NEW CAR ASSESSMENT PROGRAM
FORWARD COLLISION WARNING CONFIRMATION TEST
NCAP-DRI-FCW-20-16

2020 Nissan Altima

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10 June 2020

Final Report

Prepared Under Contract No. DTNH22-14-D-00333

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
New Car Assessment Program
1200 New Jersey Avenue, SE
West Building, 4th Floor (NRM-110)
Washington, DC 20590

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16. Abstract These tests were conducted on the subject 2020 Nissan Altima in accordance with the specifications of the New Car Assessment Program's (NCAP) most current Test Procedure in docket NHTSA-2006-26555-0134 to confirm the performance of a forward collision warning system. The vehicle passed the requirements of the test for all three FCW test scenarios.			
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Section I

INTRODUCTION

This test evaluates the ability of a Forward Collision Warning (FCW) system to detect and alert drivers to potential hazards in the path of the vehicle as specified in the New Car Assessment Program's "Forward Collision Warning Confirmation" test procedure, dated February 2013. Three driving scenarios are utilized to assess this technology. In the first test, a subject vehicle (SV) approaches a stopped principle other vehicle (POV) in the same lane of travel. The second test begins with the SV initially following the POV at the same constant speed. After a short while, the POV stops suddenly. The third test consists of the SV, traveling at a constant speed, approaching a slower moving POV, which is also being driven at a constant speed.

Section II

DATA SHEETS

FORWARD COLLISION WARNING

DATA SHEET 1: TEST RESULTS SUMMARY

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2020 Nissan Altima

VIN: *1N4BL4DV2LC19xxxx*

Test Date: *2/11/2020*

Forward Collision Warning setting: *On (only On and Off are available)*

Test 1 -	Subject Vehicle Encounters Stopped Principal Other Vehicle:	***Pass***
Test 2 -	Subject Vehicle Encounters Decelerating Principal Other Vehicle:	***Pass***
Test 3 -	Subject Vehicle Encounters Slower Principal Other Vehicle:	***Pass***

Overall: ***Pass***

Notes:

FORWARD COLLISION WARNING

DATA SHEET 2: VEHICLE DATA

(Page 1 of 1)

2020 Nissan Altima

TEST VEHICLE INFORMATION

VIN: *1N4BL4DV2LC19xxxx*

Body Style: *Sedan* Color: *Gun Metallic*

Date Received: *2/3/2020* Odometer Reading: *22 mi*

DATA FROM VEHICLE'S CERTIFICATON LABEL

Vehicle manufactured by: *Nissan Motor Co., LTD*

Date of manufacture: *10/19*

Vehicle Type: *Passenger Car*

DATA FROM TIRE PLACARD

Tires size as stated on Tire Placard: Front: *215/55R17 94V*

Rear: *215/55R17 94V*

Recommended cold tire pressure: Front: *230 kPa (33 psi)*

Rear: *230 kPa (33 psi)*

TIRES

Tire manufacturer and model: *Continental Procontact TX*

Front tire specification: *215/55R17 V94*

Rear tire specification: *215/55R17 V94*

Front tire DOT prefix: *VY3R WCN5*

Rear tire DOT prefix: *VY3R WCN5*

FORWARD COLLISION WARNING

DATA SHEET 3: TEST CONDITIONS

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2020 Nissan Altima

GENERAL INFORMATION

Test date: *2/11/2020*

AMBIENT CONDITIONS

Air temperature: *16.1 C (61 F)*

Wind speed: *1.5 m/s (3.5 mph)*

X Wind speed ≤ 10 m/s (22 mph).

X Tests were not performed during periods of inclement weather. This includes, but is not limited to, rain, snow, hail, fog, smoke, or ash.

X Tests were conducted during daylight hours with good atmospheric visibility (defined as an absence of fog and the ability to see clearly for more than 5000 meters). The tests were not conducted with the vehicle oriented into the sun during very low sun angle conditions, where the sun is oriented 15 degrees or less from horizontal, and camera “washout” or system inoperability results.

