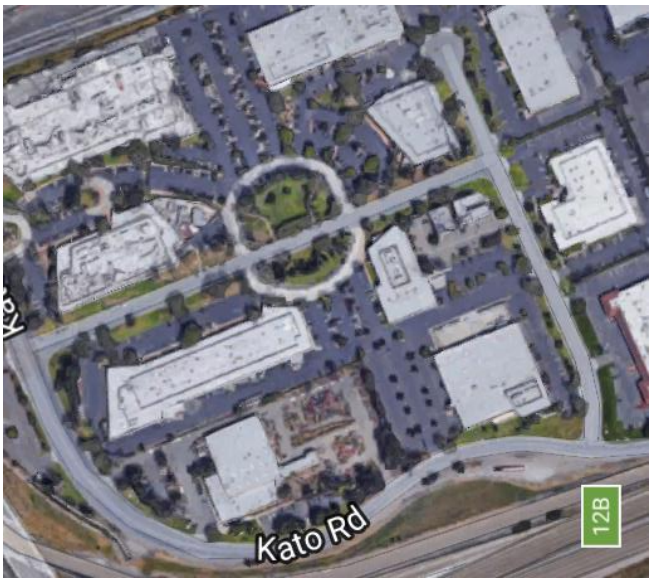
Heading / Speed Latching Instructions

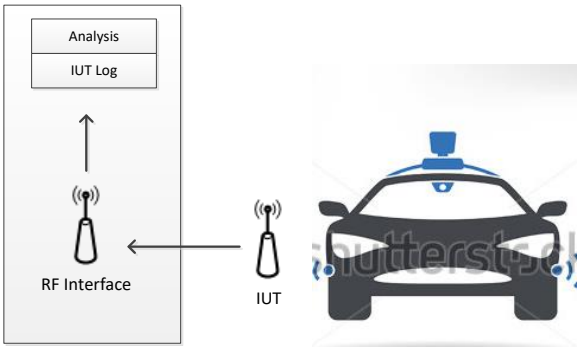
Test Case Verification Objective: TP-BSM-MV-BV-03

- BSM: TP-BSM-ST-BV-02 thru 03-x, TP-BSM-ST-BV-08, TP-BSM-ST-BV-09
- Heading Speed Latching / Unlatching: TP-BSM-MV-BV-05
- Message Timing: TP-BSM-ST-BV-21-V
- N-Header w/Power, Channel & Data Rate: TP-WSM-ROP-BV-01 thru 03
- PathHistory & PathPrediction: TP-BSM-MV-BV-06
- RadiusOfCurve: TP-BSM-ST-BV-02
- Device System Time: TP-BSM-ST-BV-20-V
- UTC Time Correlation: TP-BSM-ST-BV-20-V
- Vehicle Dimensions: TP-BSM-MV-BV-14

Test Location:

- Business Complex in non-congested/empty parking lot or street where UL-Fremont located.



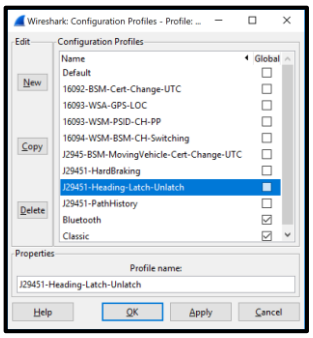


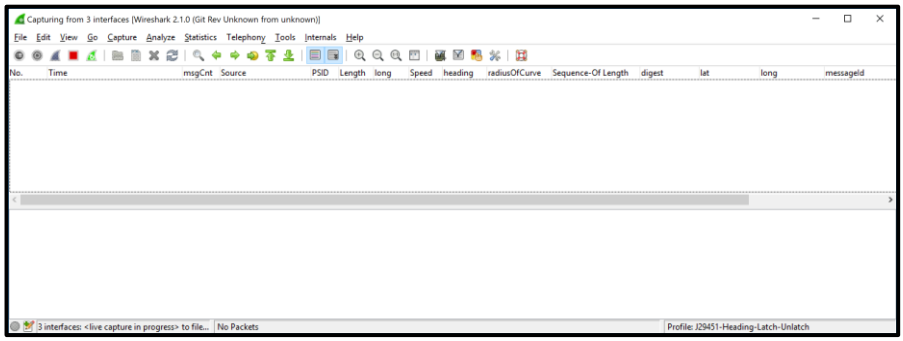
States in Initial Conditions

- IUT is powered up and transmitting.
- GNSS in open-sky conditions is being received and lock.
- IUT has security enabled with certificates and digests to successfully transmit BSMs.
- N-Type Headers enabled for power, channel and data rate.
- IUT is configured to transmit BSMs on a 10 MHz channel vChannelNumber (CH172), data rate vDataRate (6 Mbps) and power vPowerLevel (20 dBm) at 10 Hz transmission rate.

