

# **ROUTING CONSORTIUM**

Internet Group Management Protocol Version 3  
Interoperability Test Suite

**Technical Document**

Revision 1.2



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## **MODIFICATION RECORD**

- |                        |                   |   |
|------------------------|-------------------|---|
| Version 1.2            | December 10, 2008 | <ul style="list-style-type: none"><li>• Changed tests 1.4a, 2.1a-b, 2.5a-b, 3.1a-b, and 3.5a-b to use SSM address range (232.0.0.0/8) for source-specific queries.</li><li>• Corrected typos in tests 1.3b, 2.3b, and 3.3b.</li><li>• Some devices may not support or may ignore IGMPv3 Member Reports for groups that are not in the SSM address range. Added this to possible problems for all tests that do not use the SSM address range.</li></ul> |
| Version 1.1            | December 14, 2007 | <ul style="list-style-type: none"><li>• Various Typos Corrected</li></ul>   |
| Draft Version Complete | March 21, 2007    | <ul style="list-style-type: none"><li>• Initial Release</li></ul>   |

## **ACKNOWLEDGMENTS**

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Stephen Murphy	University of New Hampshire
Greg Schwendimann	University of New Hampshire
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.

### **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.

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**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 IGMPv3\_INTEROP.1.2 refers to the second test of the first test group in the IGMPv3 Interoperability 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 2236 – Internet Group Management Protocol, Version 2

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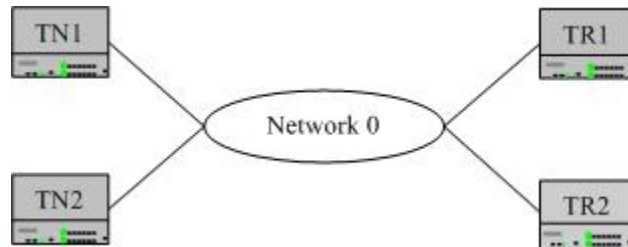
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## Common Test Setup

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.

1. Configure TR1 and TR2 on 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 IGMPv3 on all devices.
2. Return all timers and variables to their default values.

## **GROUP 1: Timers and Message Format**

### **Scope:**

The following tests are designed to verify basic IGMPv3 interoperability between routers.

### **Overview:**

These tests verify that timers are correctly calculated from the querier's timers and variables, that querier election is performed correctly, and that the reception of basic reports is handled correctly.

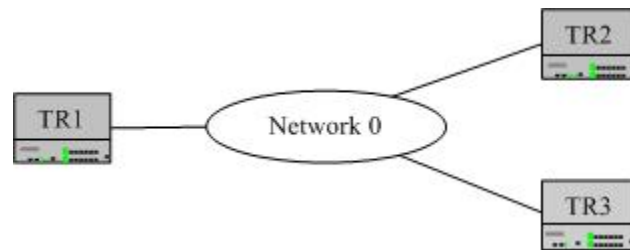
## Test IGMPv3\_INTEROP.1.1: Querier Election

**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 TR1, TR2, and TR3. The [Common Test Cleanup](#) is performed after each test.

### Procedure:

#### Part A: TR2 Elected Querier

1. Configure TR2 to have a lower IP address than TR1 on Network 0.
2. Enable IGMPv3 on TR1.
3. Observe the packets on all networks.
4. Enable IGMPv3 on TR2. TR2 sends a General Query every Query Interval.
5. Observe the packets on all networks.

#### Part B: Other-Querier Present Timer Expires

6. Configure TR2 to have a lower IP address than TR1 on Network 0.
7. Configure TR2 to have a Querier Interval of 30 on Network 0.
8. Enable IGMPv3 on TR1.
9. Enable IGMPv3 on TR2.
10. Observe the packets on all networks.
11. IGMPv3 is disabled on TR2.
12. Observe the packets on all networks.

#### Part C: TR1 Elected Querier

13. Configure TR1 to have a lower IP address than TR2 on Network 0.
14. Enable IGMPv3 on TR2.
15. Observe the packets on all networks.
16. Enable IGMPv3 on TR1. TR1 sends a General Query every Query Interval.
17. Observe the packets on all networks.

