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5G Automotive Association;
Working Group Evaluation, test beds and pilots;
C-V2X Interoperability Test Plan for Mode 4 PC5

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5GAA

Postal address

5GAA address

5GAA c/o MCI Munich
Neumarkter Str. 21
81673 München – Germany

Internet

http://www.5gaa.org

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Foreword

This Technical Report has been produced by 5GAA.

The contents of the present document are subject to continuing work within the Working Groups (WG) and may change following formal WG approval. Should the WG modify the contents of the present document, it will be re-released by the WG with an identifying change of the consistent numbering that all WG meeting documents and files should follow (according to 5GAA Rules of Procedure):

x-nnzzzz

(1) This numbering system has six logical elements:

(a) x: a single letter corresponding to the working group:

where x =

T (Use cases and Technical Requirements)

B (Business Models and Go-To-Market Strategies)

A (System Architecture and Solution Development)

S (Standards and Spectrum)

P (Evaluation, Testbed and Pilots)

(b) nn: two digits to indicate the year. i.e. 16,17,18, etc

(c) zzzz: unique number of the document

(2) No provision is made for the use of revision numbers. Documents which are a revision of a previous version should indicate the document number of that previous version

(3) The file name of documents shall be the document number. For example, document S-160357 will be contained in file S-160357.doc

1 Introduction

1.1 Purpose

This document describes the 5GAA cellular vehicle-to-everything (C-V2X) IoT test plan for mode 4 operation on a PC5 link. These tests can be done between any two devices which support mode 4 PC5 link. Sample pre-configuration settings for the tests are provided in Chapter 3. For testing purposes, the pre-configuration settings can be modified as per regional requirements.

1.2 Conventions

Function declarations, function names, type declarations, attributes, and code samples appear in a different font, for example, `#include`.

Code variables appear in angle brackets, for example, `<number>`.

Commands to be entered appear in a different font, for example, **`copy a:*.* b:`**.

Button and key names appear in bold font, for example, click **Save** or press **Enter**.

2 Test Cases

2.1 Test Case 1: 1 SPS flow 100 ms periodicity

2.1.1 Background

This test verifies that the devices under test can transmit and receive C-V2X messages (one semi-persistent scheduling (SPS) flow with 100 ms periodicity) over PC5 interface.

2.1.2 Assumptions

The operating system time of the transmitter and receiver devices is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.1.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

C-V2X on-board equipment (OBE) shall be placed in a RF shielding box to account for possible RF leakage.

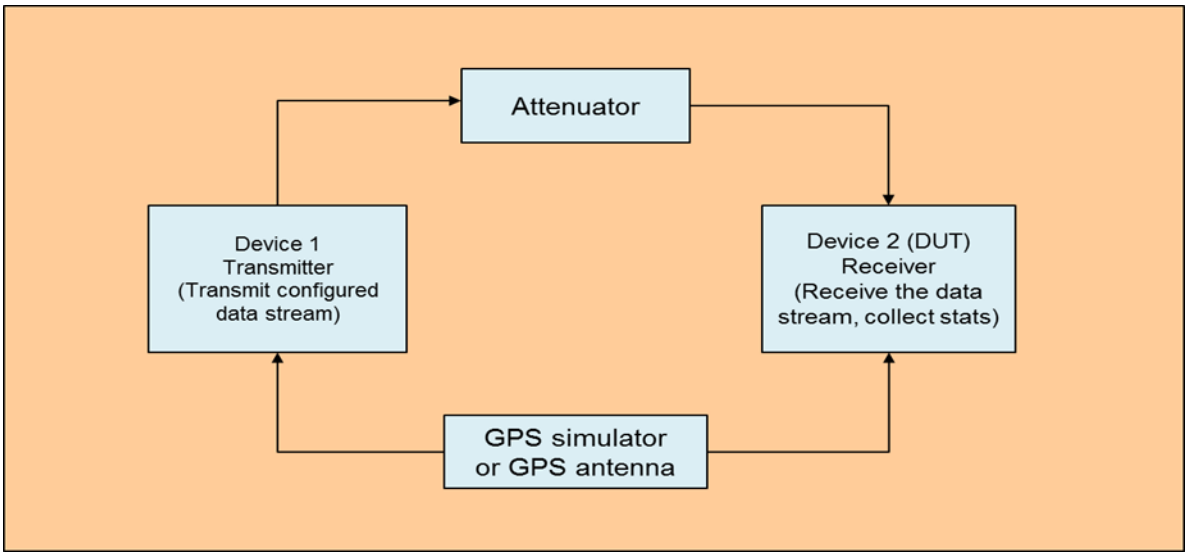

Figure 2-1 Test case setup (for Tests 1-11 and Tests 13-15)

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to generate one SPS flow messages and deliver to the lower layers with 100 ms periodicity.
  - SPS Flow 1 is configured to transmit 283 bytes (BSM/CAM/any other periodic message).
  - Transmit on ITS band with bandwidth of 10 MHz.
- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that Device 2 receives transmission from Device 1 at -50 dBm receive signal strength indicator (RSSI).
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet
- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	SPS Flow 1: 1000
Packet Size	SPS Flow 1: 283 bytes
Periodicity	SPS Flow 1: 100 ms
PPPP	SPS Flow 1: 2 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: Non-IP

2.1.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in Pre-configuration Settings 1.
3. Tx device (Device 1) is configured to transmit a payload of size 283 bytes (BSM/CAM/any other periodic message) using SPS flow at 100 ms periodicity.
4. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).

5. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

6. Run the above scenario for five iterations.

2.1.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	No. of Transmitted pkts/s	No. of Received pkts/s	Calculated at Receiver
Iteration Number	**C-V2X Transmit Device**	**C-V2X Receive Device**	**PER %**
1	1000		
2	1000		
3	1000		
4	1000		
5	1000		

2.2 Test Case 2: 2 SPS flows 100 ms periodicity each

2.2.1 Background

This test verifies that the devices under test can transmit and receive C-V2X messages (two SPS flows each with 100 ms periodicity) over PC5 interface.

2.2.2 Assumptions

The operating system time of the transmitter and receiver devices is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.2.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to generate two SPS flow messages and deliver to the lower layers with 100 ms periodicity.
  - SPS Flow 1 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) and SPS Flow 2 is configured to transmit another 283 bytes (BSM/CAM/any other periodic message).
  - Transmit on ITS band with bandwidth of 10 MHz.
- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet
- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	SPS Flow 1: 1000 SPS Flow 2: 1000
Packet Size	SPS Flow 1: 283 bytes SPS Flow 2: 283 bytes
Periodicity	SPS Flow 1: 100 ms SPS Flow 2: 100 ms
PPPP	SPS Flow 1: 2 SPS Flow 2: 5 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: Non-IP SPS Flow 2: Non-IP

2.2.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in Pre-configuration Settings 1.

3. Tx device (Device 1) is configured to transmit a payload of size 283 bytes for SPS Flow 1 with PPPP=2 and 283 bytes for SPS Flow 2 with PPPP=5, at 100 ms periodicity each.

   PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
4. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).
5. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

6. Run the above scenario for five iterations.

2.2.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	C-V2X Transmit Device		C-V2X Receive Device		Calculated at Receiver	
Iteration Number	No. of Transmitted pkts/s for SPS Flow 1	No. of Transmitted pkts/s for SPS Flow 2	No. of Received pkts/s for SPS Flow 1	No. of Received pkts/s for SPS Flow 2	PER % for SPS Flow 1	PER % for SPS Flow 2
1	1000	1000				
2	1000	1000				
3	1000	1000				
4	1000	1000				
5	1000	1000				

2.3 Test Case 3: 2 SPS flows + multiple event-driven flows

2.3.1 Background

This test verifies that the devices under test can transmit and receive C-V2X messages (two SPS flows each with 100 ms periodicity and multiple event-driven flows) over PC5 interface.