Setup Verification with Test Tool

1. Verify time correlation of Test Computer and UTC Network time at day start.
2. Verify time correlation of Test Tool (GPS PPS – Second value) and Test Computer at each test session.
3. Verify PCAP packet capture date/time stamp with the test computer at each test.
4. Select Configuration Profile “J29451-Heading-Latch-Unlatch” in Wireshark for this test.





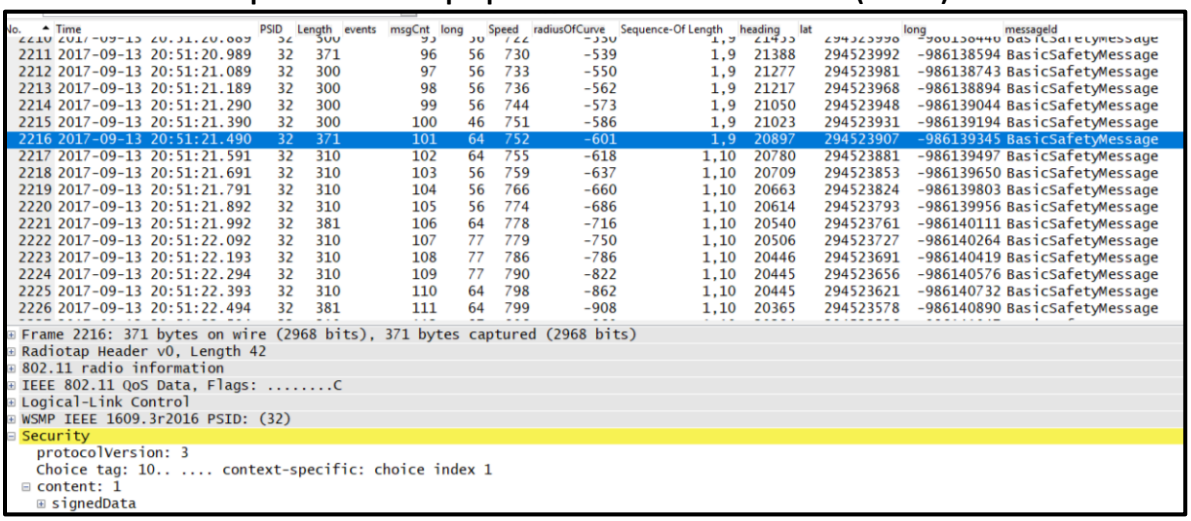
BSM Capture Population Example of Header and Speed Latching and Unlatching.

Packet 145 shows Heading and RadiusOfCurve Latching at Speed parameter.

