.
8. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
9. TN1 sends an IGMPv3 Report block 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
10. Observe the packets on all networks and the Group Membership Status on the RUT.
11. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.11 for the multicast group 224.0.6.130.
12. Observe the Group Membership Status on the RUT.

Part C: Is excluding nothing but requesting B, receives block A

13. Enable IGMPv3 on the RUT.
14. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
15. TN2 sends an IGMPv3 Report allow 10.10.10.11 for the multicast group 224.0.6.130.
16. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
17. Observe the packets on all networks and the Group Membership Status on the RUT.
18. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
19. Observe the Group Membership Status on the RUT.

Part D: Is excluding nothing but requesting A, receives block A

20. Enable IGMPv3 on the RUT.
21. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
22. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
23. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
24. Observe the packets on all networks and the Group Membership Status on the RUT.
25. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
26. Observe the Group Membership Status on the RUT.

Part E: Is excluding B but requesting A, receives block A.

27. Enable IGMPv3 on the RUT.

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28. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.
29. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
30. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130.
31. Observe the packets on all networks and the Group Membership Status on the RUT.
32. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
33. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
Step 6: The RUT must remain in the previous state.
- *Part B*
Step 10: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.11, multicast group 224.0.6.130. The RUT must be in exclude 10.10.10.10 for multicast group 224.0.6.130 with 10.10.10.11 requested for forwarding.
Step 12: The RUT must remain in the previous state.
- *Part C*
Step 17: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 and 10.10.10.11 requested for forwarding.
Step 19: The RUT must remain in the previous state.
- *Part D*
Step 24: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
Step 26: The RUT must remain in the previous state.
- *Part E*
Step 31: The RUT sent a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT was in exclude 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
Step 33: The RUT remained in the previous state.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.4.10: Is Excluding - Receives Is Include

Purpose: To verify that an IGMPv3 router properly transitions from exclude state when an Is Include is received.

References:

- [RFC-3376] – 6.4.1

Discussion: Referring to the charts given above. When in EXCLUDE (X,Y) and an IS_IN (A) is received the new router state should be EXCLUDE (X+A,Y-A) and the action performed should be (A)=GMI.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is excluding nothing, receives is include nothing

1. Enable IGMPv3 on the RUT.
2. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
3. TN1 sends an IGMPv3 Report is including nothing for the multicast group 224.0.6.130.
4. Observe the Group Membership Status on the RUT.

Part B: Is excluding nothing, receives is include A

5. Enable IGMPv3 on the RUT.
6. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
7. TN1 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
8. Observe the Group Membership Status on the RUT.

Part C: Is excluding A, receives is include nothing

9. Enable IGMPv3 on the RUT.
10. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
11. TN1 sends an IGMPv3 Report is including nothing for the multicast group 224.0.6.130.
12. Observe the Group Membership Status on the RUT.

Part D: Is excluding A, receives is include A

13. Enable IGMPv3 on the RUT.
14. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
15. TN1 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
16. Observe the Group Membership Status on the RUT.

Part E: Is excluding A, B, receives is include A

17. Enable IGMPv3 on the RUT.
18. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
19. TN1 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
20. Observe the Group Membership Status on the RUT.

Part F: Is excluding nothing but requesting A, receives is include nothing

21. Enable IGMPv3 on the RUT.
22. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
23. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
24. TN1 sends an IGMPv3 Report is including nothing for the multicast group 224.0.6.130.
25. Observe the Group Membership Status on the RUT.

Part G: Is excluding nothing but requesting A, receives is include B

26. Enable IGMPv3 on the RUT.
27. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
28. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
29. TN1 sends an IGMPv3 Report is including 10.10.10.11 for the multicast group 224.0.6.130.
30. Observe the Group Membership Status on the RUT.

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Part H: Is excluding B but requesting A, receives is include nothing

31. Enable IGMPv3 on the RUT.
32. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.
33. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
34. TN1 sends an IGMPv3 Report is including nothing for the multicast group 224.0.6.130.
35. Observe the Group Membership Status on the RUT.

Part I: Is excluding B but requesting A, receives is include B

36. Enable IGMPv3 on the RUT.
37. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.
38. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
39. TN1 sends an IGMPv3 Report is including 10.10.10.11 for the multicast group 224.0.6.130.
40. Observe the Group Membership Status on the RUT.

Part J: Is excluding A, B but requesting C, receives is include A

41. Enable IGMPv3 on the RUT.
42. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
43. TN2 sends an IGMPv3 Report allow 10.10.10.12 for the multicast group 224.0.6.130.
44. TN1 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 224.0.6.130.
45. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must be excluding nothing for multicast group 224.0.6.130.
- *Part B*
Step 8: The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part C*
Step 12: The RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130.
- *Part D*
Step 16: The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part E*
Step 20: The RUT must be excluding 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part F*
Step 24: The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part G*
Step 28: The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 and 10.10.10.11 requested for forwarding.
- *Part H*
Step 35: The RUT must be excluding 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part I*
Step 40: The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 and 10.10.10.11 requested for forwarding.
- *Part J*
Step 45: The RUT must be excluding 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 and 10.10.10.12 requested for forwarding.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.4.11: Is Excluding - Receives Is Exclude

Purpose: To verify that an IGMPv3 router properly transitions from exclude state when an Is Exclude is received.

References:

- [RFC-3376] – 6.4.1

Discussion: Referring to the charts given above. When in EXCLUDE (X,Y) and an IS_EX (A) is received the new router state should be EXCLUDE (A-Y,Y*A) and the actions performed should be (A-X-Y)=GMI, Delete (X-A), Delete (Y-A), and Group Timer=GMI.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is excluding nothing, receives is excluding nothing

1. Enable IGMPv3 on the RUT.
2. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
3. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
4. Observe the Group Membership Status on the RUT.

Part B: Is excluding nothing, receives is excluding A

5. Enable IGMPv3 on the RUT.
6. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
7. TN1 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
8. Observe the Group Membership Status on the RUT.

Part C: Is excluding A, receives is excluding nothing

9. Enable IGMPv3 on the RUT.
10. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
11. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
12. Observe the Group Membership Status on the RUT.

Part D: Is excluding A, receives is excluding A

13. Enable IGMPv3 on the RUT.
14. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
15. TN1 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
16. Observe the Group Membership Status on the RUT.

Part E: Is excluding A, receives is excluding A, B

17. Enable IGMPv3 on the RUT.
18. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
19. TN1 sends an IGMPv3 Report is excluding 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
20. Observe the Group Membership Status on the RUT.

Part F: Is excluding nothing but requesting A, receives is excluding nothing

21. Enable IGMPv3 on the RUT.
22. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
23. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
24. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
25. Observe the Group Membership Status on the RUT.

Part G: Is excluding nothing but requesting B, receives is excluding A

26. Enable IGMPv3 on the RUT.
27. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
28. TN2 sends an IGMPv3 Report allow 10.10.10.11 for the multicast group 224.0.6.130.
29. TN1 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.

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30. Observe the Group Membership Status on the RUT.

Part H: Is excluding B but requesting A, receives is excluding nothing

31. Enable IGMPv3 on the RUT.

32. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.

33. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.

34. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.

35. Observe the Group Membership Status on the RUT.

Part I: Is excluding B but requesting A, receives is excluding B

36. Enable IGMPv3 on the RUT.

37. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.

38. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.

39. TN1 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.

40. Observe the Group Membership Status on the RUT.

Part J: Is excluding B but requesting A, receives is excluding B, C

41. Enable IGMPv3 on the RUT.

42. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.

43. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.

44. TN1 sends an IGMPv3 Report is excluding 10.10.10.11 and 10.10.10.12 for the multicast group 224.0.6.130.

45. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must be excluding nothing for multicast group 224.0.6.130.
- *Part B*
Step 8: The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part C*
Step 12: The RUT must be excluding nothing for multicast group 224.0.6.130.
- *Part D*
Step 16: The RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130.
- *Part E*
Step 20: The RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130 with 10.10.10.11 requested for forwarding.
- *Part F*
Step 24: The RUT must be excluding nothing for multicast group 224.0.6.130.
- *Part G*
Step 30: The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
- *Part H*
Step 35: The RUT must be excluding nothing for multicast group 224.0.6.130.
- *Part I*
Step 40: The RUT must be excluding 10.10.10.11 for multicast group 224.0.6.130.
- *Part J*
Step 45: The RUT must be excluding 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.12 requested for forwarding.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.4.12: Is Excluding - Receives To Include

Purpose: To verify that an IGMPv3 router properly transitions from exclude state when a To Include is received.

References:

- [RFC-3376] – 6.4.2

Discussion: Referring to the charts given above. When in EXCLUDE (X,Y) and a TO_IN (A) is received the new router state should be EXCLUDE (X+A,Y-A) and the actions performed should be (A)=GMI, Send Q(G,X-A), and Send Q(G).

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Part A: Is excluding nothing, receives to include nothing

1. Enable IGMPv3 on the RUT.
2. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
3. TN1 sends an IGMPv3 Report to include nothing for the multicast group 224.0.6.130.
4. Observe the packets on all networks and the Group Membership Status on the RUT.

Part B: Is excluding nothing, receives to include A

5. Enable IGMPv3 on the RUT.
6. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
7. TN1 sends an IGMPv3 Report to include 10.10.10.10 for the multicast group 224.0.6.130.
8. Observe the packets on all networks and the Group Membership Status on the RUT.

Part C: Is excluding A, receives to include nothing

9. Enable IGMPv3 on the RUT.
10. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
11. TN1 sends an IGMPv3 Report to include nothing for the multicast group 224.0.6.130.
12. Observe the packets on all networks and the Group Membership Status on the RUT.

Part D: Is excluding A, receives to include A

13. Enable IGMPv3 on the RUT.
14. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
15. TN1 sends an IGMPv3 Report to include 10.10.10.10 for the multicast group 224.0.6.130.
16. Observe the packets on all networks and the Group Membership Status on the RUT.