VEHICLE PREPARATION

Verify the following:

All non-consumable fluids at 100% capacity: **X**

Fuel tank is full: **X**

Tire pressures are set to manufacturer's recommended cold tire pressure: **X**

Front: *230 kPa (33 psi)*

Rear: *230 kPa (33 psi)*

FORWARD COLLISION WARNING

DATA SHEET 3: TEST CONDITIONS

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2020 Nissan Altima

WEIGHT

Weight of vehicle as tested including driver and instrumentation:

Left Front:	*490.3 kg (1081 lb)*	Right Front:	*469.5 kg (1035 lb)*
Left Rear:	*344.7 kg (760 lb)*	Right Rear:	*316.2 kg (697 lb)*
		Total:	*1620.7 kg (3573 lb)*

FORWARD COLLISION WARNING

DATA SHEET 4: FORWARD COLLISION WARNING SYSTEM OPERATION

(Page 1 of 2)

2020 Nissan Altima

Name of the FCW option, option package, etc.:

Intelligent Forward Collision Warning (i-FCW), which is integrated into Automatic Emergency Braking

Forward Collision Warning Setting used in test: *On (only On and Off are available)*

Type and location of sensor(s) the system uses:

The system uses a mono front camera installed behind the windscreen near the rearview mirror and a radar sensor located behind the front grille.

How is the Forward Collision Warning presented to the driver? (Check all that apply)

- **X** Warning light
- **X** Buzzer or audible alarm
- ____ Vibration
- ____ Other ____

Describe the method by which the driver is alerted. For example, if the warning is a light, where is it located, its color, size, words or symbol, does it flash on and off, etc. If it is a sound, describe if it is a constant beep or a repeated beep. If it is a vibration, describe where it is felt (e.g., pedals, steering wheel), the dominant frequency (and possibly magnitude), the type of warning (light, audible, vibration, or combination), etc.

The visual alert is presented in the space between the speedometer and tachometer. As shown in Appendix A Figure A17, the visual alert is presented as a staged series of images as the vehicle gets closer to the vehicle ahead.

The auditory warning is presented as pulsed beeps at a rate of approximately 4 beeps/second. There are two types of auditory warning; the FCW warning is centered at 1828 Hz and the AEB warning is centered at 2445 Hz.

See Figure A15 in Appendix A

FORWARD COLLISION WARNING

DATA SHEET 4: FORWARD COLLISION WARNING SYSTEM OPERATION

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Is the vehicle equipped with a switch whose purpose is to render FCW inoperable?

X Yes

____ No

If yes, please provide a full description including the switch location and method of operation, any associated instrument panel indicator, etc.

Controls on the left side of the steering wheel are used to access the system menus. The hierarchy is:

Settings

Driver Assistance

Emergency Brake

Front - select On or Off

See Figure A13 in Appendix A

Is the vehicle equipped with a control whose purpose is to adjust the range setting or otherwise influence the operation of FCW?

____ Yes

X No

If yes, please provide a full description.

Are there other driving modes or conditions that render FCW inoperable or reduce its effectiveness?

X Yes

____ No

If yes, please provide a full description.

System limitations are described on pages 5-134 through 5-136 of the Owner's Manual. These pages are reproduced on pages B-19 through B-21 of Appendix B.

Notes:

Section III

TEST PROCEDURES

A. Test Procedure Overview

Three test procedures were used, as follows:

Test 1. Subject Vehicle (SV) Encounters Stopped Principal Other Vehicle (POV)

Test 2. Subject Vehicle Encounters Decelerating Principal Other Vehicle

Test 3. Subject Vehicle Encounters Slower Principal Other Vehicle

With the exception of trials associated with Test 1, all trials were performed with SV and POV automatic transmissions in ‘‘Drive’’ or with manual transmissions in the highest gear capable of sustaining the desired test speed. Manual transmission clutches remained engaged during all maneuvers. Except for Test 2, the brake lights of the POV were not illuminated.

In order to pass the test, if the FCW system provides a warning timing adjustment for the driver, at least one setting must meet the criterion of the test procedure. Therefore, if the vehicle was equipped with a warning timing adjustment, only the most “conservative” (earliest warning) setting was tested.

An overview of each of the test procedures follows.

1. TEST 1 – SUBJECT VEHICLE ENCOUNTERS STOPPED PRINCIPAL OTHER VEHICLE ON A STRAIGHT ROAD

This test evaluates the ability of the FCW function to detect a stopped lead vehicle, as depicted in Figure 1.