2.3.2 Assumptions

The operating system time of both the transmitter and receiver boxes is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.3.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to:
    - Generate two SPS flow messages and deliver to the lower layers with 100 ms periodicity.
    - Generate multiple event-driven flows every 2 s and deliver to the lower layers.
  - SPS Flow 1 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) and SPS Flow 2 is configured to transmit another 283 bytes (BSM/CAM/any other periodic message).
  - Event-driven flow is configured to transmit 283 bytes (TIM/IVI any other event message) every 2 s.
  - Transmit on ITS band with bandwidth of 10 MHz.
- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet
- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	SPS Flow 1: 1000 SPS Flow 2: 1000
Packet Size	SPS Flow 1: 283 bytes SPS Flow 2: 283 bytes Event-driven: 283 bytes
Periodicity	SPS Flow 1: 100 ms SPS Flow 2: 100 ms Event-driven: 2 s

Parameter	Value
PPPP	SPS Flow 1: 2 SPS Flow 2: 5 Event-driven: 2 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: Non-IP SPS Flow 2: Non-IP Event-driven: Non-IP

2.3.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in the Pre-configuration Settings 1.
3. Tx device (Device 1) is configured to transmit a payload of size 283 bytes for SPS Flow 1 and SPS Flow 2 at 100 ms periodicity each and multiple event-driven flows with message size 283 bytes every 2 s.
4. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).
5. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

6. Run the above scenario for five iterations.

2.3.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	C-V2X Transmit Device			C-V2X Receive Device			Calculated at Receiver		
Iteration Number	No. of Transmitted pkts/s for SPS Flow 1	No. of Transmitted pkts/s for SPS Flow 2	No. of Transmitted pkts/s for Event Flow	No. of Received pkts/s for SPS Flow 1	No. of Received pkts/s for SPS Flow 2	No. of Received pkts/s for Event Flow	PER % for SPS Flow 1	PER % for SPS Flow 2	PER % for Event Flow
1	1000	1000	50						
2	1000	1000	50						
3	1000	1000	50						
4	1000	1000	50						
5	1000	1000	50						

2.4 Test Case 4: 2 SPS flows (IP data) + multiple event-driven flows (non-IP data)

2.4.1 Background

This test verifies that the devices under test can transmit and receive C-V2X messages (two SPS flows each with 100 ms periodicity, IP-based and multiple event-driven flows non-IP) over PC5 interface.

2.4.2 Assumptions

The operating system time of both the transmitter and receiver boxes is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.4.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to:
    - Generate two SPS flow messages and deliver to the lower layers with 100 ms periodicity.
    - Generate multiple event-driven flows every 2 s and deliver to the lower layers.
  - SPS Flow 1 and SPS Flow 2 are configured to transmit 283 bytes (BSM/CAM/any other periodic message).
  - Event-driven flow is configured to transmit 283 bytes (TIM/IVI any other event message) every 2 s.
  - Transmit on ITS band with bandwidth of 10 MHz.
- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet

- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	SPS Flow 1: 1000 SPS Flow 2: 1000
Packet Size	SPS Flow 1: 283 bytes SPS Flow 2: 283 bytes Event-driven: 283 bytes
Periodicity	SPS Flow 1: 100 ms SPS Flow 2: 100 ms Event-driven: 2 s
PPPP	SPS Flow 1: 2 SPS Flow 2: 5 Event-driven: 2 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: IP SPS Flow 2: IP Event-driven: Non-IP

2.4.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in Pre-configuration Settings 1.
3. Tx device (Device 1) is configured to transmit a payload of size 283 bytes with PPPP=2 for SPS Flow 1 and 283 bytes with PPPP=5 for SPS Flow 2 at 100 ms periodicity and multiple event-driven flows with message size 283 bytes with PPPP=2 every 2 s.

   PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
4. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).
5. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

6. Run the above scenario for five iterations.

2.4.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	C-V2X Transmit Device			C-V2X Receive Device			Calculated at Receiver		
Iteration Number	No. of Transmitted pkts/s for SPS Flow 1	No. of Transmitted pkts/s for SPS Flow 2	No. of Transmitted pkts/s for Event Flow	No. of Received pkts/s for SPS Flow 1	No. of Received pkts/s for SPS Flow 2	No. of Received pkts/s for Event Flow	PER % for SPS Flow 1	PER % for SPS Flow 2	PER % for Event Flow
1	1000	1000	50						
2	1000	1000	50						
3	1000	1000	50						
4	1000	1000	50						
5	1000	1000	50						

2.5 Test Case 5: 2 SPS flows with 20 ms and 50 ms periodicity

2.5.1 Background

This test verifies that the devices under test can transmit and receive C-V2X messages (two SPS flows with 20 ms and 50 ms periodicity) over PC5 interface.

2.5.2 Assumptions

The operating system time of both the transmitter and receiver boxes is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.5.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to generate two SPS flow messages and deliver to the lower layers with 20 ms and 50 ms periodicity for SPS Flow 1 and SPS Flow 2 respectively.
  - SPS Flow 1 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) with PPPP=2 and SPS Flow 2 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) with PPPP=5.
  - PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
  - Transmit on ITS band with bandwidth of 10 MHz.

- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet
- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	1000
Packet Size	SPS Flow 1: 283 bytes SPS Flow 2: 283 bytes
Periodicity	SPS Flow 1: 20 ms SPS Flow 2: 50 ms
PPPP	SPS Flow 1: 2 SPS Flow 2: 5 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: Non-IP SPS Flow 2: Non-IP

2.5.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in Pre-configuration Settings 1.
3. Tx device (Device 1) is configured to transmit a payload of size 283 bytes with PPPP=2 at 20 ms periodicity for SPS Flow 1 and 283 bytes with PPPP=5 at 50 ms periodicity for SPS Flow 2.

   PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
4. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).

5. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

6. Run the above scenario for five iterations.

2.5.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	C-V2X Transmit Device		C-V2X Receive Device		Calculated at Receiver	
Iteration Number	No. of Transmitted pkts/s for SPS Flow 1	No. of Transmitted pkts/s for SPS Flow 2	No. of Received pkts/s for SPS Flow 1	No. of Received pkts/s for SPS Flow 2	PER % for SPS Flow 1	PER % for SPS Flow 2
1	1000	1000				
2	1000	1000				
3	1000	1000				
4	1000	1000				
5	1000	1000				

2.6 Test Case 6: 2 SPS flows + multiple (varying payloads) event-driven flows

2.6.1 Background

This test verifies that the devices under test can transmit and receive C-V2X messages (two SPS flows with 20 ms and 50 ms periodicity and multiple event-driven flow with varying payloads) over PC5 interface.

2.6.2 Assumptions

The operating system time of both the transmitter and receiver boxes is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.6.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to generate two SPS flow messages and deliver to the lower layers with 20 ms and 50 ms periodicity for SPS Flow 1 and SPS Flow 2 respectively.
  - SPS Flow 1 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) with PPPP=2 and SPS Flow 2 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) with PPPP=5.
  - Event-driven flow is configured to transmit 60 bytes with PPPP =2, 90 bytes with PPPP=5, 100 bytes with PPPP=2, every 2 s.
  - Transmit on ITS band with bandwidth of 10 MHz.
- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet
- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	1000
Packet Size	SPS Flow 1: 283 bytes SPS Flow 2: 283 bytes Event-driven: 60 bytes, 90 bytes, 100 bytes
Periodicity	SPS Flow 1: 20 ms SPS Flow 2: 50 ms Event-driven: Every 2 s
PPPP	SPS Flow 1: 2 SPS Flow 2: 5 Event-driven: 2, 5, 2 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: Non-IP SPS Flow 2: Non-IP Event-driven: Non-IP

2.6.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in Pre-configuration Settings 1.
3. Tx device (Device 1) is configured to transmit SPS Flow 1 at 20 ms periodicity with 283 bytes payload and SPS Flow 2 at 50 ms periodicity with 283 bytes payload.
4. Tx device (Device 1) is also configured to transmit a payload of size 60 bytes, 90 bytes and 100 bytes using event-driven flows whose priority is 2, 5, and 2 respectively once every 2 s.
5. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).
6. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

7. Run the above scenario for five iterations.

2.6.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	C-V2X Transmit Device					C-V2X Receive Device					Calculated at Receiver				
Iteration Number	No. of Transmitted pkts/s for SPS Flow 1	No. of Transmitted pkts/s for SPS Flow 2	No. of Event-Driven messages Transmitted			No. of Received pkts/s for SPS Flow 1	No. of Received pkts/s for SPS Flow 2	No. of Event-Driven messages received			PER % for SPS Flow 1	PER % for SPS Flow 2	PER % for Event-Driven flow		
			60B	90B	100B			60B	90B	100B			60B	90B	100B
1	1000	1000													
2	1000	1000													
3	1000	1000													
4	1000	1000													
5	1000	1000													

2.7 Test Case 7: 2 SPS flows + multiple event-driven flows (QPSK, 16-QAM)

2.7.1 Background

This test verifies that the devices under test can transmit and receive C-V2X messages (two SPS flows with 20 ms and 50 ms periodicity and multiple event-driven flows with varying payloads) with QPSK, 16-QAM modulation scheme over PC5 interface.