Part E: Is excluding nothing but requesting A, receives to include nothing

17. Enable IGMPv3 on the RUT.
18. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
19. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
20. TN1 sends an IGMPv3 Report to include nothing for the multicast group 224.0.6.130.
21. Observe the packets on all networks and the Group Membership Status on the RUT.

Part F: Is excluding nothing but requesting A, receives to include B

22. Enable IGMPv3 on the RUT.
23. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
24. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
25. TN1 sends an IGMPv3 Report to include 10.10.10.11 for the multicast group 224.0.6.130.
26. Observe the packets on all networks and the Group Membership Status on the RUT.

Part G: Is excluding B but requesting A, receives to include nothing

27. Enable IGMPv3 on the RUT.
28. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.
29. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
30. TN1 sends an IGMPv3 Report to include nothing for the multicast group 224.0.6.130.
31. Observe the packets on all networks and the Group Membership Status on the RUT.

Part H: Is excluding B but requesting A, receives to include A

32. Enable IGMPv3 on the RUT.
33. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.
34. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
35. TN1 sends an IGMPv3 Report to include 10.10.10.11 for the multicast group 224.0.6.130.
36. Observe the packets on all networks and the Group Membership Status on the RUT.

Part I: Is excluding nothing but requesting A, receives to include A

37. Enable IGMPv3 on the RUT.
38. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
39. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
40. TN1 sends an IGMPv3 Report to include 10.10.10.10 for the multicast group 224.0.6.130.
41. Observe the packets on all networks and the Group Membership Status on the RUT.

Part J: Is excluding B but requesting A, receives to include nothing

42. Enable IGMPv3 on the RUT.
43. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.
44. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
45. TN1 sends an IGMPv3 Report to include nothing for the multicast group 224.0.6.130.
46. Observe the packets on all networks and the Group Membership Status on the RUT.

Part K: Is excluding B but requesting A, receives to include A

47. Enable IGMPv3 on the RUT.
48. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.
49. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
50. TN1 sends an IGMPv3 Report to include 10.10.10.10 for the multicast group 224.0.6.130.
51. Observe the packets on all networks and the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must send a Group-Specific Query for multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130. After last member query time the RUT must have no members present for multicast group 224.0.6.130.
- *Part B*
Step 8: The RUT must send a Group-Specific Query for multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130 but requesting 10.10.10.10 for forwarding. After last member query time the RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part C*
Step 12: The RUT must send a Group-Specific Query for multicast group 224.0.6.130. The RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130. After last member query time the RUT must have no members present for multicast group 224.0.6.130.
- *Part D*
Step 16: The RUT must send a Group-Specific Query for multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part E*
Step 21: The RUT must send a Group-Specific Query for multicast group 224.0.6.130 along with a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must have no members present for multicast group 224.0.6.130.
- *Part F*
Step 26: The RUT must send a Group-Specific Query for multicast group 224.0.6.130 along with a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 and 10.10.10.11 requested for forwarding. After last member query time the

- RUT must be including 10.10.10.11 for multicast group 224.0.6.130.
- *Part G*
Step 31: The RUT must send a Group-Specific Query for multicast group 224.0.6.130 along with a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be excluding 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must have no members present for multicast group 224.0.6.130.
- *Part H*
Step 36: The RUT must send a Group-Specific Query for multicast group 224.0.6.130. The RUT must be excluding 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part I*
Step 41: The RUT must send a Group-Specific Query for multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must be including 10.10.10.10 for multicast group 224.0.6.130.
- *Part J*
Step 46: The RUT must send a Group-Specific Query for multicast group 224.0.6.130 along with a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be excluding 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must have no members present for multicast group 224.0.6.130.
- *Part K*
Step 51: The RUT must send a Group-Specific Query for multicast group 224.0.6.130. The RUT must be excluding 10.10.10.11 for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must be including 10.10.10.10 for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.4.13: Is Excluding - Receives To Exclude

Purpose: To verify that an IGMPv3 router properly transitions from exclude state when a To Exclude is received.

References:

- [RFC-3376] – 6.4.2

Discussion: Referring to the charts given above. When in EXCLUDE (X,Y) and a TO_EX (A) is received the new router state should be EXCLUDE (A-Y,Y*A) and the actions performed should be (A-X-Y)=Group Timer, Delete (X-A), Delete (Y-A), Send Q(G,A-Y), and Group Timer=GMI.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: Is excluding nothing, receives to exclude nothing

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1. Enable IGMPv3 on the RUT.
 2. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
 3. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 224.0.6.130.
 4. Observe the Group Membership Status on the RUT.
- Part B: Is excluding nothing, receives to exclude A, Response*
5. Enable IGMPv3 on the RUT.
 6. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
 7. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
 8. Observe the packets on all networks and the Group Membership Status on the RUT.
 9. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
 10. Observe the Group Membership Status on the RUT.
- Part C: Is excluding nothing, receives to exclude A, No Response*
11. Enable IGMPv3 on the RUT.
 12. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
 13. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
 14. Observe the packets on all networks and the Group Membership Status on the RUT.
- Part D: Is excluding A, receives to exclude nothing*
15. Enable IGMPv3 on the RUT.
 16. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
 17. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 224.0.6.130.
 18. Observe the packets on all networks and the Group Membership Status on the RUT.
- Part E: Is excluding A, receives to exclude A*
19. Enable IGMPv3 on the RUT.
 20. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
 21. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
 22. Observe the packets on all networks and the Group Membership Status on the RUT.
- Part F: Is excluding A, receives to exclude A, B, No Response*
23. Enable IGMPv3 on the RUT.
 24. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
 25. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
 26. Observe the packets on all networks and the Group Membership Status on the RUT.
- Part G: Is excluding A, receives to exclude A, B, Response*
27. Enable IGMPv3 on the RUT.
 28. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
 29. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
 30. Observe the packets on all networks and the Group Membership Status on the RUT.
 31. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.11 for the multicast group 224.0.6.130.
 32. Observe the Group Membership Status on the RUT.
- Part H: Is excluding nothing but requesting B, receives to exclude A, Response*
33. Enable IGMPv3 on the RUT.
 34. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
 35. TN2 sends an IGMPv3 Report allow 10.10.10.11 for the multicast group 224.0.6.130.
 36. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
 37. Observe the packets on all networks and the Group Membership Status on the RUT.
 38. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
 39. Observe the Group Membership Status on the RUT.
- Part I: Is excluding nothing but requesting B, receives to exclude A, No Response*
40. Enable IGMPv3 on the RUT.
 41. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
 42. TN2 sends an IGMPv3 Report allow 10.10.10.11 for the multicast group 224.0.6.130.
 43. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
 44. Observe the packets on all networks and the Group Membership Status on the RUT.

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Part J: Is excluding A but requesting B, receives to exclude nothing

45. Enable IGMPv3 on the RUT.
46. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
47. TN2 sends an IGMPv3 Report allow 10.10.10.11 for the multicast group 224.0.6.130.
48. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 224.0.6.130.
49. Observe the Group Membership Status on the RUT.

Part K: Is excluding A but requesting B, receives to exclude A

50. Enable IGMPv3 on the RUT.
51. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
52. TN2 sends an IGMPv3 Report allow 10.10.10.11 for the multicast group 224.0.6.130.
53. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
54. Observe the Group Membership Status on the RUT.

Part L: Is excluding A but requesting C, receives to exclude A, B, Response

55. Enable IGMPv3 on the RUT.
56. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
57. TN2 sends an IGMPv3 Report allow 10.10.10.12 for the multicast group 224.0.6.130.
58. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
59. Observe the packets on all networks and the Group Membership Status on the RUT.
60. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.11 for the multicast group 224.0.6.130.
61. Observe the Group Membership Status on the RUT.

Part M: Is excluding A but requesting C, receives to exclude A, B, No Response

62. Enable IGMPv3 on the RUT.
63. TN2 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 224.0.6.130.
64. TN2 sends an IGMPv3 Report allow 10.10.10.12 for the multicast group 224.0.6.130.
65. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 and 10.10.10.11 for the multicast group 224.0.6.130.
66. Observe the packets on all networks and the Group Membership Status on the RUT.

Part N: Is excluding nothing but requesting A, receives to exclude A, Response

67. Enable IGMPv3 on the RUT.
68. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
69. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
70. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
71. Observe the packets on all networks and the Group Membership Status on the RUT.
72. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
73. Observe the Group Membership Status on the RUT.

Part O: Is excluding nothing but requesting A, receives to exclude A, No Response

74. Enable IGMPv3 on the RUT.
75. TN2 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130.
76. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
77. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
78. Observe the packets on all networks and the Group Membership Status on the RUT.

Part P: Is excluding B but requesting A, receives to exclude A, Response

79. Enable IGMPv3 on the RUT.
80. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.
81. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.
82. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
83. Observe the packets on all networks and the Group Membership Status on the RUT.
84. TN2 sends an IGMPv3 Report in response to the RUT's Group-and-Source Specific Query, is including 10.10.10.10 for the multicast group 224.0.6.130.
85. Observe the Group Membership Status on the RUT.

Part Q: Is excluding B but requesting A, receives to exclude A, No Response

86. Enable IGMPv3 on the RUT.
87. TN2 sends an IGMPv3 Report is excluding 10.10.10.11 for the multicast group 224.0.6.130.
88. TN2 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 224.0.6.130.