No.	Time	PSID	Length	msgCnt	long	Speed	radiusOfCurve	Sequence-Of Length	heading	lat	long	messageId
137	2017-09-13 20:24:55.040	32	310	34	-184	120	-12165	1,10	10993	294413995	-986020310	BasicSafetyMessage
138	2017-09-13 20:24:55.140	32	381	35	-175	112	-11979	1,10	10951	294413981	-986020292	BasicSafetyMessage
139	2017-09-13 20:24:55.240	32	310	36	-184	102	-11509	1,10	10965	294413968	-986020279	BasicSafetyMessage
140	2017-09-13 20:24:55.341	32	310	37	-184	94	-10019	1,10	11000	294413955	-986020264	BasicSafetyMessage
141	2017-09-13 20:24:55.441	32	310	38	-184	85	-9377	1,10	10871	294413944	-986020250	BasicSafetyMessage
142	2017-09-13 20:24:55.541	32	310	39	-184	76	-7619	1,10	10978	294413934	-986020241	BasicSafetyMessage
143	2017-09-13 20:24:55.641	32	381	40	-184	68	-6124	1,10	10949	294413925	-986020230	BasicSafetyMessage
144	2017-09-13 20:24:55.742	32	310	41	-184	60	-5243	1,10	10916	294413917	-986020219	BasicSafetyMessage
145	2017-09-13 20:24:55.841	32	310	42	-184	50	-4412	1,10	11073	294413908	-986020214	BasicSafetyMessage
146	2017-09-13 20:24:55.943	32	310	43	-175	54	32767	1,10	11073	294413903	-986020207	BasicSafetyMessage
147	2017-09-13 20:24:56.044	32	310	44	-175	37	32767	1,10	11073	294413898	-986020201	BasicSafetyMessage
148	2017-09-13 20:24:56.143	32	381	45	-175	28	32767	1,10	11073	294413895	-986020197	BasicSafetyMessage
149	2017-09-13 20:24:56.244	32	310	46	-155	20	32767	1,10	11073	294413893	-986020195	BasicSafetyMessage
150	2017-09-13 20:24:56.344	32	310	47	-134	15	32767	1,10	11073	294413892	-986020193	BasicSafetyMessage
151	2017-09-13 20:24:56.444	32	310	48	-105	10	32767	1,10	11073	294413892	-986020195	BasicSafetyMessage
152	2017-09-13 20:24:56.549	32	310	49	-37	0	32767	1,10	11073	294413892	-986020193	BasicSafetyMessage
153	2017-09-13 20:24:56.645	32	381	50	-9	0	32767	1,10	11073	294413893	-986020194	BasicSafetyMessage

```
⊞ Frame 145: 310 bytes on wire (2480 bits), 310 bytes captured (2480 bits)
⊞ Radiotap Header v0, Length 42
⊞ 802.11 radio information
⊞ IEEE 802.11 QoS Data, Flags: ........C
⊞ Logical-Link Control
⊞ WSMP IEEE 1609.3r2016 PSID: (32)
⊟ Security
    protocolVersion: 3
    Choice tag: 10.. .... context-specific: choice index 1
  ⊟ content: 1
    ⊞ signedData
```

Packet 2216 PH Sample where max. perpendicular distance identified (0.96m) within 1m limit.



No.	Time	PSID	Length	events	msgCnt	long	Speed	radiusOfCurve	Sequence-Of Length	heading	lat	long	messageId
2211	2017-09-13 20:51:20.989	32	371		96	56	730	-539	1,9	21388	294523992	-986138594	BasicSafetyMessage
2212	2017-09-13 20:51:21.089	32	300		97	56	733	-550	1,9	21277	294523981	-986138743	BasicSafetyMessage
2213	2017-09-13 20:51:21.189	32	300		98	56	736	-562	1,9	21217	294523968	-986138894	BasicSafetyMessage
2214	2017-09-13 20:51:21.290	32	300		99	56	744	-573	1,9	21050	294523948	-986139044	BasicSafetyMessage
2215	2017-09-13 20:51:21.390	32	300		100	46	751	-586	1,9	21023	294523931	-986139194	BasicSafetyMessage
2216	2017-09-13 20:51:21.490	32	371		101	64	752	-601	1,9	20897	294523907	-986139345	BasicSafetyMessage
2217	2017-09-13 20:51:21.591	32	310		102	64	755	-618	1,10	20780	294523881	-986139497	BasicSafetyMessage
2218	2017-09-13 20:51:21.691	32	310		103	56	759	-637	1,10	20709	294523853	-986139650	BasicSafetyMessage
2219	2017-09-13 20:51:21.791	32	310		104	56	766	-660	1,10	20663	294523824	-986139803	BasicSafetyMessage
2220	2017-09-13 20:51:21.892	32	310		105	56	774	-686	1,10	20614	294523793	-986139956	BasicSafetyMessage
2221	2017-09-13 20:51:21.992	32	381		106	64	778	-716	1,10	20540	294523761	-986140111	BasicSafetyMessage
2222	2017-09-13 20:51:22.092	32	310		107	77	779	-750	1,10	20506	294523727	-986140264	BasicSafetyMessage
2223	2017-09-13 20:51:22.193	32	310		108	77	786	-786	1,10	20446	294523691	-986140419	BasicSafetyMessage
2224	2017-09-13 20:51:22.294	32	310		109	77	790	-822	1,10	20445	294523656	-986140576	BasicSafetyMessage
2225	2017-09-13 20:51:22.393	32	310		110	64	798	-862	1,10	20445	294523621	-986140732	BasicSafetyMessage
2226	2017-09-13 20:51:22.494	32	381		111	64	799	-908	1,10	20365	294523578	-986140890	BasicSafetyMessage

```
⊞ Frame 2216: 371 bytes on wire (2968 bits), 371 bytes captured (2968 bits)
⊞ Radiotap Header v0, Length 42
⊞ 802.11 radio information
⊞ IEEE 802.11 QoS Data, Flags: ........C
⊞ Logical-Link Control
⊞ WSMP IEEE 1609.3r2016 PSID: (32)
⊟ Security
    protocolVersion: 3
    Choice tag: 10.. .... context-specific: choice index 1
  ⊟ content: 1
    ⊞ signedData
```