#### Part D: Other-Querier Present Timer Expires

18. Configure TR1 to have a lower IP address than TR2 on Network 0.
19. Configure TR1 to have a Querier Interval of 30 on Network 0.

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20. Enable IGMPv3 on TR2.
21. Enable IGMPv3 on TR1.
22. Observe the packets on all networks.
23. IGMPv3 is disabled on TR1.
24. Observe the packets on all networks.

*Part E: Three Routers, TR1 Middle Address, TR2 Elected Querier*

25. Configure TR2 to have a lower IP address than TR1 on Network 0.
26. Configure TR3 to have a higher IP address than the TR1 on Network 0.
27. Enable IGMPv3 on TR1.
28. Observe the packets on all networks.
29. Enable IGMPv3 on TR3. TR3 sends a General Query.
30. Observe the packets on all networks.
31. Enable IGMPv3 on TR2. TR2 sends a General Query every Query Interval.
32. Observe the packets on all networks.
33. Disable IGMPv3 on TR3.
34. Enable IGMPv3 on TR3. TR3 sends a General Query.
35. Observe the packets on all networks.

**Observable Results:**

- *Part A*
  - Step 3:** TR1 must transmit General Queries every Query Interval.
  - Step 5:** TR1 must cease transmission of Queries for at least Other Querier Present Interval.
- *Part B*
  - Step 10:** TR2 must be elected Querier and TR1 must not be sending Queries.
  - Step 12:** After Other Querier Present Interval, TR1 must resume transmission of General Queries.
- *Part C*
  - Step 15:** TR2 must transmit General Queries every Query Interval.
  - Step 17:** TR1 must cease transmission of Queries for at least Other Querier Present Interval.
- *Part D*
  - Step 22:** TR1 must be elected Querier and TR2 must not be sending Queries.
  - Step 24:** After Other Querier Present Interval, TR2 must resume transmission of General Queries.
- *Part E*
  - Step 28:** TR1 must transmit General Queries every Query Interval.
  - Step 30:** TR1 must transmit General Queries every Query Interval. TR3 must cease transmission of Queries
  - Step 32:** TR1 and TR3 must cease transmission of Queries for at least Other Querier Present Interval. TR2 must transmit General Queries every Query Interval.
  - Step 35:** TR3 must cease transmission of General Queries. TR1 must not resume transmission of General Queries.

**Possible Problems:**

- None

## **Test IGMPv3\_INTEROP.1.2: 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 TR1 and TR2. The [Common Test Cleanup](#) is performed after each test.

### **Procedure:**

#### *Part A: TR1 and TR2 to Exclude Nothing Reception*

1. Configure TR2 to have a lower IP address than TR1 on Network 0.
2. IGMPv3 is enabled on TR1 and TR2. TR2 is elected Querier.
3. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
4. Observe the Group Membership Status on both TR1 and TR2.

#### *Part B: TR1 and TR2 to Include Nothing Reception*

5. Configure TR2 to have a lower IP address than TR1 on Network 0.
6. IGMPv3 is enabled on TR1 and TR2. TR2 is elected Querier.
7. TN1 sends a Report to exclude nothing for the multicast group 224.0.6.130 on Network 0.
8. TN1 sends a Report to include nothing for the multicast group 224.0.6.130 on Network 0.
9. Observe the packets transmitted on all networks and the Group Membership Status on both TR1 and TR2.

### **Observable Results:**

- *Part A*  
**Step 4:** TR1 and TR2 both must be in exclude nothing for the multicast group 224.0.6.130.
- *Part B*  
**Step 9:** At first both TR1 and TR2 must be in exclude nothing for the multicast group 224.0.6.130. TR1 sends a Group Specific Query for multicast group 224.0.6.130. After there is no response for the Group Specific Query both TR1 and TR2 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.

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- Some devices may not support or may ignore IGMPv3 Member Report messages for groups that are not in the SSM address range.

### **Test IGMPv3\_INTEROP.1.3: 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 TR1 and TR2. TR2 is configured to have a lower IP address than TR1. The [Common Test Cleanup](#) is performed after each test.