2.7.2 Assumptions

The operating system time of both the transmitter and receiver boxes is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.7.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to generate two SPS flow messages and deliver to the lower layers with 20 ms and 50 ms periodicity for SPS Flow 1 and SPS Flow 2 respectively.
  - SPS Flow 1 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) with PPPP=2 and SPS Flow 2 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) with PPPP=5.
  - Event-driven flow is configured to transmit Payload 1 with PPPP =2, Payload 2 with PPPP=5, Payload 3 with PPPP=2, every 2 s.
  - PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
  - Transmit on ITS band with bandwidth of 10 MHz.
- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet

- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	1000
Packet Size	SPS Flow 1: 283 bytes SPS Flow 2: 283 bytes Event-driven: Payload 1, Payload 2, Payload 3
Periodicity	SPS Flow 1: 20 ms SPS Flow 2: 50 ms Event-driven: Every 2 s
PPPP	SPS Flow 1: 2 SPS Flow 2: 5 Event-driven: 2, 5, 2 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: Non-IP SPS Flow 2: Non-IP Event-driven: Non-IP

2.7.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in the reconfiguration File 1.
3. Tx device (Device 1) is configured to transmit SPS Flow 1 at 20 ms periodicity with 283 bytes payload and SPS Flow 2 at 50 ms periodicity with 283 bytes payload.
4. Tx device (Device 1) is also configured to transmit a Payload 1, Payload 2 and Payload 3 using event-driven flows whose priority is 2, 5, and 2 respectively once every 2 s. Such that Payload 1 and Payload 2 will use QPSK modulation, and Payload 3 will use 16-QAM modulation scheme.
5. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).
6. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

7. Run the above scenario for five iterations.

2.7.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	C-V2X Transmit Device					C-V2X Receive Device					Calculated at Receiver				
Iteration Number	No. of Transmitted pkts/s for SPS Flow 1	No. of Transmitted pkts/s for SPS Flow 2	No. of Transmitted pkts/s for Event-Driven Flow			No. of Received pkts/s for SPS Flow 1	No. of Received pkts/s for SPS Flow 2	No. of Received pkts/s for Event-Driven Flow			PER % for SPS Flow 1	PER % for SPS Flow 2	PER % for Event Flow		
			Payload 1 QPSK	Payload 2 QPSK	Payload 3 16-QAM			Payload 1 QPSK	Payload 2 QPSK	Payload 3 16-QAM			Payload 1 QPSK	Payload 2 QPSK	Payload 3 16-QAM
1	1000	1000													
2	1000	1000													
3	1000	1000													
4	1000	1000													
5	1000	1000													

2.8 Test Case 8: 4 Rx pools

2.8.1 Background

This test verifies that the devices under test, the transmitter can transmit using one Tx pool (two SPS flows each with 100 ms periodicity) and the receiver can receive C-V2X messages on the corresponding Rx pool over PC5 interface when the receiver is configured with four Rx pools that overlap in SF bitmap, non-overlapping RBs.

2.8.2 Assumptions

The operating system time of both the transmitter and receiver boxes is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.8.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 20 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The Transmit and Receive devices are configured with one Tx pool and four Rx pools, where the Tx pool matches with one Rx pool.
  - The Rx pools have overlapping SF bitmap. However, there are no overlapping RBs between the Rx pools.
  - The application layer is configured to generate two SPS flow messages and deliver to the lower layers with 100 ms periodicity for SPS Flow 1 and SPS Flow 2 respectively.
  - SPS Flow 1 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) with PPPP=2 and SPS Flow 2 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) with PPPP=5.
  - PPPP can be changed based on the priority that is supported in the region where the test is being conducted)
  - Transmit on ITS band with bandwidth of 20 MHz.
- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 20 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet

- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	20 MHz
Number of Samples	1000
Packet Size	SPS Flow 1: 283 bytes SPS Flow 2: 283 bytes
Periodicity	SPS Flow 1: 100 ms SPS Flow 2: 100 ms
PPPP	SPS Flow 1: 2 SPS Flow 2: 5 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: Non-IP SPS Flow 2: Non-IP

2.8.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured to have one Tx pool and four Rx pools, where the Tx pool matches with one Rx pool as mentioned in Pre-configuration Settings 2.
3. Tx device (Device 1) is configured to transmit a payload of size 283 bytes with 100 ms periodicity for each SPS flows. SPS Flow 1 transmits with PPPP=2 and SPS Flow 2 transmits packets with PPPP=5.

   PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
4. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

5. Run the above scenario for five iterations.

2.8.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	C-V2X Transmit Device		C-V2X Receive Device		Calculated at Receiver	
Iteration Number	No. of Transmitted pkts/s for SPS Flow 1	No. of Transmitted pkts/s for SPS Flow 2	No. of Received pkts/s for SPS Flow 1	No. of Received pkts/s for SPS Flow 2	PER % for SPS Flow 1	PER % for SPS Flow 2
1	1000	1000				
2	1000	1000				
3	1000	1000				
4	1000	1000				
5	1000	1000				

2.9 Test Case 9: 2 Rx pools

2.9.1 Background

This test verifies that the devices under test, the transmitter can transmit using one Tx pool (two SPS flows each with 100 ms periodicity) and the receiver can receive C-V2X messages on the corresponding Rx pool over PC5 interface when the receiver is configured with two Rx pools that are non-overlapping in SF bitmap, but overlapping in RBs.

2.9.2 Assumptions

The operating system time of both the transmitter and receiver boxes is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.9.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 20 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The Transmit and Receive devices are configured with one Tx pool and two Rx pools, where the Tx pool matches with one Rx pool.
  - Two Rx pools have non-overlapping SF bitmap but overlapping in RBs.
  - The application layer is configured to generate two SPS flow messages and deliver to the lower layers with 100 ms periodicity for SPS Flow 1 and SPS Flow 2 respectively.
  - SPS Flow 1 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) with PPPP=2 and SPS Flow 2 is configured to transmit 283 bytes (BSM/CAM/any other periodic message) with PPPP=5.
  - PPPP can be changed based on the priority that is supported in the region where the test is being conducted.

- Transmit on ITS band with bandwidth of 20 MHz.

- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 20 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet
- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	20 MHz
Number of Samples	1000
Packet Size	SPS Flow 1: 283 bytes SPS Flow 2: 283 bytes
Periodicity	SPS Flow 1: 100 ms SPS Flow 2: 100 ms
PPPP	SPS Flow 1: 2 SPS Flow 2: 5 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: Non-IP SPS Flow 2: Non-IP

2.9.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured to have one Tx pool and two Rx pools, where the Tx pool matches with one Rx pool as mentioned in Pre-configuration Settings 3.
3. Tx device (Device 1) is configured to transmit a payload of size 283 bytes for both the SPS flows. SPS Flow 1 and SPS Flow 2 transmit packets at 100 ms periodicity.
4. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

5. Run the above scenario for five iterations.

2.9.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	C-V2X Transmit Device		C-V2X Receive Device		Calculated at Receiver	
Iteration Number	No. of Transmitted pkts/s for SPS Flow 1	No. of Transmitted pkts/s for SPS Flow 2	No. of Received pkts/s for SPS Flow 1	No. of Received pkts/s for SPS Flow 2	PER % for SPS Flow 1	PER % for SPS Flow 2
1	1000	1000				
2	1000	1000				
3	1000	1000				
4	1000	1000				
5	1000	1000				

2.10 Test Case 10: T5000 timer validation

2.10.1 Background

This test verifies that the transmit device changes its source address after T5000 timer expiry, the receiver should be able to receive all the transmissions from the transmitter and pass it to the higher layers.

2.10.2 Assumptions

The operating system time of both the transmitter and receiver boxes is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.10.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to generate one SPS flow and deliver to the lower layers with 100 ms periodicity.
  - SPS Flow 1 is configured to transmit 283 bytes (BSM/CAM/any other periodic message).
  - Transmit on ITS band with bandwidth of 10 MHz.
  - T5000 timer is set to 300 s.

- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet
- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	6000
Packet Size	SPS Flow 1: 283 bytes
Periodicity	SPS Flow 1: 100 ms
PPPP	SPS Flow 1: 2 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: Non-IP

2.10.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in Pre-configuration Settings 1.
3. Tx device (Device 1) is configured to transmit a payload of size 283 bytes using SPS flow at 100 ms periodicity.
4. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).
5. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

6. Run the above scenario for five iterations.

2.10.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	No. of Transmitted pkts/s	**No. of Received pkts/s**	**Calculated at Receiver**	**Tx Device source ID changed after T5000 timer expiry (Yes/No)**
Iteration Number	**C-V2X Transmit Device**	**C-V2X Receive Device**	**PER %**	
1	6000			
2	6000			
3	6000			
4	6000			
5	6000			

2.11 Test Case 11: 2 Tx/Rx pools

2.11.1 Background

This test verifies that the devices under test can transmit and receive C-V2X messages (two SPS flows each with 100 ms periodicity, each SPS flow corresponding to a Tx pool) over PC5 interface. The transmit and receive devices are configured with two Tx pools and two Rx pools with Pre-configuration Settings 4..

2.11.2 Assumptions

The operating system time of both the transmitter and receiver boxes is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.11.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 20 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - Device is configured with two Tx pools and two Rx pools.
  - The application layer is configured to generate one SPS flow per Tx pool and deliver to the lower layers with 100 ms periodicity.
  - SPS Flow 1 and SPS Flow 2 are configured to transmit 283 bytes (BSM/CAM/any other periodic message).
  - Transmit on ITS band with bandwidth of 20 MHz.
- Settings on the C-V2X Device 2 [Receive Radio]:

- Device is configured with two Tx pools and two Rx Pools.
- Configured to receive on ITS band (Channel 172) and bandwidth of 20 MHz.
- Receive Radio in C-V2X listens on all occasions.
- Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.

- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet
- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	20 MHz
Number of Samples	1000
Packet Size	SPS Flow 1: 283 bytes SPS Flow 2: 283 bytes
Periodicity	SPS Flow 1: 100 ms SPS Flow 2: 100 ms
PPPP	SPS Flow 1: 2 SPS Flow 2: 2 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: Non-IP SPS Flow 2: Non-IP

2.11.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in Pre-configuration Settings 4.
3. Tx device (Device 1) is configured to transmit a payload of size 283 bytes using SPS flow at 100 ms periodicity where each SPS flow corresponding to a Tx pool.
4. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's) on both the Rx pools.
5. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

6. Run the above scenario for five iterations.

2.11.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	C-V2X Transmit Device		C-V2X Receive Device		Calculated at Receiver	
Iteration Number	**No. of Transmitted pkts/s for SPS Flow 1**	**No. of Transmitted pkts/s for SPS Flow 2**	**No. of Received pkts/s for SPS Flow 1**	**No. of Received pkts/s for SPS Flow 2**	**PER % for SPS Flow 1**	**PER % for SPS Flow 2**
1	1000	1000				
2	1000	1000				
3	1000	1000				
4	1000	1000				
5	1000	1000				

2.12 Test Case 12: Congestion

2.12.1 Background

This test verifies that the devices under test can transmit and receive C-V2X messages (SPS flow with 100 ms periodicity) over PC5 interface in presence of congestion.

2.12.2 Assumptions

Operating system time of both the transmitter, receiver and congesting device is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.12.3 Setup

This test uses a lab cabled setup as shown in Figure 2-2.

A C-V2X congesting device/source is configured to create ~ 60% CBR on the system, C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

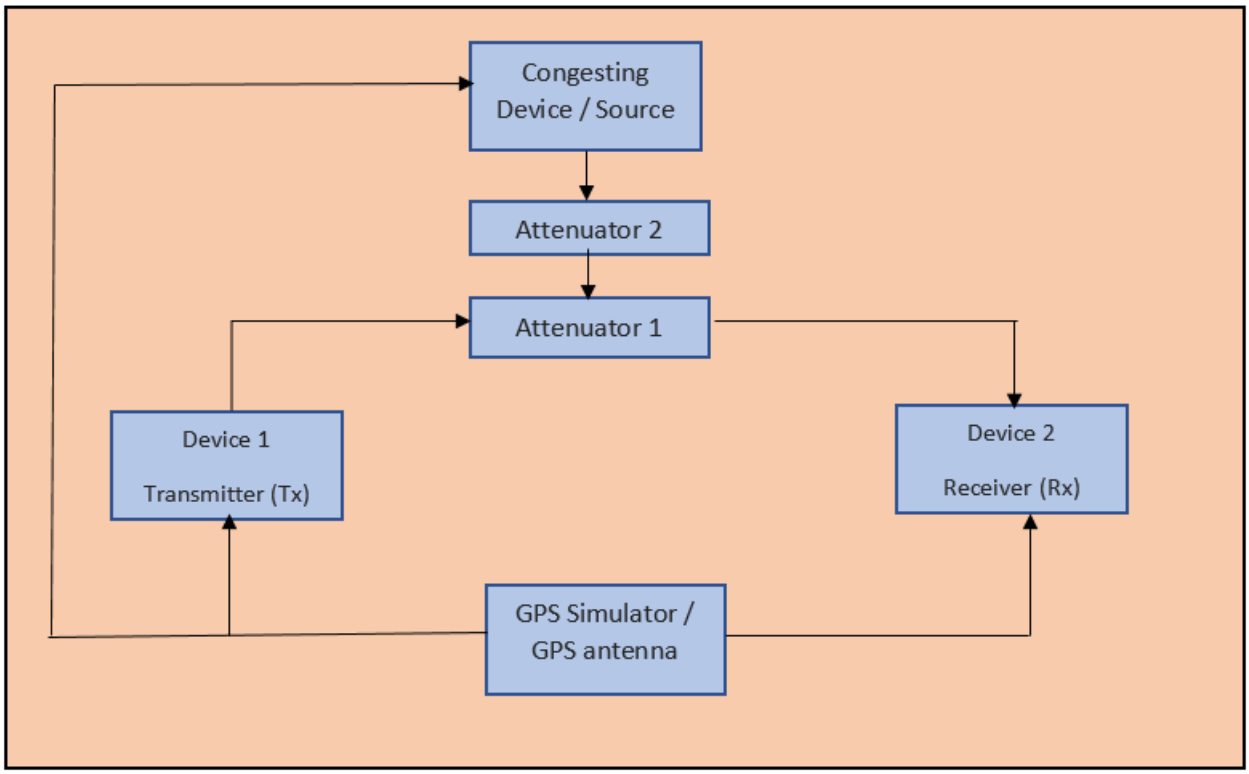

Figure 2-2 Test case setup for Test 12

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to generate one SPS flow and deliver to the lower layers with 100 ms periodicity.
  - SPS Flow 1 is configured to transmit 283 bytes (BSM/CAM/any other periodic message).
  - Transmit on ITS band with bandwidth of 10 MHz.
- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Settings on the C-V2X Device 3 [Congesting Radio]:
  - Configured to create CBR of ~ 60% on the system.
  - Configured bandwidth is 10 MHz.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet

- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	1000
Packet Size	SPS Flow 1: 283 bytes
Periodicity	SPS Flow 1: 100 ms
PPPP	SPS Flow 1: 2 PPPP can be changed based on the priority that is supported in the region where the test is being conducted)
IP Type	SPS Flow 1: Non-IP

2.12.4 Execution

1. Set the value of the Attenuator 1 such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. After setting the Attenuator 1, now set the value of Attenuator 2 such that the Tx and Rx devices receive transmissions from the congestion device at -70 dBm power.
3. Tx device (Device 1), Rx device (Device 2) and Congesting Device (Device 3) are configured with the values in Pre-configuration Settings 1.
4. Congesting device (Device 3) is configured to create congestion such that both the Tx device (Device 1) and Rx device (Device) have ~ 60% CBR.
5. Tx device (Device 1) is configured to transmit a payload of size 283 bytes using SPS flow at 100 ms periodicity.
6. Tx device should apply the appropriate CBR – CRlimit values based on the PPPP (in this case PPPP=2) of the transmitted packet.
7. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).
8. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

9. Run the above scenario for five iterations.

2.12.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	No. of Transmitted pkts/s	No. of Received pkts/s	Calculated at Receiver
Iteration Number	**C-V2X Transmit Device**	**C-V2X Receive Device**	**PER %**
1	1000		
2	1000		
3	1000		
4	1000		
5	1000		

2.13 Test Case 13: TIM (or) equivalent message

2.13.1 Background

This test verifies that the devices under test can transmit and receive C-V2X traffic information message (TIM) (or) equivalent message, depending on the region that is being tested (event-driven flows with 1000 ms periodicity) over PC5 interface.