Setup OBU Verification while Vehicle Stationary

1. Three Sharkfin magnet mount dual “DSRC/GNSS” antennas with 10M cables with fakra connectors mounted on vehicle’s roof in organized alignment across vehicle directional center line. 10m cables These components are consistent with all tests and testing sessions.
2. Single IUT should use center mounted antenna.
3. Single IUT should provide their power cable if cable is not available.
4. IUT verifies its UTC Time Correlation (TP-BSM-ST-BV-20-V) with its system clock and BSM capture of the test tool.
5. IUT verifies vehicle’s length and width (TP-BSM-MV-BV-14) in BSM that matches vehicle used in the test.

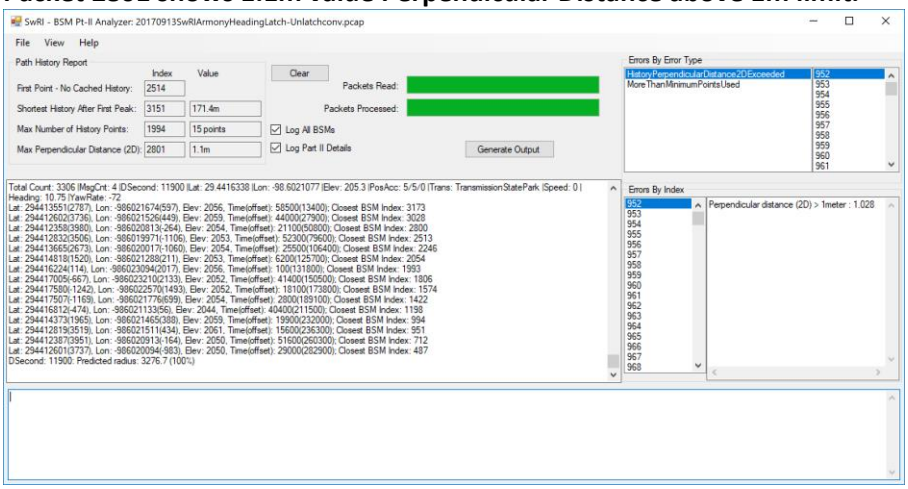
Test Procedure

1. Start packet sniffer with CH172 enabled and GPS/Time synchronized to record PCAP and WireShark in “J29451-Heading-Latch-Unlatch” configuration profile.
2. Power OBU under test with BSMs starting to transmit. Verify Capture TimeStamp and GPS coordinates being populated.
3. Drive vehicle in motion in completing figure 8 clockwise under 2.5 mph (<4 kph = 1.11 m/s). Heading and RadiusofCurve should stay constant (latched).
4. Start increasing speed very slowly in completing second figure 8 over 3.1 mph (>5 kph= 1.39 m/s) to see Heading and RadiusofCurve change (unlatch).
5. Starting third figure 8 clockwise at 10 mph and then slowing under 2 (<4 kph) mph to see “latched” occurring. Saved PCAP titled “HeadingLatching-CW-[Manufacturer’s Name].pcap or pcapng.
6. Repeat test going counter clockwise. Save PCAP titled “HeadingLatching-CCW-[Manufacturer’s Name].pcap or pcapng.

Test Analysis for PathHistory (PH).

- Bring PCAPs to Randy Roebuck for PathHistory analysis. Shown below is PathHistory results example.

Packet 2801 shows 1.1m value Perpendicular Distance above 1m limit.



Pictorial shows Figure 8 route