**Procedure:**

*Part A: Older Host Present Interval Expires, QQIC 30*

1. TR2's Query Interval is sent to 30.
2. IGMPv3 is enabled on TR1 and TR2.
3. TN2 sends an IGMPv1 Report on Network 0 for multicast group 224.0.6.130.
4. TN2 ceases transmission on Network 0.
5. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
6. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
7. Observe Group Membership Status on TR1.
8. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
9. Observe when Older Host Present Interval Expires.
10. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
11. Observe Group Membership Status on TR1.

*Part B: Older Host Present Interval Expires, QQIC 144*

12. TR2's Query Interval is sent to 144.
13. IGMPv3 is enabled on TR1 and TR2.
14. TN2 sends an IGMPv1 Report on Network 0 for multicast group 224.0.6.130.
15. TN2 ceases transmission on Network 0.
16. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
17. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
18. Observe Group Membership Status on TR1.

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19. TN1 sends a Report to exclude nothing for multicast group 224.0.6.130.
20. Observe when Older Host Present Interval Expires.
21. TN1 sends a Report to include nothing for multicast group 224.0.6.130.
22. Observe Group Membership Status on TR1.

**Observable Results:**

- *Part A*
  - Step 7:** TR1 must continue to exclude nothing for multicast group 224.0.6.130.
  - Step 9:** Older Host Present Interval expired after the calculated time using the Query Interval adopted from the QQIC field in TR2's query.
  - Step 11:** TR1 must not show members present for multicast group 224.0.6.130.
- *Part B*
  - Step 18:** TR1 must continue to exclude nothing for multicast group 224.0.6.130.
  - Step 20:** Older Host Present Interval expired after the calculated time using the Query Interval adopted from the QQIC field in TR2's query.
  - Step 22:** TR1 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.
- Some devices may not support or may ignore IGMPv3 Member Report messages for groups that are not in the SSM address range.



## Test IGMPv3\_INTEROP.1.4: Multiple Networks

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

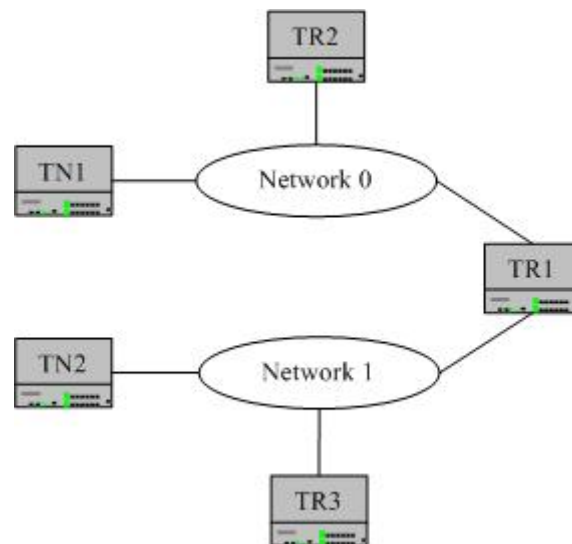
### References:

- [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. TR2 has a lower IP Address than TR1 on Network 0. TR3 has a higher IP Address than TR1 on Network 1. The [Common Test Cleanup](#) is performed after each test.



### Procedure:

#### Part A: Independent Interface States

1. IGMPv3 is enabled on TR1 on Networks 0 and 1.
2. IGMPv3 is enabled on TR2 on Network 0.
3. IGMPv3 is enabled on TR3 on Network 1.
4. Observe the packets on all networks.
5. TN1 sends a Report to exclude nothing for the multicast group 232.0.6.130 on Network 0.
6. TN2 sends a Report to include 10.10.10 for the multicast group 232.0.6.130 on Network 1.
7. Observe the Group Membership Status on TR1.
8. TN2 sends a Report to include nothing for the multicast group 232.0.6.130 on Network 1.
9. Observe the Group Membership Status on TR1.

**Observable Results:**

- *Part A*
  - Step 4:** TR1 must be Non-Querier on Network 0 and Querier on Network 1.
  - Step 7:** TR1 must be excluding nothing for the multicast group 232.0.6.130 on Network 0. TR1 must be including 10.10.10.10 for the multicast group 232.0.6.130 on Network 1.
  - Step 9:** After Last Member Query Time TR1 must be excluding nothing for the multicast group 232.0.6.130 on Network 0. TR1 must be including nothing for the multicast group 232.0.6.130 on Network 1.