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- 89. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
- 90. Observe the packets on all networks and the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must be in exclude nothing for multicast group 224.0.6.130.
- *Part B*
Step 8: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
Step 10: The RUT must remain in the previous state.
- *Part C*
Step 14: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be in exclude nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must transition to exclude 10.10.10.10 for multicast group 224.0.6.130.
- *Part D*
Step 18: The RUT must be in exclude nothing for multicast group 224.0.6.130.
- *Part E*
Step 22: The RUT must be in exclude 10.10.10.10 for multicast group 224.0.6.130.
- *Part F*
Step 26: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.11, multicast group 224.0.6.130. The RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130 with 10.10.10.11 requested for forwarding. After last member query time the RUT must transition to exclude 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.
- *Part G*
Step 30: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.11, multicast group 224.0.6.130. The RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130 with 10.10.10.11 requested for forwarding.
Step 32: The RUT must remain in the previous state.
- *Part H*
Step 5: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.
Step 7: The RUT must remain in the previous state.
- *Part I*
Step 12: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must transition to exclude 10.10.10.10 for multicast group 224.0.6.130.
- *Part J*
Step 17: The RUT must be in exclude nothing for multicast group 224.0.6.130.
- *Part K*
Step 22: The RUT must be in exclude 10.10.10.10 for multicast group 224.0.6.130.
- *Part L*
Step 27: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.11, multicast group 224.0.6.130. The RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130 with 10.10.10.11 requested for forwarding.
Step 29: The RUT must remain in the previous state.
- *Part M*
Step 34: The RUT must send a Group-and-Source Specific Query for the source

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10.10.10.11, multicast group 224.0.6.130. The RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130 with 10.10.10.11 requested for forwarding. After last member query time the RUT must transition to exclude 10.10.10.10 and 10.10.10.11 for multicast group 224.0.6.130.

- *Part N*

Step 39: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.

Step 41: The RUT must remain in the previous state.

- *Part O*

Step 46: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must transition to exclude 10.10.10.10 for multicast group 224.0.6.130.

- *Part P*

Step 51: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding.

Step 53: The RUT must remain in the previous state.

- *Part Q*

Step 58: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 224.0.6.130. The RUT must be excluding nothing for multicast group 224.0.6.130 with 10.10.10.10 requested for forwarding. After last member query time the RUT must transition to exclude 10.10.10.10 for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

GROUP 5: Version Interoperability

Scope:

The following tests are designed to verify that an IGMPv3 Router Interoperates with IGMPv2 and IGMPv1 hosts and routers as described in RFC 3376.

Overview:

These tests verify that an IGMPv3 Router ignores the appropriate Reports when in IGMPv1 and IGMPv2 Group Member Compatibility Modes. These tests also verify the Router translates IGMPv1 and IGMPv2 Reports into their corresponding IGMPv3 Reports, that the Router has the appropriate Group Compatibility Mode scope, and that the Other Host Present Interval expires and transitions modes as expected.

Test IGMP.5.1: IGMPv1 Group Member Compatibility, Report Ignores

Purpose: To verify that an IGMPv3 router ignores the appropriate reports when in IGMPv1 Group Member Compatibility Mode.

References:

- [RFC 3376] – 7.3.2

Discussion: When Group Compatibility Mode is IGMPv1... In addition to ignoring IGMPv3 BLOCK messages and source-lists in TO_EX() messages as in IGMPv2 Group Compatibility Mode, IGMPv2 Leave messages and IGMPv3 TO_IN() messages are also ignored.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: IGMPv1 Compatibility Mode: Ignores a block

1. Enable IGMPv3 on the RUT.
2. TN2 sends an IGMPv1 Report on Network 0 for the multicast group 224.0.6.130.
3. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130
4. Observe the Group Membership Status on the RUT.

Part B: IGMPv1 Compatibility Mode: Ignores a to exclude A

5. Enable IGMPv3 on the RUT.
6. TN2 sends an IGMPv1 Report on Network 0 for the multicast group 224.0.6.130.
7. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
8. Observe the Group Membership Status on the RUT.

Part C: IGMPv1 Compatibility Mode: Ignores an IGMPv2 Leave

9. Enable IGMPv3 on the RUT.
10. TN2 sends an IGMPv1 Report on Network 0 for 224.0.6.130.
11. TN1 sends an IGMPv2 Leave for 224.0.6.130.
12. Observe the Group Membership Status on the RUT.

Part D: IGMPv1 Compatibility Mode: Ignores a to include nothing

13. Enable IGMPv3 on the RUT.
14. TN3 sends an IGMPv1 Report on Network 0 for 224.0.6.130.
15. TN1 sends an IGMPv3 Report to include nothing for the multicast group 224.0.6.130.
16. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must ignore the block. The RUT must continue to show multicast group members present for the group 224.0.6.130.
- *Part B*
Step 8: The RUT must ignore the exclude A. The RUT must continue to show multicast group members present for the group 224.0.6.130.
- *Part C*
Step 12: The RUT must ignore the leave. The RUT must continue to show multicast group members present for the group 224.0.6.130.
- *Part D*
Step 16: The RUT must ignore the include nothing. The RUT must continue to show multicast group members present for the group 224.0.6.130.

Possible Problems:

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- It may not be possible to view multicast group membership on the device.

Test IGMP.5.2: IGMPv2 Group Member Compatibility, Report Ignores

Purpose: To verify that an IGMPv3 router ignores the appropriate reports when in IGMPv2 Group Member Compatibility Mode.

References:

- [RFC 3376] – 7.3.2

Discussion: When Group Compatibility Mode is IGMPv2... IGMPv3 BLOCK messages are ignored, as are source-lists in TO_EX() messages (i.e., any TO_EX() message is treated as TO_EX({})).

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: IGMPv2 Compatibility Mode: Ignores a block

1. Enable IGMPv3 on the RUT.
2. TN2 sends an IGMPv2 Report on Network 0 for 224.0.6.130.
3. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130
4. Observe the packets transmitted by the RUT.

Part B: IGMPv2 Compatibility Mode: Ignores a to exclude A

5. Enable IGMPv3 on the RUT.
6. TN2 sends an IGMPv2 Report on Network 0 for 224.0.6.130.
7. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 224.0.6.130.
8. Observe the packets transmitted by the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must ignore the block. The RUT must continue to show multicast group members present for the group 224.0.6.130.
- *Part B*
Step 8: The RUT must ignore the exclude A. The RUT must continue to show multicast group members present for the group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.5.3: IGMPv1 Group Member Compatibility, Translations

Purpose: To verify that an IGMPv3 router translates lower version Reports into IGMPv3 Reports correctly when in IGMPv1 Group Member Compatibility Mode.

References:

- [RFC 3376] – 7.3.2

Discussion: When Group Compatibility Mode is IGMPv1, a router internally translates the following IGMPv1 and IGMPv2 messages for that group to their IGMPv3 equivalents:

v1 Report -> IS_EX({ })
v2 Report -> IS_EX({ })

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: IGMPv1 Report Translation

1. Enable IGMPv3 on the RUT.
2. TN2 sends an IGMPv1 Report for the multicast group 224.0.6.130.
3. Observe the Group Membership Status on the RUT.

Part B: IGMPv2 Report Translation

4. Enable IGMPv3 on the RUT.
5. TN2 sends an IGMPv1 Report for the multicast group 224.0.6.130.
6. TN1 sends an IGMPv2 Report for the multicast group 224.0.6.130.
7. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must be in exclude nothing for multicast groups 224.0.6.130.
- *Part B*
Step 7: The RUT must be in exclude nothing for multicast groups 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.5.4: IGMPv2 Group Member Compatibility, Translations

Purpose: To verify that an IGMPv3 router translates lower version Reports into IGMPv3 Reports correctly when in IGMPv2 Group Member Compatibility Mode.

References:

- [RFC 3376] – 7.3.2

Discussion: When Group Compatibility Mode is IGMPv2, a router internally translates the following IGMPv2 messages for that group to their IGMPv3 equivalents:

Report -> IS_EX({})
Leave -> TO_IN({})

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: IGMPv2 Report Translation

1. Enable IGMPv3 on the RUT.
2. TN1 sends an IGMPv2 Report for the multicast group 224.0.6.130.
3. Observe the Group Membership Status on the RUT.

Part B: IGMPv2 Leave Translation

4. Enable IGMPv3 on the RUT.
5. TN2 sends an IGMPv3 Report to exclude nothing for the multicast group 224.0.6.130.
6. Observe the Group Membership Status on the RUT.
7. TN1 sends an IGMPv2 Leave for the multicast group 224.0.6.130.
8. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must be in exclude nothing for multicast group 224.0.6.130.
- *Part B*
Step 6: The RUT must be in exclude nothing for multicast group 224.0.6.130.
Step 8: After last member query time, the RUT must be in including nothing for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.5.5: Unknown Query Length

Purpose: To verify that an IGMPv3 router handles query messages with an unknown length correctly.

References:

- [RFC-3376] – 7.1

Discussion: The IGMP version of a Membership Query message is determined as follows:

IGMPv1 Query: length = 8 octets AND Max Resp Code field is zero
IGMPv2 Query: length = 8 octets AND Max Resp Code field is non-zero
IGMPv3 Query: length \geq 12 octets

Query messages that do not match any of the above conditions (e.g., a Query of length 10 octets) MUST be silently ignored.

Test Setup: The [Common Test Setup](#) is performed on the RUT and TR1. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: 10 Octets Query Length

1. Enable IGMPv3 on the RUT.
2. TR1 has the lower IP address on Network 0.
3. TR1 begins to send General Query Messages with a length of 10 octets.
4. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 4: The RUT must not crash or generate invalid packets. The RUT also must not cease transmission of General Queries.

Possible Problems:

- None

Test IGMP.5.6: Group Compatibility Mode Scope

Purpose: To verify that an IGMPv3 router maintains the correct group compatibility mode scope.