2.13.2 Assumptions

The operating system time of the transmitter and receiver devices is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.13.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to generate one event-driven flow (TIM or equivalent message) and deliver to the lower layers with 1000 ms periodicity.
  - Event-driven flow is configured to transmit 576 bytes (TIM or equivalent message).
  - Transmit on ITS band with bandwidth of 10 MHz.
  - Appropriate transmit power and fixed attenuation added to ensure DUT input of -50 dBm.
- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet

- Sequence number of the transmitted packet

- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	Event flow: 100
Packet Size	Event flow: 576 bytes
Periodicity	Event flow: 1000 ms
PPPP	Event flow: 2 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	Event flow: Non-IP

2.13.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in Pre-configuration Settings 1.
3. Tx device (Device 1) is configured to transmit a payload of size 576 bytes using event-driven flow at 1000 ms periodicity.
4. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).
5. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

6. Run the above scenario for five iterations.

2.13.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	No. of Transmitted pkts/s	No. of Received pkts/s	Calculated at Receiver
Iteration Number	**C-V2X Transmit Device**	**C-V2X Receive Device**	**PER %**
1	100		
2	100		
3	100		
4	100		
5	100		

2.14 Test Case 14: SPAT message (or) equivalent message

2.14.1 Background

This test verifies that the devices under test can transmit and receive C-V2X SPAT (or) equivalent message, depending on the region that is being tested (one SPS flow each with 100 ms periodicity) over PC5 interface.

2.14.2 Assumptions

The operating system time of the transmitter and receiver devices is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.14.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to generate one SPS flow and deliver to the lower layers with 100 ms periodicity.
  - SPS Flow 1 is configured to transmit 479 bytes (SPAT or equivalent message).
  - Transmit on ITS band with bandwidth of 10 MHz.
- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X monitors for data packets on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet

- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	SPS Flow 1: 1000
Packet Size	SPS Flow 1: 479 bytes
Periodicity	SPS Flow 1: 100 ms
PPPP	SPS Flow 1: 2 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	SPS Flow 1: Non-IP

2.14.4 Execution

1. Set the value of the attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in Pre-configuration Settings 1.
3. Tx device (Device 1) is configured to transmit a payload of size 479 bytes using SPS flow at 100 ms periodicity.
4. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).
5. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

6. Run the above scenario for five iterations.

2.14.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	No. of Transmitted pkts/s	No. of Received pkts/s	Calculated at Receiver
Iteration Number	**C-V2X Transmit Device**	**C-V2X Receive Device**	**PER %**
1	1000		
2	1000		
3	1000		
4	1000		
5	1000		

2.15 Test Case 15: MAP message (or) equivalent message

2.15.1 Background

This test verifies that the devices under test can transmit and receive C-V2X MAP (or) equivalent messages depending on the region that is being tested (event-driven flows with 1000 ms periodicity) over PC5 interface.

2.15.2 Assumptions

The operating system time of the transmitter and receiver devices is synchronized to the common clock (e.g., GPS) with an error of no more than 1 ms.

2.15.3 Setup

This test uses a lab cabled setup as shown in Figure 2-1.

A C-V2X Device 2 [Receive Radio] is configured to receive data from C-V2X Device 1 [Transmit Radio] on the ITS band (Channel 172) with a bandwidth of 10 MHz.

Each C-V2X OBE shall be placed in a RF shielding box to account for possible RF leakage.

- Settings on the C-V2X Device 1 [Transmit Radio]:
  - The application layer is configured to generate one event-driven flow and deliver to the lower layers with 1000 ms periodicity.
  - Event-driven flow is configured to transmit 6594 bytes (MAP or equivalent message).
  - Transmit on ITS band with bandwidth of 10 MHz.
- Settings on the C-V2X Device 2 [Receive Radio]:
  - Configured to receive on ITS band (Channel 172) and bandwidth of 10 MHz.
  - Receive Radio in C-V2X listens on all occasions.
  - Appropriate attenuation is added such that the Device 2 receives transmission from Device 1 at -50 dBm RSSI.
- Data collection at Tx:
  - OS timestamp for each transmitted packet
  - Sequence number of the transmitted packet

- Data collection at Rx:
  - OS timestamp for each received packet
  - Sequence number of the received packet

Parameter	Value
Bandwidth	10 MHz
Number of Samples	Event flow: 100
Packet Size	Event flow: 6594 bytes
Periodicity	Event flow: 1000 ms
PPPP	Event flow: 2 PPPP can be changed based on the priority that is supported in the region where the test is being conducted.
IP Type	Event flow: Non-IP

2.15.4 Execution

1. Set the value of VA attenuator such that the Rx device receives transmissions from the Tx device at -50 dBm power.
2. Tx device (Device 1) and Rx device (Device 2) are configured with the values in Pre-configuration Settings 1.
3. Tx device (Device 1) is configured to transmit a payload of size 6594 bytes using event-driven flow at 1000 ms periodicity.
4. Rx device (Device 2) is configured to receive packets on every subframe (SF bitmap set to 1's).
5. Record the following statistics on the C-V2X devices in the log file:
   a. OS timestamp for each Tx/Rx packet
   b. Sequence number of the Tx/Rx packet

NOTE: Tests should be conducted at room temperature (21°C +/- 5°).

6. Run the above scenario for five iterations.

2.15.5 Required documentation

Using the data collected from the log files, fill in the following table.

The packet error rate (PER) is computed from both the Tx and Rx logs. It is the number of missing (not received) packets divided by the total number of transmitted packets.

	No. of Transmitted pkts/s	No. of Received pkts/s	Calculated at Receiver
Iteration Number	**C-V2X Transmit Device**	**C-V2X Receive Device**	**PER %**
1	100		
2	100		
3	100		
4	100		