**Possible Problems:**

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

## **GROUP 2: Querier Interoperability**

### **Scope:**

The following tests are designed to verify a router interoperates with other routers on a network when acting as the Querier for that network.

### **Overview:**

In IGMPv3 when a Query with the S Flag set is received the router should suppress router-side processing. When a router is Non-Querier on a network if the QRV received from the Querier is non-zero the router adopts this QRV value. Similarly, when a router is Non-Querier on a network if the QQIC received from the querier is non-zero the router adopts this QQI value. When a Non-Querier receives a Group Specific Query or Group and Source specific query the router updates its timers accordingly.

## **Test IGMPv3\_INTEROP.2.1: 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 [Common Test Setup](#) is performed on TR2. TR1 has the lower IP address, a robustness variable of 7, a Query Interval of 125, Query Response Interval of 100 1/10<sup>th</sup> of a second, and a Last Member Query Interval of 30 1/10<sup>th</sup> of a second. The [Common Test Cleanup](#) is performed after each test.

### **Procedure:**

#### *Part A: TR2 suppresses Router-Side Processing*

1. IGMPv3 is enabled on TR1 and TR2. TR1 is the Querier.
2. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for multicast group 232.0.6.130.
3. TN1 sends a Report to include nothing for multicast group 232.0.6.130.
4. TR1 sends one Group and Source Specific Query for the sources 10.10.10.10 and 10.10.10.11, multicast group 232.0.6.130 with the S Flag clear.
5. TN2 sends one Report to include 10.10.10.10 for multicast group 232.0.6.130.
6. TR1 sends six additional Group and Source Specific Queries for the source 10.10.10.10, multicast group 232.0.6.130 with the S Flag set and six Group and Source Specific Queries for the source 10.10.10.11, multicast group 232.0.6.130 with the S Flag clear.
7. Observe the Group Membership Status on TR2.

#### *Part B: TR2 does not suppress Router-Side Processing*

8. IGMPv3 is enabled on TR1 and TR2. TR1 is the Querier.
9. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for multicast group 232.0.6.130.
10. TN1 sends a Report to include nothing for multicast group 232.0.6.130.
11. Observe the Group Membership Status on TR2 and the packets sent by TR1 on network 0.

### **Observable Results:**

- *Part A*  
**Step 7:** TR2 must be including 10.10.10.10 for the multicast group 232.0.6.130.
- *Part B*  
**Step 11:** TR1 sends seven Group and Source Specific Query for the sources 10.10.10.10 and

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10.10.10.11, multicast group 232.0.6.130 with the S Flag clear. After Last Member Query Time, TR2 must not show members present for the multicast group 232.0.6.130.

**Possible Problems:**

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

## **Test IGMPv3\_INTEROP.2.2: 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 TR2. TR1 has the lower IP address, a robustness variable of 4, a Query Interval of 125, Query Response Interval of 100 1/10<sup>th</sup> of a second, and a Last Member Query Interval of 10 1/10<sup>th</sup> of a second. The [Common Test Cleanup](#) is performed after each test.

### **Procedure:**

*Part A: TR2 adopts TR1's Querier's Robustness Variable*

1. IGMPv3 is enabled on TR1 and TR2. 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 TR2.

### **Observable Results:**

- *Part A*  
**Step 4:** TR2 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.
- Some devices may not support or may ignore IGMPv3 Member Report messages for groups that are not in the SSM address range.

### **Test IGMPv3\_INTEROP.2.3: 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 TR1 and TR2. TR1 has the lower IP address. The [Common Test Cleanup](#) is performed after each test.

**Procedure:**

*Part A: TR2 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 TR2. 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 TR2.

*Part B: TR2 adopts TR1's Querier's Query Interval Code, QQIC 144*

6. TR1's Query Interval is sent to 144.
7. IGMPv3 is enabled on TR1 and TR2. 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 TR2.

**Observable Results:**

- *Part A*  
**Step 5:** TR2 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:** TR2 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.
- Some devices may not support or may ignore IGMPv3 Member Report messages for groups that are not in the SSM address range.

## Test IGMPv3\_INTEROP.2.4: 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 TR2. 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 TR2. 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 TR2.