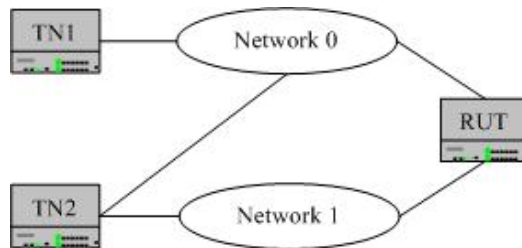
References:

- [RFC 3376] – 7.3.2

Discussion: IGMPv3 routers may be placed on a network where there are hosts that have not yet been upgraded to IGMPv3. In order to be compatible with older version hosts, IGMPv3 routers MUST operate in version 1 and version 2 compatibility modes. IGMPv3 routers keep a compatibility mode per group record. A group's compatibility mode is determined from the Group Compatibility Mode variable which can be in one of three states: IGMPv1, IGMPv2 or IGMPv3. This variable is kept per group record and is dependent on the version of Membership Reports heard for that group as well as the Older Version Host Present timer for the group.

In order to switch gracefully between versions of IGMP, routers keep an IGMPv1 Host Present timer and an IGMPv2 Host Present timer per group record. The IGMPv1 Host Present timer is set to Older Version Host Present Timeout seconds whenever an IGMPv1 Membership Report is received. The IGMPv2 Host Present timer is set to Older Version Host Present Timeout seconds whenever an IGMPv2 Membership Report is received.

Test Setup: The devices are setup as seen below. The [Common Test Cleanup](#) is performed after each test.



Procedure:

Part A: IGMPv2 Compatibility Mode Per Interface

1. IGMPv3 is enabled on the RUT on Networks 0 and 1.
2. TN2 sends an IGMPv2 Report on Network 1 for the multicast group 224.0.6.130.
3. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130 on Network 0.
4. Observe the Group Membership Status on the RUT.
5. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130 on Network 0.
6. Observe the Group Membership Status on the RUT.

Part B: IGMPv1 Compatibility Mode Per Interface

7. IGMPv3 is enabled on the RUT on Networks 0 and 1.
8. TN2 sends an IGMPv1 Report on Network 1 for the multicast group 224.0.6.130.
9. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130 on Network 0.
10. Observe the Group Membership Status on the RUT.
11. TN1 sends an IGMPv3 Report include nothing for the multicast group 224.0.6.130 on Network 1.
12. Observe the Group Membership Status on the RUT.

Part C: IGMPv2 Compatibility Mode Per Group Record

13. IGMPv3 is enabled on the RUT on Networks 0.
14. TN2 sends an IGMPv2 Report on Network 0 for the multicast group 224.0.6.131.

15. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130 on Network 0.
16. Observe the Group Membership Status on the RUT.
17. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 224.0.6.130 on Network 0.
18. Observe the Group Membership Status on the RUT.

Part D: IGMPv1 Compatibility Mode Per Group Record

19. IGMPv3 is enabled on the RUT on Networks 0.
20. TN2 sends an IGMPv1 Report on Network 0 for the multicast group 224.0.6.131.
21. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 224.0.6.130 on Network 0.
22. Observe the Group Membership Status on the RUT.
23. TN1 sends an IGMPv3 Report include nothing for the multicast group 224.0.6.130 on Network 0.
24. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must be excluding nothing for multicast group 224.0.6.130 on Networks 0 and 1.
Step 6: The RUT must be excluding nothing for multicast group 224.0.6.130 on Networks 1 and after last member query time the RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130 on Network 0.
- *Part B*
Step 10: The RUT must be excluding nothing for multicast group 224.0.6.130 on Networks 0 and 1.
Step 12: The RUT must be excluding nothing for multicast group 224.0.6.130 on Networks 1 and after last member query time the RUT must be including nothing for multicast group 224.0.6.130 on Network 0.
- *Part C*
Step 16: The RUT must be excluding nothing for the multicast groups 224.0.6.130 and 224.0.6.131 on Networks 0.
Step 18: The RUT must be excluding nothing for multicast group 224.0.6.131 on Network 0 and after last member query time the RUT must be excluding 10.10.10.10 for multicast group 224.0.6.130 on Network 0.
- *Part D*
Step 22: The RUT must be excluding nothing for the multicast groups 224.0.6.130 and 224.0.6.131 on Networks 0.
Step 24: The RUT must be excluding nothing for multicast group 224.0.6.131 on Network 0 and after last member query time the RUT must be including nothing for multicast group 224.0.6.130 on Network 0.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

Test IGMP.5.7: Older Host Present Interval Transitions

Purpose: To verify that an IGMPv3 router properly calculates the Older Host Present Interval.

References:

- [RFC 3376] – 7.3.2, 8.13

Discussion: When Group Compatibility Mode is IGMPv1, a router internally translates the following IGMPv1 and IGMPv2 messages for that group to their IGMPv3 equivalents:

<u>IGMP Message</u>	<u>IGMPv3 Equivalent</u>
v1 Report	IS_EX({ })
v2 Report	IS_EX({ })

In addition to ignoring IGMPv3 BLOCK messages and source-lists in TO_EX() messages as in IGMPv2 Group Compatibility Mode, IGMPv2 Leave messages and IGMPv3 TO_IN() messages are also ignored.

The Older Host Present Interval is the time-out for transitioning a group back to IGMPv3 mode once an older version report is sent for that group. When an older version report is received, routers set their Older Host Present Timer to Older Host Present Interval. This value MUST be ((the Robustness Variable) times (the Query Interval)) plus (one Query Response Interval).

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: IGMPv1 to IGMPv3 Transition

1. IGMPv3 is enabled on the RUT.
2. TN2 sends an IGMPv1 Report on Network 0 for multicast group 224.0.6.130.
3. TN2 ceases transmission on Network 0.
4. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
5. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
6. Observe Group Membership Status on the RUT.
7. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
8. Observe when Older Host Present Interval Expires.
9. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
10. Observe Group Membership Status on the RUT.

Part B: IGMPv1 to IGMPv2 Transition

11. IGMPv3 is enabled on the RUT.
12. TN2 sends an IGMPv1 Report on Network 0 for multicast group 224.0.6.130.
13. TN3 sends IGMPv2 Reports on Network 0 for multicast group 224.0.6.130.
14. TN2 ceases transmission on Network 0.
15. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
16. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
17. Observe Group Membership Status on the RUT.
18. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
19. Observe when Older Host Present Interval Expires.
20. TN1 sends a Report a block 10.10.10.10 for multicast group 224.0.6.130.
21. Observe Group Membership Status on the RUT.
22. TN3 ceases transmission on Network 0.
23. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
24. Observe Group Membership Status on the RUT.

Part C: IGMPv2 to IGMPv3 Transition

25. IGMPv3 is enabled on the RUT.
26. TN2 sends an IGMPv2 Report on Network 0 for multicast group 224.0.6.130.
27. TN2 ceases transmission on Network 0.
28. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
29. TN1 sends a Report block 10.10.10.10 for multicast group 224.0.6.130.
30. Observe Group Membership Status on the RUT.
31. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
32. Observe when Older Host Present Interval Expires.
33. TN1 sends a Report block 10.10.10.10 for multicast group 224.0.6.130.
34. Observe Group Membership Status on the RUT.

Observable Results:

- *Part A*
 - Step 6:** The RUT must continue to exclude nothing for multicast group 224.0.6.130.
 - Step 8:** Older Host Present Interval expired after 260 seconds.
 - Step 10:** The RUT must not show members present for multicast group 224.0.6.130.
- *Part B*
 - Step 17:** The RUT must continue to exclude nothing for multicast group 224.0.6.130.
 - Step 19:** Older Host Present Interval expired after 260 seconds.
 - Step 21:** The RUT must continue to exclude nothing for multicast group 224.0.6.130.
 - Step 24:** The RUT must not show members present for multicast group 224.0.6.130.
- *Part C*
 - Step 30:** The RUT must continue to exclude nothing for multicast group 224.0.6.130.
 - Step 32:** Older Host Present Interval expired after 260 seconds.
 - Step 34:** The RUT must not show members present for multicast group 224.0.6.130.

Possible Problems:

- It may not be possible to view multicast group membership on the device.

GROUP 6: Source Specific Multicast

Scope:

The following tests are designed to verify that an IGMPv3 Router implements Source Specific Multicast as specified by RFC 4604.

Overview:

These tests verify that an IGMPv3 Router implements Source Specific Multicast (SSM) correctly. These verify the SSM multicast range, that IGMPv3 Reports that are invalid under SSM are ignored while other Reports are properly accepted, that the General and Group and Source Specific Queries are still sent in the same manner, and finally these tests verify that IGMPv1 and IGMPv2 Reports are ignored.

Test IGMP.6.1: SSM Range

Purpose: To verify that an IGMPv3 router utilizes the appropriate SSM range.

References:

- [RFC 4604] – 3

Discussion: Routers must be aware of the SSM address range in order to provide the SSM service model. A router that knows the SSM address range and is capable of applying SSM semantics to it as described in this section is described as an "SSM-aware" router. An SSM-aware router MAY have a configuration option to apply SSM semantics to addresses other than the IANA-allocated range, but if such an option exists, it MUST default to the IANA-allocated range.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is an "SSM-Aware" router.

Procedure:

Part A: Default SSM Range

1. Enable IGMPv3 on the RUT.
2. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 232.0.0.1.
3. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 232.254.254.254.
4. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 231.254.254.254.
5. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 233.0.0.1.
6. Observe the Group Membership Status on the RUT

Part B: Configured SSM Range

7. Configure the SSM range on the RUT to be 222.0.0.0/8.
8. Enable IGMPv3 on the RUT.
9. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 222.0.0.1.
10. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 222.254.254.254.
11. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 221.254.254.254.
12. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 223.0.0.1.
13. Observe the Group Membership Status on the RUT

Observable Results:

- *Part A*
Step 6: The RUT must be excluding nothing for multicast group 231.254.254.254 and 233.0.0.1.
- *Part B*
Step 13: The RUT must be excluding nothing for multicast group 221.254.254.254 and 223.0.0.1.

Possible Problems:

- The RUT may not support configuration of the SSM range.