	No. of Transmitted pkts/s	No. of Received pkts/s	Calculated at Receiver
5	100		

3 Device Settings

3.1 Pre-configuration Settings 1

```
{
  v2x-PreconfigFreqList-r14 {
    {
      v2x-CommPreconfigGeneral-r14 {
        rohc-Profiles-r12 {
          profile0x0001-r12 FALSE,
          profile0x0002-r12 FALSE,
          profile0x0004-r12 FALSE,
          profile0x0006-r12 FALSE,
          profile0x0101-r12 FALSE,
          profile0x0102-r12 FALSE,
          profile0x0104-r12 FALSE
        },
        carrierFreq-r12 55190,
        maxTxPower-r12 23,
        additionalSpectrumEmission-r12 32,
        sl-bandwidth-r12 n50,
        tdd-ConfigSL-r12 {
          subframeAssignmentSL-r12 none
        },
        reserved-r12 '0000000000000000000'B
      },
      v2x-CommRxPoolList-r14 {
        {
          sl-Subframe-r14 bs20-r14 : 'FFFFF'H,
          adjacencyPSCCH-PSSCH-r14 TRUE,
          sizeSubchannel-r14 n10,
          numSubchannel-r14 n5,
          startRB-Subchannel-r14 0,
          dataTxParameters-r14 23,
          syncAllowed-r14 {
            gnss-Sync-r14 true
          }
        }
      },
      v2x-CommTxPoolList-r14 {
        {
```

```
    sl-Subframe-r14 bs20-r14 : 'FFFFF'H,
    adjacencyPSCCH-PSSCH-r14 TRUE,
    sizeSubchannel-r14 n10,
    numSubchannel-r14 n5,
    startRB-Subchannel-r14 0,
    dataTxParameters-r14 23,
    threshS-RSSI-CBR-r14 10,
    cbr-pssch-TxConfigList-r14 {
      {
        priorityThreshold-r14 2,
        defaultTxConfigIndex-r14 1,
        cbr-ConfigIndex-r14 0,
        tx-ConfigIndexList-r14 {
          0,
          1
        }
      },
      {
        priorityThreshold-r14 5,
        defaultTxConfigIndex-r14 3,
        cbr-ConfigIndex-r14 1,
        tx-ConfigIndexList-r14 {
          0,
          2,
          3,
          4
        }
      }
    },
    syncAllowed-r14 {
      gnss-Sync-r14 true
    }
  }
},
p2x-CommTxPoolList-r14 {
  {
    sl-Subframe-r14 bs10-r14 : '0000000000'B,
    adjacencyPSCCH-PSSCH-r14 FALSE,
    sizeSubchannel-r14 n4,
    numSubchannel-r14 n1,
    startRB-Subchannel-r14 0,
    dataTxParameters-r14 -126
  }
},
v2x-ResourceSelectionConfig-r14 {
  pssch-TxConfigList-r14 {
    {
      thresUE-Speed-r14 kmph120,
```

```
    parametersAboveThres-r14 {
      minMCS-PSSCH-r14 0,
      maxMCS-PSSCH-r14 7,
      minSubChannel-NumberPSSCH-r14 1,
      maxSubchannel-NumberPSSCH-r14 5,
      allowedRetxNumberPSSCH-r14 n1
    },
    parametersBelowThres-r14 {
      minMCS-PSSCH-r14 5,
      maxMCS-PSSCH-r14 11,
      minSubChannel-NumberPSSCH-r14 1,
      maxSubchannel-NumberPSSCH-r14 2,
      allowedRetxNumberPSSCH-r14 n1
    }
  }
},
thresPSSCH-RSRP-List-r14 {
  2,
  2,
  11,
  11,
  11,
  11,
  11,
  11,
  2,
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        2,
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        11,
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        11,
        11
      },
      restrictResourceReservationPeriod-r14 {
        v1
      },
      probResourceKeep-r14 v0dot8,
      sl-ReselectAfter-r14 n5
    },
    syncPriority-r14 gnss
  }
},
cbr-PreconfigList-r14 {
  cbr-RangeCommonConfigList-r14 {
    {
      65,
      100
```

```
    },
    {
      30,
      65,
      80,
      100
    }
  },
  sl-CBR-PSSCH-TxConfigList-r14 {
    {
      cr-Limit-r14 10000,
      tx-Parameters-r14 {
        minMCS-PSSCH-r14 5,
        maxMCS-PSSCH-r14 11,
        minSubChannel-NumberPSSCH-r14 1,
        maxSubchannel-NumberPSSCH-r14 2,
        allowedRetxNumberPSSCH-r14 n1,
        maxTxPower-r14 txPower-r14 : 23
      }
    },
    {
      cr-Limit-r14 200,
      tx-Parameters-r14 {
        minMCS-PSSCH-r14 5,
        maxMCS-PSSCH-r14 11,
        minSubChannel-NumberPSSCH-r14 1,
        maxSubchannel-NumberPSSCH-r14 2,
        allowedRetxNumberPSSCH-r14 n1,
        maxTxPower-r14 txPower-r14 : 23
      }
    },
    {
      cr-Limit-r14 300,
      tx-Parameters-r14 {
        minMCS-PSSCH-r14 5,
        maxMCS-PSSCH-r14 11,
        minSubChannel-NumberPSSCH-r14 1,
        maxSubchannel-NumberPSSCH-r14 2,
        allowedRetxNumberPSSCH-r14 n1,
        maxTxPower-r14 txPower-r14 : 23
      }
    },
    {
      cr-Limit-r14 60,
      tx-Parameters-r14 {
        minMCS-PSSCH-r14 5,
        maxMCS-PSSCH-r14 11,
        minSubChannel-NumberPSSCH-r14 1,
```

```
          maxSubchannel-NumberPSSCH-r14 2,
          allowedRetxNumberPSSCH-r14 n1,
          maxTxPower-r14 txPower-r14 : 23
        }
      },
      {
        cr-Limit-r14 30,
        tx-Parameters-r14 {
          minMCS-PSSCH-r14 5,
          maxMCS-PSSCH-r14 11,
          minSubChannel-NumberPSSCH-r14 1,
          maxSubchannel-NumberPSSCH-r14 2,
          allowedRetxNumberPSSCH-r14 n1,
          maxTxPower-r14 txPower-r14 : 23
        }
      }
    }
  }
}
```

3.2 Pre-configuration Settings 2

```
{
  v2x-PreconfigFreqList-r14 {
    {
      v2x-CommPreconfigGeneral-r14 {
        rohc-Profiles-r12 {
          profile0x0001-r12 FALSE,
          profile0x0002-r12 FALSE,
          profile0x0004-r12 FALSE,
          profile0x0006-r12 FALSE,
          profile0x0101-r12 FALSE,
          profile0x0102-r12 FALSE,
          profile0x0104-r12 FALSE
        },
        carrierFreq-r12 55190,
        maxTxPower-r12 23,
        additionalSpectrumEmission-r12 32,
        sl-bandwidth-r12 n100,
        tdd-ConfigSL-r12 {
          subframeAssignmentSL-r12 none
        },
        reserved-r12 '0000000000000000000'B
      },
      v2x-CommRxPoolList-r14 {
        {
```

```
      sl-Subframe-r14 bs20-r14 : 'FFFFF'H,
      adjacencyPSCCH-PSSCH-r14 TRUE,
      sizeSubchannel-r14 n10,
      numSubchannel-r14 n2,
      startRB-Subchannel-r14 0,
      dataTxParameters-r14 23,
    },
    {
      sl-Subframe-r14 bs20-r14 : 'FFFFF'H,
      adjacencyPSCCH-PSSCH-r14 TRUE,
      sizeSubchannel-r14 n10,
      numSubchannel-r14 n2,
      startRB-Subchannel-r14 20,
      dataTxParameters-r14 23,
    },
    {
      sl-Subframe-r14 bs20-r14 : 'FFFFF'H,
      adjacencyPSCCH-PSSCH-r14 TRUE,
      sizeSubchannel-r14 n10,
      numSubchannel-r14 n2,
      startRB-Subchannel-r14 40,
      dataTxParameters-r14 23,
    },
    {
      sl-Subframe-r14 bs20-r14 : 'FFFFF'H,
      adjacencyPSCCH-PSSCH-r14 TRUE,
      sizeSubchannel-r14 n10,
      numSubchannel-r14 n2,
      startRB-Subchannel-r14 60,
      dataTxParameters-r14 23,
    }
  },
  v2x-CommTxPoolList-r14 {
    {
      sl-Subframe-r14 bs20-r14 : 'FFFFF'H,
      adjacencyPSCCH-PSSCH-r14 TRUE,
      sizeSubchannel-r14 n10,
      numSubchannel-r14 n2,
      startRB-Subchannel-r14 0,
      dataTxParameters-r14 23,
      threshS-RSSI-CBR-r14 10,
      cbr-pssch-TxConfigList-r14 {
        {
          priorityThreshold-r14 2,
          defaultTxConfigIndex-r14 1,
          cbr-ConfigIndex-r14 0,
          tx-ConfigIndexList-r14 {
            0,
```

```
          1
        }
      },
      {
        priorityThreshold-r14 5,
        defaultTxConfigIndex-r14 3,
        cbr-ConfigIndex-r14 1,
        tx-ConfigIndexList-r14 {
          0,
          2,
          3,
          4
        }
      }
    },
    syncAllowed-r14 {
      gnss-Sync-r14 true
    }
  }
},
p2x-CommTxPoolList-r14 {
  {
    sl-Subframe-r14 bs10-r14 : '0000000000'B,
    adjacencyPSCCH-PSSCH-r14 FALSE,
    sizeSubchannel-r14 n4,
    numSubchannel-r14 n1,
    startRB-Subchannel-r14 0,
    dataTxParameters-r14 -126
  }
},
v2x-ResourceSelectionConfig-r14 {
  pssch-TxConfigList-r14 {
    {
      thresUE-Speed-r14 kmph120,
      parametersAboveThres-r14 {
        minMCS-PSSCH-r14 0,
        maxMCS-PSSCH-r14 7,
        minSubChannel-NumberPSSCH-r14 1,
        maxSubchannel-NumberPSSCH-r14 2,
        allowedRetxNumberPSSCH-r14 n1
      },
      parametersBelowThres-r14 {
        minMCS-PSSCH-r14 5,
        maxMCS-PSSCH-r14 11,
        minSubChannel-NumberPSSCH-r14 1,
        maxSubchannel-NumberPSSCH-r14 2,
        allowedRetxNumberPSSCH-r14 n1
      }
```

```
    }
  },
  thresPSSCH-RSRP-List-r14 {
    2,
    2,
    11,
    11,
    11,
    11,
    11,
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    2,
    2,
    11,
    11,
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        11
      },
      restrictResourceReservationPeriod-r14 {
        v1
      },
      probResourceKeep-r14 v0dot8,
      sl-ReselectAfter-r14 n5
    },
    syncPriority-r14 gnss
  }
},
cbr-PreconfigList-r14 {
  cbr-RangeCommonConfigList-r14 {
    {
      65,
      100
    },
    {
      30,
      65,
      80,
      100
    }
  },
  sl-CBR-PSSCH-TxConfigList-r14 {
    {
      cr-Limit-r14 10000,
      tx-Parameters-r14 {
        minMCS-PSSCH-r14 5,
        maxMCS-PSSCH-r14 11,
```

```
    minSubChannel-NumberPSSCH-r14 1,
    maxSubchannel-NumberPSSCH-r14 2,
    allowedRetxNumberPSSCH-r14 n1,
    maxTxPower-r14 txPower-r14 : 23
  }
},
{
  cr-Limit-r14 200,
  tx-Parameters-r14 {
    minMCS-PSSCH-r14 5,
    maxMCS-PSSCH-r14 11,
    minSubChannel-NumberPSSCH-r14 1,
    maxSubchannel-NumberPSSCH-r14 2,
    allowedRetxNumberPSSCH-r14 n1,
    maxTxPower-r14 txPower-r14 : 23
  }
},
{
  cr-Limit-r14 300,
  tx-Parameters-r14 {
    minMCS-PSSCH-r14 5,
    maxMCS-PSSCH-r14 11,
    minSubChannel-NumberPSSCH-r14 1,
    maxSubchannel-NumberPSSCH-r14 2,
    allowedRetxNumberPSSCH-r14 n1,
    maxTxPower-r14 txPower-r14 : 23
  }
},
{
  cr-Limit-r14 60,
  tx-Parameters-r14 {
    minMCS-PSSCH-r14 5,
    maxMCS-PSSCH-r14 11,
    minSubChannel-NumberPSSCH-r14 1,
    maxSubchannel-NumberPSSCH-r14 2,
    allowedRetxNumberPSSCH-r14 n1,
    maxTxPower-r14 txPower-r14 : 23
  }
},
{
  cr-Limit-r14 30,
  tx-Parameters-r14 {
    minMCS-PSSCH-r14 5,
    maxMCS-PSSCH-r14 11,
    minSubChannel-NumberPSSCH-r14 1,
    maxSubchannel-NumberPSSCH-r14 2,
    allowedRetxNumberPSSCH-r14 n1,
    maxTxPower-r14 txPower-r14 : 23
```

```
          }
        }
      }
    }
  }
```