#### *Part B: Group Specific Query Reception, Response*

6. IGMPv3 is enabled on TR1 and TR2. 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 TR2.

### Observable Results:

- *Part A*  
**Step 5:** TR2 must not show members present for 224.0.6.130.
- *Part B*  
**Step 10:** TR2 must show members present for 224.0.6.130.

### Possible Problems:

- It may not be possible to view multicast group membership on the device.
- Some devices may not support or may ignore IGMPv3 Member Report messages for groups that



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are not in the SSM address range.

## Test IGMPv3\_INTEROP.2.5: 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 TR2. 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 TR2. TR1 is Querier.
2. TN1 sends a Report to include 10.10.10.10 for multicast group 232.0.6.130.
3. TN1 sends a Report to include nothing for multicast group 232.0.6.130.
4. TR1 sends two Group and Source Specific Queries, TN1 does not respond.
5. Observe the Group Membership Status on TR2.

#### *Part B: Group and Source Specific Query Reception, Response*

6. IGMPv3 is enabled on TR1 and TR2. TR1 is Querier.
7. TN1 sends a Report to include 10.10.10.10 for multicast group 232.0.6.130.
8. TN1 sends a Report to include nothing for multicast group 232.0.6.130.
9. TR1 sends two Group and Source Specific Queries, TN1 responds with a Report is including 10.10.10.10 for multicast group 232.0.6.130.
10. Observe the Group Membership Status on TR2.

### Observable Results:

- *Part A*  
**Step 5:** TR2 must not show members present for 232.0.6.130.
- *Part B*  
**Step 10:** TR2 must show members present for 232.0.6.130.

### Possible Problems:

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

## **GROUP 3: Non-Querier Interoperability**

### **Scope:**

The following tests are designed to verify a router interoperates with other routers on a network when acting as the Non-Querier for that network.

### **Overview:**

In IGMPv3 when a Query with the S Flag set is received the router should suppress router-side processing. When a router is Non-Querier on a network if the QQI received from the Querier is non-zero the router adopts this QQI value. Similarly, when a router is Non-Querier on a network if the QRV received from the querier is non-zero the router adopts this QRV value. When a Non-Querier receives a Group and or Source Specific Query the router updates its timers accordingly.

### **Test IGMPv3\_INTEROP.3.1: 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 [Common Test Setup](#) is performed on TR1. TR2 has the lower IP address, a robustness variable of 7, a Query Interval of 125, Query Response Interval of 100 1/10<sup>th</sup> of a second, and a Last Member Query Interval of 30 1/10<sup>th</sup> of a second. The [Common Test Cleanup](#) is performed after each test.

**Procedure:**

*Part A: TR1 suppresses Router-Side Processing*

1. IGMPv3 is enabled on TR1 and TR2. TR2 is the Querier.
2. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for multicast group 232.0.6.130.
3. TN1 sends a Report to include nothing for multicast group 232.0.6.130.
4. TR2 sends one Group and Source Specific Query for the sources 10.10.10.10 and 10.10.10.11, multicast group 232.0.6.130 with the S Flag clear.
5. TN2 sends one Report to include 10.10.10.10 for multicast group 232.0.6.130.
6. TR2 sends six additional Group and Source Specific Queries for the source 10.10.10.10, multicast group 232.0.6.130 with the S Flag set and six Group and Source Specific Queries for the source 10.10.10.11, multicast group 232.0.6.130 with the S Flag clear.
7. Observe the Group Membership Status on TR1.

*Part B: TR1 does not suppress Router-Side Processing*

8. IGMPv3 is enabled on TR1 and TR2. TR2 is the Querier.
9. TN1 sends a Report to include 10.10.10.10 and 10.10.10.11 for multicast group 232.0.6.130.
10. TN1 sends a Report to include nothing for multicast group 232.0.6.130.
11. Observe the Group Membership Status on TR1 and the packets sent by TR2 on network 0.

**Observable Results:**

- *Part A*  
**Step 7:** TR1 must be including 10.10.10.10 for the multicast group 232.0.6.130.
- *Part B*

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**Step 11:** TR2 sends seven Group and Source Specific Query for the sources 10.10.10.10 and 10.10.10.11, multicast group 232.0.6.130 with the S Flag clear. After Last Member Query Time, TR1 must not show members present for the multicast group 232.0.6.130.