Test IGMP.6.2: SSM IGMPv3 Reports

Purpose: To verify that an IGMPv3 router properly handles IGMPv3 Reports when SSM is enabled.

References:

- [RFC 4604] – 3.1

Discussion: SFGMP Reports are used to report source-specific subscriptions in the SSM address range. A router SHOULD ignore a group record of either of the following types if it refers to an SSM destination address:

- MODE_IS_EXCLUDE Current-State Record
- CHANGE_TO_EXCLUDE_MODE Filter-Mode-Change Record

A router MAY choose to log an error in either case. It MUST process any other group records within the same report. These behaviors are MODIFICATIONS to [IGMPv3, MLDv2] to prevent non-source-specific semantics from being applied to SSM addresses, and to avoid reverting to older-version compatibility mode.

A CHANGE_TO_INCLUDE_MODE Filter-Mode-Change Record is processed per the normal SFGMP rules; Section 2.2.2 describes a legitimate scenario when this could occur.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is an “SSM-Aware” router.

Procedure:

Part A: Ignores To Exclude

1. Enable IGMPv3 on the RUT.
2. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 232.0.0.1.
3. TN1 sends an IGMPv3 Report to exclude 10.10.10.10 for the multicast group 232.0.0.1.
4. Observe the Group Membership Status on the RUT.

Part B: Ignores Is Exclude

5. Enable IGMPv3 on the RUT.
6. TN1 sends an IGMPv3 Report is excluding nothing for the multicast group 232.0.0.1.
7. TN1 sends an IGMPv3 Report is excluding 10.10.10.10 for the multicast group 232.0.0.1.
8. Observe the Group Membership Status on the RUT.

Part C: Accepts To Include

9. Enable IGMPv3 on the RUT.
10. TN1 sends an IGMPv3 Report to include 10.10.10.10 for the multicast group 232.0.0.1.
11. Observe the Group Membership Status on the RUT.

Part D: Accepts Is Include

12. Enable IGMPv3 on the RUT.
13. TN1 sends an IGMPv3 Report is including 10.10.10.10 for the multicast group 232.0.0.1.
14. Observe the Group Membership Status on the RUT.

Part E: Accepts Allow

15. Enable IGMPv3 on the RUT.
16. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 232.0.0.1.
17. Observe the Group Membership Status on the RUT.

Part F: Accepts Block

18. Enable IGMPv3 on the RUT.
19. TN1 sends an IGMPv3 Report allow 10.10.10.10 for the multicast group 232.0.0.1.
20. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 232.0.0.1.
21. Observe the Group Membership Status on the RUT.

Part G All Group Records Processed

22. Enable IGMPv3 on the RUT.

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23. TN1 sends an IGMPv3 Report to exclude nothing for the multicast group 232.0.0.1 and to include 10.10.10.10 for the multicast group 232.0.0.1.

24. Observe the Group Membership Status on the RUT.

Part H All Sources Processed

25. Enable IGMPv3 on the RUT.

26. TN1 sends an IGMPv3 Report allow 10.10.10.10 and 10.10.10.11 for the multicast group 232.0.0.1.

27. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must have no members present for multicast group 232.0.0.1.
- *Part B*
Step 8: The RUT must have no members present for multicast group 232.0.0.1.
- *Part C*
Step 11: The RUT must be including 10.10.10.10 for multicast group 232.0.0.1.
- *Part D*
Step 14: The RUT must be including 10.10.10.10 for multicast group 232.0.0.1.
- *Part E*
Step 17: The RUT must be including 10.10.10.10 for multicast group 232.0.0.1.
- *Part F*
Step 21: The RUT must have no members present for multicast group 232.0.0.1.
- *Part G*
Step 24: The RUT must be including 10.10.10.10 for multicast group 232.0.0.1.
- *Part H*
Step 27: The RUT must be including 10.10.10.10 and 10.10.10.11 for multicast group 232.0.0.1.

Possible Problems:

- None

Test IGMP.6.3: SSM IGMPv3 General Queries

Purpose: To verify that an IGMPv3 router does not change the General Query behavior when SSM is enabled.

References:

- [RFC 4604] – 3.2

Discussion: An SSM router sends periodic SFGMP General Queries as per the IGMPv3 and MLDv2 specifications. No change in behavior is required for SSM.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is an “SSM-Aware” router.

Procedure:

Part A: General Queries Unchanged

1. Enable IGMPv3 on the RUT.
2. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 2: The RUT must send a General Query every 125 seconds disregarding the startup queries.

Possible Problems:

- None

Test IGMP.6.4: SSM IGMPv3 Group and Source Specific Queries

Purpose: To verify that an IGMPv3 router does not change the Group and Source Specific Query behavior when SSM is enabled.

References:

- [RFC 4604] – 3.4

Discussion: SFGMP Group-and-Source-Specific Queries are used when a receiver has indicated that it is no longer interested in receiving traffic from a particular (S,G) pair to determine if there are any remaining directly-attached hosts with interest in that (S,G) pair. Group-and-Source-Specific Queries are used within the source-specific address range when a router receives a BLOCK_OLD_SOURCES Record for one or more source-specific groups. These queries are sent normally, as per [IGMPv3, MLDv2].

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is an “SSM-Aware” router.

Procedure:

Part A: Block caused Group and Source Specific Query

1. Enable IGMPv3 on the RUT.
2. TN2 sends an IGMPv3 Report including 10.10.10.10 for the multicast group 232.0.0.1.
3. TN1 sends an IGMPv3 Report block 10.10.10.10 for the multicast group 232.0.0.1.
4. Observe the packets on all networks and the Group Membership Status on the RUT.

Part B: To Include caused Group and Source Specific Query

5. Enable IGMPv3 on the RUT.
6. TN2 sends an IGMPv3 Report including 10.10.10.10 for the multicast group 232.0.0.1.
7. TN1 sends an IGMPv3 Report to include nothing for the multicast group 232.0.0.1.
8. Observe the packets on all networks and the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 4: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 232.0.0.1. The RUT must be including 10.10.10.10 for multicast group 232.0.0.1. After last member query time the RUT must transition to no members present for multicast group 232.0.0.1.
- *Part B*
Step 8: The RUT must send a Group-and-Source Specific Query for the source 10.10.10.10, multicast group 232.0.0.1. The RUT must be including 10.10.10.10 for multicast group 232.0.0.1. After last member query time the RUT must transition to no members present for multicast group 232.0.0.1.

Possible Problems:

- None

Test IGMP.6.5: SSM IGMPv1/2 Reports and Leaves

Purpose: To verify that an IGMPv3 router ignores IGMPv1/2 Reports and Leaves when SSM is enabled.

References:

- [RFC 4604] – 3.5, 3.7

Discussion: An IGMPv1/v2 or MLDv1 report for an address in the source-specific range could be sent by a non-SSM-aware host. A router SHOULD ignore all such reports and specifically SHOULD NOT use them to establish IP forwarding state. This is a MODIFICATION to [IGMPv3, MLDv2]. A router MAY log an error if it receives such a report (also a MODIFICATION).

An IGMPv2 Leave or MLDv1 Done message may be sent by a non-SSM-aware host. A router SHOULD ignore all such messages in the source-specific address range and MAY log an error (MODIFICATION).

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is an “SSM-Aware” router.

Procedure:

Part A: IGMPv1 Report Ignored

1. Enable IGMPv3 on the RUT.
2. TN1 sends an IGMPv1 Report on Network 0 for the multicast group 232.0.0.1.
3. Observe the Group Membership Status on the RUT.

Part B: IGMPv2 Report Ignored

4. Enable IGMPv3 on the RUT.
5. TN1 sends an IGMPv2 Report on Network 0 for the multicast group 232.0.0.1.
6. Observe the Group Membership Status on the RUT.

Part C: IGMPv2 Leave Ignored

7. Enable IGMPv3 on the RUT.
8. TN2 sends an IGMPv3 Report including 10.10.10.10 for the multicast group 232.0.0.1.
9. TN1 sends an IGMPv2 Leave for the multicast group 232.0.0.1.
10. Observe the Group Membership Status on the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must have no members present for multicast group 232.0.0.1.
- *Part B*
Step 6: The RUT must have no members present for multicast group 232.0.0.1.
- *Part C*
Step 10: The RUT must be including 10.10.10.10 for multicast group 232.0.0.1.

Possible Problems:

- None

GROUP 7: Internet Group Management Protocol Version 1

Scope:

The following tests are designed to verify conformance with the Internet Group Management Protocol Version 1.

Overview:

IGMP is used by IP hosts to report multicast group memberships to neighboring routers. IGMPv1 is defined in Appendix I of Host Extensions for IP Multicasting.

Test IGMP.7.1: IGMPv1 Query Transmission

Purpose: To verify that an IGMP router properly sends IGMP Queries.

References:

- [RFC 2236] – Appendix I

Discussion: A router sends Queries to a network to determine local group membership. Hosts respond to the Queries with Membership Reports.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test.

Procedure:

Part A: IGMPv1 Query Transmission

1. Enable IGMP Version 1 on the RUT.
2. Observe the packets on all networks.

Observable Results:

- *Part A*
Step 2: The RUT must send periodic Queries to the All Nodes (224.0.0.1) multicast address. The TTL of the Queries should be set to 1. The RUT should not send more than one Query per minute.

Possible Problems:

- None

Test IGMP.7.2: Invalid IGMPv1 Message Reception

Purpose: To verify that a router properly processes incoming IGMPv1 packets with incorrect checksums

References:

- [RFC 1112] - Appendix 1
- [RFC 2236] - Sections 2, 7 and 8

Discussion: When receiving packets, the checksum MUST be verified before processing a packet. Events such as receiving invalid IGMP messages, or IGMP messages other than Query or Report are ignored in all states for an IGMPv1 entity. Unused type fields include type 0 and types 3 through 15.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv1.