3.3 Pre-configuration Settings 3

```
{
  v2x-PreconfigFreqList-r14 {
    {
      v2x-CommPreconfigGeneral-r14 {
        rohc-Profiles-r12 {
          profile0x0001-r12 FALSE,
          profile0x0002-r12 FALSE,
          profile0x0004-r12 FALSE,
          profile0x0006-r12 FALSE,
          profile0x0101-r12 FALSE,
          profile0x0102-r12 FALSE,
          profile0x0104-r12 FALSE
        },
        carrierFreq-r12 55190,
        maxTxPower-r12 23,
        additionalSpectrumEmission-r12 32,
        sl-bandwidth-r12 n1000,
        tdd-ConfigSL-r12 {
          subframeAssignmentSL-r12 none
        },
        reserved-r12 '0000000000000000000'B
      },
      v2x-CommRxPoolList-r14 {
        {
          sl-Subframe-r14 bs20-r14 : 'FFC00'H,
          adjacencyPSCCH-PSSCH-r14 TRUE,
          sizeSubchannel-r14 n10,
          numSubchannel-r14 n10,
          startRB-Subchannel-r14 0,
          dataTxParameters-r14 23,
        },
        {
          sl-Subframe-r14 bs20-r14 : '003FF'H,
          adjacencyPSCCH-PSSCH-r14 TRUE,
          sizeSubchannel-r14 n10,
          numSubchannel-r14 n10,
          startRB-Subchannel-r14 0,
          dataTxParameters-r14 23,
```

```
    }
  },
  v2x-CommTxPoolList-r14 {
    {
      sl-Subframe-r14 bs20-r14 : 'FFC00'H,
      adjacencyPSCCH-PSSCH-r14 TRUE,
      sizeSubchannel-r14 n10,
      numSubchannel-r14 n10,
      startRB-Subchannel-r14 0,
      dataTxParameters-r14 23,
      threshS-RSSI-CBR-r14 10,
      cbr-pssch-TxConfigList-r14 {
        {
          priorityThreshold-r14 2,
          defaultTxConfigIndex-r14 1,
          cbr-ConfigIndex-r14 0,
          tx-ConfigIndexList-r14 {
            0,
            1
          }
        },
        {
          priorityThreshold-r14 5,
          defaultTxConfigIndex-r14 3,
          cbr-ConfigIndex-r14 1,
          tx-ConfigIndexList-r14 {
            0,
            2,
            3,
            4
          }
        }
      },
      syncAllowed-r14 {
        gnss-Sync-r14 true
      }
    }
  },
  p2x-CommTxPoolList-r14 {
    {
      sl-Subframe-r14 bs10-r14 : '0000000000'B,
      adjacencyPSCCH-PSSCH-r14 FALSE,
      sizeSubchannel-r14 n4,
      numSubchannel-r14 n1,
      startRB-Subchannel-r14 0,
      dataTxParameters-r14 -126
    }
  },
```

```
v2x-ResourceSelectionConfig-r14 {
  pssch-TxConfigList-r14 {
    {
      thresUE-Speed-r14 kmph120,
      parametersAboveThres-r14 {
        minMCS-PSSCH-r14 0,
        maxMCS-PSSCH-r14 7,
        minSubChannel-NumberPSSCH-r14 1,
        maxSubchannel-NumberPSSCH-r14 5,
        allowedRetxNumberPSSCH-r14 n1
      },
      parametersBelowThres-r14 {
        minMCS-PSSCH-r14 5,
        maxMCS-PSSCH-r14 11,
        minSubChannel-NumberPSSCH-r14 1,
        maxSubchannel-NumberPSSCH-r14 2,
        allowedRetxNumberPSSCH-r14 n1
      }
    }
  },
  thresPSSCH-RSRP-List-r14 {
    2,
    2,
    11,
    11,
    11,
    11,
    11,
    11,
    2,
    2,
    11,
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        11
      },
      restrictResourceReservationPeriod-r14 {
        v1
      },
      probResourceKeep-r14 v0dot8,
      sl-ReselectAfter-r14 n5
    },
    syncPriority-r14 gnss
  }
},
cbr-PreconfigList-r14 {
```

```
cbr-RangeCommonConfigList-r14 {
  {
    65,
    100
  },
  {
    30,
    65,
    80,
    100
  }
},
sl-CBR-PSSCH-TxConfigList-r14 {
  {
    cr-Limit-r14 10000,
    tx-Parameters-r14 {
      minMCS-PSSCH-r14 5,
      maxMCS-PSSCH-r14 11,
      minSubChannel-NumberPSSCH-r14 1,
      maxSubchannel-NumberPSSCH-r14 2,
      allowedRetxNumberPSSCH-r14 n1,
      maxTxPower-r14 txPower-r14 : 23
    }
  },
  {
    cr-Limit-r14 200,
    tx-Parameters-r14 {
      minMCS-PSSCH-r14 5,
      maxMCS-PSSCH-r14 11,
      minSubChannel-NumberPSSCH-r14 1,
      maxSubchannel-NumberPSSCH-r14 2,
      allowedRetxNumberPSSCH-r14 n1,
      maxTxPower-r14 txPower-r14 : 23
    }
  },
  {
    cr-Limit-r14 300,
    tx-Parameters-r14 {
      minMCS-PSSCH-r14 5,
      maxMCS-PSSCH-r14 11,
      minSubChannel-NumberPSSCH-r14 1,
      maxSubchannel-NumberPSSCH-r14 2,
      allowedRetxNumberPSSCH-r14 n1,
      maxTxPower-r14 txPower-r14 : 23
    }
  },
  {
    cr-Limit-r14 60,
```

```
        tx-Parameters-r14 {
          minMCS-PSSCH-r14 5,
          maxMCS-PSSCH-r14 11,
          minSubChannel-NumberPSSCH-r14 1,
          maxSubchannel-NumberPSSCH-r14 2,
          allowedRetxNumberPSSCH-r14 n1,
          maxTxPower-r14 txPower-r14 : 23
        }
      },
      {
        cr-Limit-r14 30,
        tx-Parameters-r14 {
          minMCS-PSSCH-r14 5,
          maxMCS-PSSCH-r14 11,
          minSubChannel-NumberPSSCH-r14 1,
          maxSubchannel-NumberPSSCH-r14 2,
          allowedRetxNumberPSSCH-r14 n1,
          maxTxPower-r14 txPower-r14 : 23
        }
      }
    }
  }
}
```