**Possible Problems:**

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

### **Test IGMPv3\_INTEROP.3.2: 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 TR1. TR2 has the lower IP address, a robustness variable of 4, a Query Interval of 125, Query Response Interval of 100 1/10<sup>th</sup> of a second, and a Last Member Query Interval of 10 1/10<sup>th</sup> of a second. The [Common Test Cleanup](#) is performed after each test.

**Procedure:**

*Part A: TR1 adopts TR2's Querier's Robustness Variable*

1. IGMPv3 is enabled on TR1 and TR2. TR2 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 TR1.

**Observable Results:**

- *Part A*  
**Step 4:** TR1 showed multicast group 224.0.6.130 members present for Group Membership Interval. The Robustness Variable must be adopted from TR2.

**Possible Problems:**

- It may not be possible to view multicast group membership on the device.
- Some devices may not support or may ignore IGMPv3 Member Report messages for groups that are not in the SSM address range.

### **Test IGMPv3\_INTEROP.3.3: 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 TR1 and TR2. TR2 has the lower IP address. The [Common Test Cleanup](#) is performed after each test.

**Procedure:**

*Part A: TR1 adopts TR2's Querier's Query Interval Code, QQIC 30*

1. Configure TR2 with a QQIC of 30 on Network 0.
2. IGMPv3 is enabled on TR1 and TR2. TR2 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 TR1.

*Part B: TR1 adopts TR2's Querier's Query Interval Code, QQIC 144*

6. Configure TR2 with a QQIC of 144 on Network 0.
7. IGMPv3 is enabled on TR1 and TR2. TR2 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 TR1.

**Observable Results:**

- *Part A*  
**Step 5:** TR1 showed multicast group 224.0.6.130 members present for Group Membership Interval. The Query Interval must be adopted from TR2.
- *Part B*  
**Step 10:** TR1 showed multicast group 224.0.6.130 members present for Group Membership Interval. The Query Interval must be adopted from TR2.

**Possible Problems:**

- It may not be possible to view multicast group membership on the device.
- Some devices may not support or may ignore IGMPv3 Member Report messages for groups that are not in the SSM address range.

## Test IGMPv3\_INTEROP.3.4: 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 TR2. TR2 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 TR2. TR2 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. TR2 sends two Group Specific Queries, TN1 does not respond.
5. Observe the Group Membership Status on TR1.

#### *Part B: Group Specific Query Reception, Response*

6. IGMPv3 is enabled on TR1 and TR2. TR2 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. TR2 sends two Group Specific Queries, TN1 responds with a Report, including nothing, for multicast group 224.0.6.130.
10. Observe the Group Membership Status on TR1.

### Observable Results:

- *Part A*  
**Step 5:** TR1 must not show members present for 224.0.6.130.
- *Part B*  
**Step 10:** TR1 must show members present for 224.0.6.130.

### Possible Problems:

- It may not be possible to view multicast group membership on the device.
- Some devices may not support or may ignore IGMPv3 Member Report messages for groups that are not in the SSM address range.



## Test IGMPv3\_INTEROP.3.5: 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 TR2. TR2 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 TR2. TR2 is Querier.
2. TN1 sends a Report to include 10.10.10.10 for multicast group 232.0.6.130.
3. TN1 sends a Report to include nothing for multicast group 232.0.6.130.
4. TR2 sends two Group and Source Specific Queries, TN1 does not respond.
5. Observe the Group Membership Status on TR1.

#### *Part B: Group and Source Specific Query Reception, Response*

6. IGMPv3 is enabled on TR1 and TR2. TR2 is Querier.
7. TN1 sends a Report to include 10.10.10.10 for multicast group 232.0.6.130.
8. TN1 sends a Report to include nothing for multicast group 232.0.6.130.
9. TR2 sends two Group and Source Specific Queries, TN1 responds with a Report is including 10.10.10.10 for multicast group 232.0.6.130.
10. Observe the Group Membership Status on TR1.

### Observable Results:

- *Part A*  
**Step 5:** TR1 must not show members present for 232.0.6.130.
- *Part B*  
**Step 10:** TR1 must show members present for 232.0.6.130.

### Possible Problems:

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