Procedure:

Part A: IGMPv1 Report Received with Invalid Checksum

1. Ensure that the RUT is in Querier state on Network 0, and in the Non-Member state for multicast group 224.0.6.130.
2. TN1 transmits an IGMPv1 report with an invalid checksum for the multicast group 224.0.6.130.
3. Observe the packets transmitted by the RUT.

Part B: IGMPv1 Messages Received

4. Ensure that the RUT is in Querier state on Network 0, and in the Non-Member state for multicast group 224.0.6.130.
5. TN1 transmits an IGMPv1 report for each of the unused type fields with a valid checksum for the multicast group 224.0.6.130.
6. Observe the packets transmitted by the RUT.

Observable Results:

- *Part A*
Step 3: The RUT must not show any members present in multicast group 224.0.6.130 on Network 0.
- *Part B*
Step 6: The RUT must not show any members present in multicast group 224.0.6.130 on Network 0.

Possible Problems:

- None

Test IGMP.7.3: ICMP Error Conditions

Purpose: To verify that a router does not send ICMP Error packets in response to multicast packets.

References:

- [RFC 1112] – Section 7.2

Discussion: An ICMP error message (Destination Unreachable, Time Exceeded, Parameter Problem, Source Quench, or Redirect) is never generated in response to a datagram destined to an IP host group.

Test Setup: The RUT is configured with IGMPv1 as seen below.



Procedure:

Part A: Destination Unreachable

1. Enable a multicast routing protocol on the RUT.
2. TN1 transmits a Report message for multicast group 224.0.6.130 on Network 0.
3. TN1 transmits a Leave message for multicast group 224.0.6.130 on Network 0.
4. On Network 1, the TR transmits packets to the RUT with destination address equal to 224.0.6.130.
5. Observe the packets transmitted by the RUT.

Part B: Time Exceeded

6. TN1 transmits a Report message for multicast group 224.0.6.130 on Network 0.
7. TR1 transmits a packet to the RUT with destination address equal to 224.0.6.130 and a TTL of zero.
8. Observe the packets transmitted by the RUT.

Part C: Parameter Problem

9. TN1 transmits a Report message for multicast group 224.0.6.130 on Network 0.
10. TR1 transmits a packet to the RUT with destination address equal to 224.0.6.130 and a TOS field of 0xFF.
11. Observe the packets transmitted by the RUT.

Observable Results:

- *Part A*
Step 5: The RUT must not send any ICMP error messages.
- *Part B*
Step 8: The RUT must not send any ICMP error messages.
- *Part C*
Step 11: The RUT must not send any ICMP error messages.

Possible Problems:

- None

GROUP 8: Internet Group Management Protocol Version 2

Scope:

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The following tests are designed to verify conformance with the Internet Group Management Protocol Version 2. This section covers the conformance of routers.

Overview:

IGMPv2 is used by IP hosts to report their host group memberships to any immediately neighboring multicast routers. IGMPv2 allows group membership terminations to be quickly reported to the routing protocol, which is important for high-bandwidth multicast groups and/or subnets with highly volatile group membership.

Test IGMP.8.1: Transmission of Initial and General Queries

Purpose: To verify that a router running IGMP version 2 will properly implement transmission of initial Queries, as well as periodic transmission of General Queries.

References:

- [RFC 2236] - Sections 3, 7, 8.6 and 8.7

Discussion: On startup, a router SHOULD send [Startup Query Count] General Queries spaced closely together (Startup Query Interval) in order to quickly and reliably determine membership information.

After initialization, a router transitions to the Querier state. In this state, the router sends IGMP Queries every (Query Interval)..

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2.

Procedure:

Part A: Proper transmission of IGMPv2 Queries

1. Restart the RUT.
2. Observe the packets transmitted by the RUT.

Observable Results:

- *Part A*
Step 2: The RUT must transmit [Startup Query Count] General Queries spaced at [Startup Query Interval]. After the initialization, the RUT should transition into the Querier state, and transmit one IGMP General Query every (Query Interval) seconds.

Possible Problems:

- Transmission of initial queries is only recommended, so a device cannot fail that piece of the test.

Test IGMP.8.2: Other Querier Present Interval

Purpose: To verify that a router running IGMP version 2 will properly implement Other Querier Present Interval

References:

- [RFC 2236] - Sections 3, 7 and 8

Discussion: Upon initialization, a router transitions to the Querier state. If a multicast router hears a Query message from a router with a lower IP address, it MUST transition to the Non Querier state and start the Other Querier Present Timer. This timer contains the value of Other Querier Present Interval, which MUST be $((\text{the Robustness Variable}) * (\text{the Query Interval})) + (\text{one half of one Query Response Interval})$. Query Response Interval is present in the Max Response Time field of the received IGMP messages.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2. Configure TR1 to have a lower IP address than that of the RUT.

Procedure:

Part A: Other Querier Present Timer Set

1. On network 0, TR1 transmits a general query to the all-systems multicast group every (Query Interval) seconds. This should place the RUT in the Non Querier state.
2. TR1 ceases transmission of General Queries.
3. Observe the time from when TR1 sent its last General Query to when the RUT transitions to the Querier state and transmits a Query.

Part B: Other Querier Present Timer Reset

4. On network 0, TR1 transmits a general query to the all-systems multicast group every (Query Interval) seconds. This should place the RUT in the Non Querier state.
5. TR1 ceases transmission of General Queries for a time that is greater than Query Interval and less than Other Querier Present Interval.
6. TR1 resumes transmission of general queries as in step 4.
7. Observe the packets transmitted by the RUT.

Observable Results:

- *Part A*
Step 3: The time from when TR1 sends its last General Query to when the RUT transitions to the Querier state and transmits a Query must be equal to Other Querier Present Interval.
- *Part B*
Step 7: The RUT must not transmit any Query messages.

Possible Problems:

- None

Test IGMP.8.3: Querier, Members Present

Purpose: To verify that a router properly implements the Members Present state for a multicast group when it is in Querier state

References:

- [RFC 2236] - Sections 3, 7 and 8.4

Discussion: The IGMP Querier sends periodic IGMP Queries to the network to determine the group membership. All multicast routers start up as a Querier on each attached network and initialize in the No Members Present state. If a multicast router receives a Report message, it notifies the routing protocol that there are members of that group present. It also starts a timer for that multicast group, which expires at Group Membership Interval. Group Membership Interval MUST be ((the Robustness Variable) * (the Query Interval)) + (one Query Response Interval). Query Response Interval is present in the Max Response Time field of the received IGMP messages.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2.

Procedure:

Part A: Group Membership Timer Set

1. Restart IGMP on the RUT. The RUT should be in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
2. TR1 transmits an IGMPv2 Report for the multicast group 224.0.6.130.
3. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Part B: Group Membership Timer Reset

4. TR1 transmits valid IGMPv2 Reports for the multicast group 224.0.6.130 in response to each General Query sent by the RUT
5. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Part C: Group Membership Timer Expired

6. TR1 ceases transmission of Reports.
7. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Observable Results:

- *Part A*
Step 3: The RUT must show members present in multicast group 224.0.6.130 on Network 0.
- *Part B*
Step 5: The RUT must show members present in multicast group 224.0.6.130 on Network 0.
- *Part C*
Step 7: The RUT must stop showing members in the 224.0.6.130 group ((the Robustness Variable) * (the Query Interval)) + (one Query Response Interval) seconds after TN1 sends its last Report.

Possible Problems:

- None

Test IGMP.8.4: Querier, Checking Membership

Purpose: To verify that a router properly implements the Checking Membership state for a multicast group while it is in the Querier state.

References:

- [RFC 2236] - Sections 3, 7 and 8

Discussion: When a leave message is received for a multicast group, a router in the Query state must:

- Start timer and set the expiration value to [Last Member Query Interval] * [Last Member Query Count]. Last Member Query Interval has a default of 1 second. Last Member Query Count has a default of the Robustness variable.
- Start the retransmit timer and set the expiration value to [Last Member Query Interval].
- Send a group-specific Query for that multicast group.
- Transition to the Checking Membership state.

In the Checking Membership state, a Group-Specific Query is sent each time the retransmit timer expires. If the timer expires, the router notifies the routing protocol that there are no more members in the multicast group, clears the retransmit timer and transitions to the No Members Present state. If an IGMPv2 report is received, the router resets the group membership timer for the group and transitions to the Members Present state. Group Membership interval was observed in test 2.3.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2.

Procedure:

Part A: IGMPv2 Leave Received

1. Ensure that the RUT is in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
2. TN1 transmits an IGMPv2 report for the multicast group 224.0.6.130.
3. TN1 transmits a Leave message for the multicast group 224.0.6.130 to the all-routers multicast address (224.0.0.2).
4. Observe the packets sent by the RUT. Wait until the RUT has transmitted one group-specific query for group 224.0.6.130.

Part B: Membership Report Seen

5. TN2 transmits an IGMPv2 report for the multicast group 224.0.6.130.
6. Observe the packets sent by the RUT for at least (Last Member Query Interval) seconds.
7. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Part C: Timer Expires

8. Restart IGMP on the RUT. The RUT should be in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
9. TN1 transmits an IGMPv2 report for the multicast group 224.0.6.130.
10. TN1 transmits a Leave message for the multicast group 224.0.6.130 to the all-routers multicast address (224.0.0.2).
11. Observe the packets sent by the RUT for at least (Last Member Query Interval) * (Last Member Query Count) seconds.
12. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Observable Results:

- *Part A*
Step 4: Upon receiving the Leave message, the RUT must transmit a Group-Specific Query for group 224.0.6.130 before transitioning it into the Checking Membership state.
- *Part B*
Step 7: As soon as the IGMPv2 Report is received from TN2, the RUT must transition to the Members Present state for 224.0.6.130. The RUT must not generate any additional Group-Specific Queries after it receives the Membership Report. The RUT must show members in group 224.0.6.130 for the duration of parts A and B.
- *Part C*

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Step 12: The RUT must keep group 224.0.6.130 in the Checking Membership state for (Last Member Query Interval) * (Last Member Query Count) seconds. During this time, the RUT must transmit (Last Member Query Count) Group-Specific Queries. (Last Member Query Interval) seconds after the RUT sends its last Group-Specific Query, the RUT must no longer show any members in the 224.0.6.130 group on Network 0.