3.4 Pre-configuration Settings 4

```
{
  v2x-PreconfigFreqList-r14 {
    {
      v2x-CommPreconfigGeneral-r14 {
        rohc-Profiles-r12 {
          profile0x0001-r12 FALSE,
          profile0x0002-r12 FALSE,
          profile0x0004-r12 FALSE,
          profile0x0006-r12 FALSE,
          profile0x0101-r12 FALSE,
          profile0x0102-r12 FALSE,
          profile0x0104-r12 FALSE
        },
        carrierFreq-r12 55140,
        maxTxPower-r12 23,
        additionalSpectrumEmission-r12 32,
        sl-bandwidth-r12 n100,
        tdd-ConfigSL-r12 {
          subframeAssignmentSL-r12 none
        },
```

```
  reserved-r12 '0000000000000000000'B
},
v2x-CommRxPoolList-r14 {
  {
    sl-Subframe-r14 bs20-r14 : 'FFFFF'H,
    adjacencyPSCCH-PSSCH-r14 TRUE,
    sizeSubchannel-r14 n10,
    numSubchannel-r14 n5,
    startRB-Subchannel-r14 0,
    dataTxParameters-r14 23
  },
  {
    sl-Subframe-r14 bs20-r14 : 'FFFFF'H,
    adjacencyPSCCH-PSSCH-r14 TRUE,
    sizeSubchannel-r14 n10,
    numSubchannel-r14 n5,
    startRB-Subchannel-r14 50,
    dataTxParameters-r14 31
  }
},
v2x-CommTxPoolList-r14 {
  {
    sl-Subframe-r14 bs20-r14 : 'FFFFF'H,
    adjacencyPSCCH-PSSCH-r14 TRUE,
    sizeSubchannel-r14 n10,
    numSubchannel-r14 n5,
    startRB-Subchannel-r14 0,
    dataTxParameters-r14 23,
    threshS-RSSI-CBR-r14 10,
    cbr-pssch-TxConfigList-r14 {
      {
        priorityThreshold-r14 2,
        defaultTxConfigIndex-r14 1,
        cbr-ConfigIndex-r14 0,
        tx-ConfigIndexList-r14 {
          0,
          1
        }
      },
      {
        priorityThreshold-r14 5,
        defaultTxConfigIndex-r14 2,
        cbr-ConfigIndex-r14 1,
        tx-ConfigIndexList-r14 {
          0,
          2,
          3,
          4
```

```
        }
      }
    }
  },
  {
    sl-Subframe-r14 bs20-r14 : 'FFFFF'H,
    adjacencyPSCCH-PSSCH-r14 TRUE,
    sizeSubchannel-r14 n10,
    numSubchannel-r14 n5,
    startRB-Subchannel-r14 50,
    dataTxParameters-r14 23,
    threshS-RSSI-CBR-r14 10,
    cbr-pssch-TxConfigList-r14 {
      {
        priorityThreshold-r14 2,
        defaultTxConfigIndex-r14 1,
        cbr-ConfigIndex-r14 0,
        tx-ConfigIndexList-r14 {
          0,
          1
        }
      },
      {
        priorityThreshold-r14 5,
        defaultTxConfigIndex-r14 2,
        cbr-ConfigIndex-r14 1,
        tx-ConfigIndexList-r14 {
          0,
          2,
          3,
          4
        }
      }
    }
  }
},
p2x-CommTxPoolList-r14 {
  {
    sl-Subframe-r14 bs10-r14 : '0000000000'B,
    adjacencyPSCCH-PSSCH-r14 FALSE,
    sizeSubchannel-r14 n4,
    numSubchannel-r14 n1,
    startRB-Subchannel-r14 0,
    dataTxParameters-r14 -126
  }
},
v2x-ResourceSelectionConfig-r14 {
  pssch-TxConfigList-r14 {
```

```
    {
      thresUE-Speed-r14 kmph120,
      parametersAboveThres-r14 {
        minMCS-PSSCH-r14 0,
        maxMCS-PSSCH-r14 7,
        minSubChannel-NumberPSSCH-r14 1,
        maxSubchannel-NumberPSSCH-r14 5,
        allowedRetxNumberPSSCH-r14 n1
      },
      parametersBelowThres-r14 {
        minMCS-PSSCH-r14 5,
        maxMCS-PSSCH-r14 11,
        minSubChannel-NumberPSSCH-r14 1,
        maxSubchannel-NumberPSSCH-r14 2,
        allowedRetxNumberPSSCH-r14 n1
      }
    }
  },
  thresPSSCH-RSRP-List-r14 {
    2,
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      },
      restrictResourceReservationPeriod-r14 {
        v1
      },
      probResourceKeep-r14 v0dot8,
      sl-ReselectAfter-r14 n5
    },
    syncPriority-r14 gnss
  }
},
cbr-PreconfigList-r14 {
  cbr-RangeCommonConfigList-r14 {
    {
```

```
    65,
    100
  },
  {
    30,
    65,
    80,
    100
  }
},
sl-CBR-PSSCH-TxConfigList-r14 {
  {
    cr-Limit-r14 10000,
    tx-Parameters-r14 {
      minMCS-PSSCH-r14 5,
      maxMCS-PSSCH-r14 11,
      minSubChannel-NumberPSSCH-r14 1,
      maxSubchannel-NumberPSSCH-r14 2,
      allowedRetxNumberPSSCH-r14 n1,
      maxTxPower-r14 txPower-r14 : 23
    }
  },
  {
    cr-Limit-r14 200,
    tx-Parameters-r14 {
      minMCS-PSSCH-r14 5,
      maxMCS-PSSCH-r14 11,
      minSubChannel-NumberPSSCH-r14 1,
      maxSubchannel-NumberPSSCH-r14 2,
      allowedRetxNumberPSSCH-r14 n1,
      maxTxPower-r14 txPower-r14 : 23
    }
  },
  {
    cr-Limit-r14 300,
    tx-Parameters-r14 {
      minMCS-PSSCH-r14 5,
      maxMCS-PSSCH-r14 11,
      minSubChannel-NumberPSSCH-r14 1,
      maxSubchannel-NumberPSSCH-r14 2,
      allowedRetxNumberPSSCH-r14 n1,
      maxTxPower-r14 txPower-r14 : 23
    }
  },
  {
    cr-Limit-r14 60,
    tx-Parameters-r14 {
      minMCS-PSSCH-r14 5,
```

```
          maxMCS-PSSCH-r14 11,
          minSubChannel-NumberPSSCH-r14 1,
          maxSubchannel-NumberPSSCH-r14 2,
          allowedRetxNumberPSSCH-r14 n1,
          maxTxPower-r14 txPower-r14 : 23
        }
      },
      {
        cr-Limit-r14 30,
        tx-Parameters-r14 {
          minMCS-PSSCH-r14 5,
          maxMCS-PSSCH-r14 11,
          minSubChannel-NumberPSSCH-r14 1,
          maxSubchannel-NumberPSSCH-r14 2,
          allowedRetxNumberPSSCH-r14 n1,
          maxTxPower-r14 txPower-r14 : 23
        }
      }
    }
  }
}
```

4 Acronyms and terms

Acronym or term	Definition
C-V2X	Connected vehicle-to-everything
OBE	Onboard equipment
PER	Packet error rate
QTI	Qualcomm Technologies, Inc.
RSSI	Receive signal strength indicator
SPS	Semi-persistent scheduling
TIM	Traffic information message
UE	User equipment

Annex A: Change History

Date	Meeting	TDoc	Subject/Comment
2019-10-09	2019-09-11	P-190085	Final version v1.0