Possible Problems:

- None

Test IGMP.8.5: Querier, Version 1 Members Present

Purpose: To verify that a router properly implements the Version 1 Members Present state for a multicast group while it is in the Querier state.

References:

- [RFC 2236] - Sections 4, 7 and 8

Discussion: When an ICMPv1 report is received for a multicast group, a router must:

- Notify the routing protocol that there is a member, if it has not done so already.
- Start the timer and set the expiration value to Group Membership Interval.
- Start the v1 host timer and set the expiration to Group Membership Interval.
- Transition to the Version 1 Members Present state.

Both the timer and the v1 host timer are reset with the reception of an IGMPv1 report. Only the timer is reset with the reception of an IGMPv2 report. If the v1 host timer expires and the timer does not, the router transitions to the Members Present state. If the timer expires, the router notifies the routing protocol that there are no more members and transitions to the No Members state.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2.

Procedure:

Part A: IGMPv1 Report Received in the No Members Present State

1. Ensure that the RUT is in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
2. TN1 transmits an IGMPv1 report for the multicast group 224.0.6.130.
3. Wait (Robustness Variable) * (Query Interval) + (one Query Response Interval) - 5 seconds.
4. TN2 transmits a Leave message for group 224.0.6.130 to the all-routers multicast group (224.0.0.2).
5. Observe the packets sent by the RUT, as well as the duration for which the RUT shows members present in the 224.0.6.130 group on Network 0.

Part B: IGMPv1 Host Timer Expired

6. Ensure that the RUT is in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
7. Wait for the RUT to transmit a General Query.
8. TN1 transmits an IGMPv1 report for the multicast group 224.0.6.130.
9. TN2 responds to the next (Robustness Variable) General Queries from the RUT by sending IGMPv2 Membership Reports to the group.
10. Wait (one Query Response Interval) + 5 seconds.
11. TN2 transmits a Leave message for group 224.0.6.130 to the all-routers multicast group (224.0.0.2).
12. Observe the packets sent by the RUT, as well as the duration for which the RUT shows members present in the 224.0.6.130 group on Network 0.

Part C: IGMPv1 Host Timer Reset

13. Ensure that the RUT is in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
14. Wait for the RUT to transmit a General Query.
15. TN1 transmits an IGMPv1 report for the multicast group 224.0.6.130
16. TN1 responds to the next (Robustness Variable) General Queries from the RUT by sending IGMPv1 Membership Reports to the group.
17. Wait (one Query Response Interval) + 5 seconds.
18. TN2 transmits a Leave message for group 224.0.6.130 to the all-routers multicast group (224.0.0.2).

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19. Observe the packets sent by the RUT, as well as the duration for which the RUT shows members present in the 224.0.6.130 group on Network 0.

Part D: IGMPv1 Report Received in the Members Present State

20. Ensure that the RUT is in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.

21. TN2 transmits a valid IGMPv2 report for the multicast group 224.0.6.130 to the RUT.

22. TN1 transmits a valid IGMPv1 report for the multicast group 224.0.6.130 to the RUT.

23. TN2 transmits a Leave message for group 224.0.6.130 to the all-routers multicast group (224.0.0.2).

24. Observe the packets sent by the RUT, as well as the duration for which the RUT shows members present in the 224.0.6.130 group on Network 0.

Part E: IGMPv1 Report Received in the Checking Membership State

25. Ensure that the RUT is in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.

26. TN2 transmits a valid IGMPv2 report for the multicast group 224.0.6.130 to the RUT.

27. TN2 transmits a Leave message for group 224.0.6.130 to the all-routers multicast group (224.0.0.2).

28. TN1 transmits a valid IGMPv1 report for the multicast group 224.0.6.130 to the RUT.

29. TN2 transmits a Leave message for group 224.0.6.130 to the all-routers multicast group (224.0.0.2).

30. Observe the packets sent by the RUT, as well as the duration for which the RUT shows members present in the 224.0.6.130 group on Network 0.

Observable Results:

- *Part A*
Step 5: The RUT must ignore the Leave messages received while in this state. The RUT must not generate any Group-Specific Queries.
- *Part B*
Step 12: The RUT must send two Group-Specific queries for group 224.0.6.130. (Last Member Query Interval) seconds after the RUT sends its last Group-Specific Query, the RUT must no longer show any members in the 224.0.6.130 group on Network 0.
- *Part C*
Step 19: The RUT must ignore the Leave messages received while in this state. The RUT must not generate any Group-Specific Queries.
- *Part D*
Step 24: The RUT must ignore the Leave messages received while in this state. The RUT must not generate any Group-Specific Queries.
- *Part E*
Step 30: The RUT must ignore the Leave messages received while in this state. Only the first leave message should cause the RUT to send a single Group-Specific Query. The RUT must show members in the 224.0.6.130 group from when the first Report (version 1 or 2) is received, until (((the Robustness Variable) * (the Query Interval)) + (one Query Response Interval)) seconds after the last Report is received

Possible Problems:

- Transmission of initial queries is only recommended, so a device cannot fail that piece of the test.

Test IGMP.8.6: Non-Querier, Members Present

Purpose: To verify that a router properly implements the Members Present state for a multicast group while in the Non-Querier state

References:

- [RFC 2236] - Sections 3, 7 and 8.4

Discussion: The Non-Querier state diagram is similar to the Querier state diagram, but Non-Queriers do not send messages and are only driven by message reception. The Non-Querier test results are thus dependent on the notification of the routing protocol.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2. Configure TR1 with a lower IP address than that of the RUT.

Procedure:

Part A: Group Membership Timer Set

1. Ensure that the RUT is in Non-Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
2. TN1 transmits an IGMPv2 report for the multicast group 224.0.6.130. The RUT should transition to the Members Present state.
3. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Part B: Group Membership Timer Reset

4. TN1 continues to transmit IGMPv2 reports for the multicast group 224.0.6.130 every (Query Interval) + (Query Response Interval) seconds.
5. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Part C: Group Membership Timer Expired

6. TN1 ceases transmission of Reports.
7. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Observable Results:

- *Part A*
Step 3: The RUT must show members in the 224.0.6.130 group from when the first report was sent by TN1 through part B.
- *Part B*
Step 5: The RUT must show members in the 224.0.6.130 group from when the first report was sent by TN1 through part B.
- *Part C*
Step 7: The RUT must stop showing members in the 224.0.6.130 group (((the Robustness Variable) * (the Query Interval)) + (one Query Response Interval)) seconds after TN1 sends its last Report.

Possible Problems:

- None

Test IGMP.8.7: Non-Querier, Checking Membership

Purpose: To verify that a router properly implements the Checking Membership state for a multicast group while in the Non-Querier state.

References:

- [RFC 2236] - Sections 3, 7 and 8

Discussion: When a Group-Specific Query is received for a Non-Querier router in the Members Present state, it must start the timer and set the expiration to ([the Max Response Time in the received packet] * [Last Member Query Count]). Then the router must transition to the Checking Membership state. If a report is received before the timer expires, the router resets the timer to Group Membership Interval and transitions to the Members Present state. If the router is in the Checking Membership state and the timer expires, the router notifies the routing protocol that there are no more members and transitions to the No Members Present state. Last Member Query Count has a default value of the Robustness Variable.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2. Configure TR1 to have a lower IP address than that of the RUT.

Procedure:

Part A: Group-Specific Query Received

1. Ensure that the RUT is in Non-Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
2. TN1 transmits a valid IGMPv2 report for the multicast group 224.0.6.130.
3. TR1 transmits a Group-Specific Query for 224.0.6.130 to the group.
4. Observe the duration for which the RUT shows members present in the 224.0.6.130 group on Network 0.

Part B: Report Received in the Checking Membership State

5. Ensure that the RUT is in Non-Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
6. TN1 transmits a valid IGMPv2 report for the multicast group 224.0.6.130.
7. TR1 transmits a Group-Specific Query for 224.0.6.130 to the group.
8. Before Query Response Interval expires, the TN transmits an IGMPv2 report for 224.0.6.130.
9. Observe the duration for which the RUT shows members present in the 224.0.6.130 group on Network 0.

Observable Results:

- *Part A*
Step 4: Upon receiving the Group-Specific Query, the RUT must transition into the Checking Membership state for group 224.0.6.130. The time from when the Group-Specific Query was transmitted to when the RUT transitions to the No Members Present state and no longer show members in group 224.0.6.130 must be equal to (Max Response Time) * (Last Member Query Count).
- *Part B*
Step 9: Upon receiving the Group-Specific Query, the RUT must transition into the Checking Membership state for group 224.0.6.130. Upon receiving the second Report from the TN, the RUT must transition to the Members Present state and reset the timer to Group Membership interval. The RUT must show members in group 224.0.6.130 for the duration of the test, until group membership expires normally after the second Report from the TN.

Possible Problems:

- None

Test IGMP.8.8: Invalid IGMP Message Reception in the Querier State

Purpose: To verify that a router running IGMP version 2 properly processes incoming packets with incorrect checksums while in the Querier state.

References:

- [RFC 1112] - Appendix 1
- [RFC 2236] - Sections 2, 7 and 8

Discussion: When receiving packets, the checksum MUST be verified before processing a packet. The checksum for IGMPv1 is the 16-bit one's complement of the one's complement sum of the 8-octet IGMP message. For computing the checksum, the checksum field is zeroed. The checksum for IGMPv2 is the 16-bit one's complement of the one's complement sum of the whole IGMP message (the entire IP payload).

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2.

Procedure:

Part A: IGMPv2 Reports with Invalid Checksums

1. Ensure that the RUT is in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
2. TN1 transmits an IGMPv2 report with an invalid checksum for the multicast group 224.0.6.130.
3. TN1 transmits a Leave message for 224.0.6.130 to the all-routers multicast group.
4. Observe the packets transmitted by the RUT.

Part B: Leave Received in the Checking Membership State

5. Ensure that the RUT is in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
6. TN1 transmits an IGMPv2 report for the multicast group 224.0.6.130.
7. TN1 transmits an IGMPv2 Leave message with an invalid checksum for the multicast group 224.0.6.130 to the all-routers multicast group.
8. Observe the packets transmitted by the RUT.

Part C: IGMPv1 Report Received in the Members Present state

9. Ensure that the RUT is in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
10. TN1 transmits an IGMPv2 Report message for the group 224.0.6.130.
11. TN2 transmits 3 IGMPv1 Reports with invalid checksums for the multicast group 224.0.6.130, (Query Interval) seconds apart.
12. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Part D: IGMPv1 Report Received in the Checking Membership state

13. Ensure that the RUT is in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
14. TN1 transmits an IGMPv2 Report message for the group 224.0.6.130.
15. TN1 transmits an IGMPv2 Leave message for the group 224.0.6.130 to the all-routers multicast group.
16. TN2 transmits an IGMPv1 Report with an invalid checksum for the multicast group 224.0.6.130.
17. Wait at least (Last member Query Count) * (Last Member Query Interval) seconds.
18. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Part E: IGMPv1 Report Received in the Version 1 Members Present state

19. Ensure that the RUT is in Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.

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20. TN1 transmits an IGMPv1 Report message for the group 224.0.6.130.
21. TN1 transmits 3 IGMPv1 Reports with invalid checksums for the multicast group 224.0.6.130, (Query Interval) seconds apart.
22. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Observable Results:

- *Part A*
Step 4: The RUT must not send any Group-Specific Queries, because it did not transition to the Member Present state.
- *Part B*
Step 8: The RUT must not send any Group-Specific Queries, because the Leave messages it receives while in the Members Present state are invalid.
- *Part C*
Step 12: The Members Present timer must expire for the group 224.0.6.130 (((the Robustness Variable) * (the Query Interval)) + (one Query Response Interval)) seconds after the first and only valid report is sent by TN1. After this time, the RUT must not show members in group 224.0.6.130 on Network 0.
- *Part D*
Step 18: The RUT must not show members in group 224.0.6.130 on Network 0 when checked in step 22, because the ICMPv1 message is invalid, and does not stop the timeout.
- *Part E*
Step 22: The Members Present timer must expire for the group 224.0.6.130 (((the Robustness Variable) * (the Query Interval)) + (one Query Response Interval)) seconds after the first and only valid report is sent by TN1. After this time, the RUT must not show members in group 224.0.6.130 on Network 0.

Possible Problems:

- None

Test IGMP.8.9: Invalid IGMP Message Reception in the Non-Querier State

Purpose: To verify that a router running IGMP version 2 properly processes incoming packets with invalid checksums while in the Non-Querier state.

References:

- [RFC 1112] - Appendix 1
- [RFC 2236] - Sections 2, 7 and 8

Discussion: When receiving packets, the checksum MUST be verified before processing a packet. The checksum for IGMPv1 is the 16-bit one's complement of the one's complement sum of the 8-octet IGMP message. For computing the checksum, the checksum field is zeroed. . The checksum for IGMPv2 is the 16-bit one's complement of the one's complement sum of the whole IGMP message (the entire IP payload).

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2. Configure TR1 to have a lower IP address than that of the RUT.

Procedure:

Part A: IGMPv2 Reports with Invalid Checksums

1. Ensure that the RUT is in Non-Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
2. The TN transmits an IGMPv2 report with an invalid checksum for the multicast group 224.0.6.130 to the RUT.
3. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Part B: Group-Specific Query Received in the Members Present State

4. Ensure that the RUT is in Non-Querier state on Network 0, and in the No Members Present state for multicast group 224.0.6.130.
5. The TN transmits an IGMPv2 Report message for group 224.0.6.130.
6. The TR transmits an IGMPv2 Group-Specific Query with an invalid checksum for the multicast group 224.0.6.130.
7. Wait at least (Last member Query Count) * (Last Member Query Interval) seconds, but less than ((the Robustness Variable) * (the Query Interval)) + (one Query Response Interval) seconds.
8. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Observable Results:

- *Part A*
Step 3: The RUT must not show members in group 224.0.6.130 on Network 0, because the Reports were invalid.
- *Part B*
Step 8: The RUT must show members in group 224.0.6.130 on Network 0 at step 9, because the Group-Specific Queries were invalid. Therefore, the RUT must remain in the Members Present state for group 224.0.6.130 until the members present timer expires.

Possible Problems:

- None

GROUP 9: Security for Internet Group Management Protocol Version 2

Scope:

The following tests are designed to verify security with the Internet Group Management Protocol Version 2. This section covers the security of routers.

Overview:

IGMPv2 considers the ramification for these types of forged messages: Report message (v1 and v2) and Leave Message.

Test IGMP.9.1: Forged IGMPv2 Report

Purpose: To verify that a router properly ignores forged IGMPv2 Reports.

References:

- [RFC 2236] – Section 10

Discussion: A forged Report message may cause multicast routers to think there are members of a group on a subnet when there are not. Forged Report messages from local subnets are meaningless, since joining a group is unprivileged. A forged Report from an external source must be dealt with. There are two defenses for externally forged Reports:

- Ignore the Report if you cannot identify the source address of the packets as belonging to a subnet assigned to the interface on which the packet was received.
- Ignore Report messages without Router Alert options [RFC 2113], and require that routers not forward Report messages.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2.

Procedure:

Part A: IGMPv2 Report from different subnet

1. Ensure that the RUT is in Querier state on Network 0, and in No Members Present state for multicast group 224.0.6.130.
2. TN1 transmits an IGMPv2 Report for the multicast group 224.0.6.130 from the address 10.0.2.2.
3. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Part B: IGMPv2 Report without Router Alert option

4. Ensure that the RUT is in Querier state on Network 0, and in No Members Present state for multicast group 224.0.6.130.
5. TN1 transmits an IGMPv2 Report for the multicast group 224.0.6.130. The Report does not have the Router Alert option.
6. Determine whether the RUT shows members in the 224.0.6.130 group on Network 0.

Observable Results:

- *Part A*
Step 3: The RUT must not show members present in multicast group 224.0.6.130 on Network 0.
- *Part B*
Step 6: The RUT must not show members present in multicast group 224.0.6.130 on Network 0.

Possible Problems:

- None

Test IGMP.9.2: Forged IGMPv1 Report

Purpose: To verify that a router properly ignores forged IGMPv1 Reports.

References:

- [RFC 2236] – Section 10

Discussion: A forged Report message may cause multicast routers to think there are members of a group on a subnet when there are not. Forged Report messages from local subnets are meaningless, since joining a group is unprivileged. A forged Report from an external source must be ignored. Ignore the Report if you cannot identify the source address of the packet as belonging to a subnet assigned to the interface on which the packet was received.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2.

Procedure:

Part A: Forged IGMPv1 Report

1. Ensure that the RUT is in Querier state on Network 0, and in No Members Present state for multicast group 224.0.6.130. The RUT should also be on the 10.10.10.0/24 network.
2. TN1 transmits an IGMPv1 Report for the multicast group 224.0.6.130 from the address 10.0.2.2.
3. Determine whether the RUT shows members in the 224.0.6.130 on Network 0.

Observable Results:

- *Part A*
Step 3: The RUT must not show members present in multicast group 224.0.6.130 on Network 0.

Possible Problems:

- None

Test IGMP.9.3: Forged IGMPv2 Leave Message

Purpose: To verify that a router properly ignores forged Leave messages.

References:

- [RFC 2236] – Section 10

Discussion: A forged Leave message may cause multicast routers to think there are members of a group on a subnet when there are not. Forged Leave messages from local subnets are meaningless, since joining a group is unprivileged. A forged Leave message from an external source must be dealt with. There are two defenses for externally forged Report messages:

- Ignore the Leave message if you cannot identify the source address of the packets as belonging to a subnet assigned to the interface on which the packet was received.
- Ignore Leave messages without Router Alert options [RFC 2113], and require that routers not forward Report messages.

Test Setup: The [Common Test Setup](#) is performed on the RUT. The [Common Test Cleanup](#) is performed after each test. The RUT is configured with IGMPv2.

Procedure:

Part A: Leave message from different subnet

1. Ensure that the RUT is in Querier state on Network 0, and in No Members Present state for multicast group 224.0.6.130. The RUT should also be on the 10.10.10.0/24 network.
2. TN1 transmits an IGMPv2 Report for the multicast group 224.0.6.130 from the address 10.10.10.60.
3. TN1 transmits a Leave Message for the multicast group 224.0.6.130 from the address 10.0.2.2.
4. Determine whether the RUT shows members in the 224.0.6.130 on Network 0.

Part B: Leave message without Router Alert option

5. Ensure that the RUT is in Querier state on Network 0, and in No Members Present state for multicast group 224.0.6.130.
6. TN1 transmits an IGMPv2 Report for the multicast group 224.0.6.130 from the address 10.10.10.60.
7. TN1 transmits a Leave Message for the multicast group 224.0.6.130. The Leave message does not have the Router Alert option.
8. Determine whether the RUT shows members in the 224.0.6.130 on Network 0.

Observable Results:

- *Part A*
Step 4: The RUT must show members present in multicast group 224.0.6.130 on Network 0.
- *Part B*
Step 8: The RUT must show members present in multicast group 224.0.6.130 on Network 0.

Possible Problems:

- None