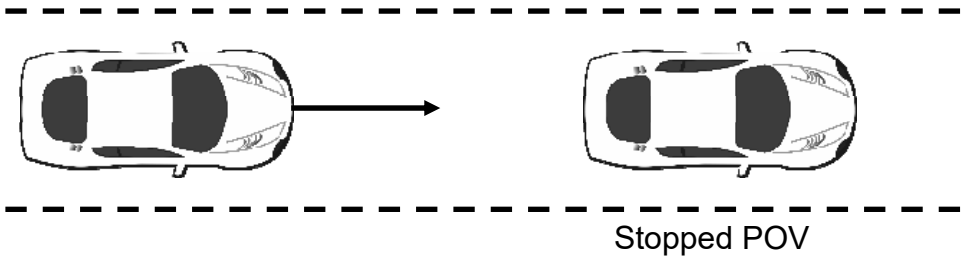


Figure 1. Depiction of Test 1

a. Alert Criteria

In order to pass the test, the FCW alert must be issued when the time-to-collision (TTC) is at least 2.1 seconds. The TTC for this test was calculated by considering the speeds of the SV and the POV at the time of the FCW alert (i.e., when the SV and POV speeds are nominally equal to 45 and 0 mph (72.4 and 0 km/h), respectively).

b. Procedure

The POV was parked in the center of a travel lane, with its longitudinal axis oriented parallel to the roadway edge and facing the same direction as the SV so that the SV approaches the rear of the POV.

The SV was driven at a nominal speed of 45 mph (72.4 km/h) in the center of the lane of travel, toward the parked POV. The test began when the SV was 492 ft (150 m) from the POV and ended when either of the following occurred:

- The required FCW alert occurred.
- The TTC to the POV fell to less than 90% of the minimum allowable range (i.e., TTC = 1.9 sec) for the onset of the required FCW alert.

The SV driver then steered and/or braked to keep the SV from striking the POV.

For an individual test trial to be valid, the following was required throughout the test:

- The SV vehicle speed could not deviate from the nominal speed by more than 1.0 mph (1.6 km/h) for a period of three seconds prior to (1) the required FCW alert or (2) before the range fell to less than 90% of the minimum allowable range for onset of the required FCW alert.
- The SV driver could not apply any force to the brake pedal before (1) the required FCW alert occurred or (2) the range fell to less than 90% of the minimum allowable range for onset of the required FCW alert.
- The lateral distance between the centerline of the SV, relative to the centerline of the POV, in road coordinates, could not exceed 2.0 ft (0.6 m).
- The yaw rate of the SV could not exceed ±1 deg/sec during the test.

Nominally, the Test 1 series was comprised of seven individual trials. The FCW system must satisfy the TTC alert criteria for at least five of the seven test trials.

2. TEST 2 – SUBJECT VEHICLE ENCOUNTERS DECELERATING PRINCIPAL OTHER VEHICLE

The SV in this test initially followed the POV at a constant time gap and then the POV suddenly decelerated, as depicted in Figure 2. The test evaluates the ability of the FCW to recognize a decelerating lead vehicle and to issue an alert to SV driver in a timely manner.

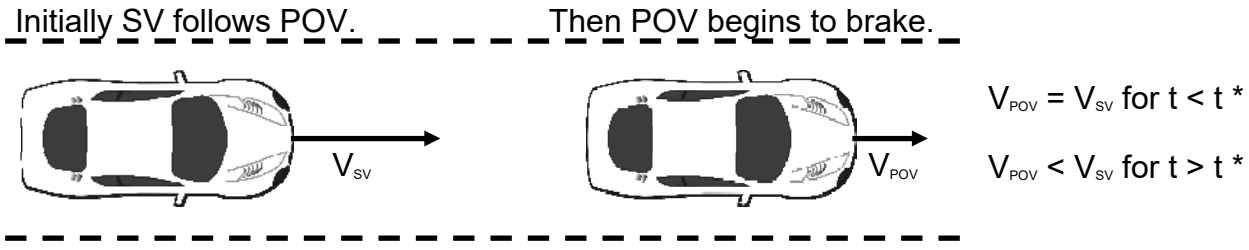


Figure 2. Depiction of Test 2

a. Alert Criteria

In order to pass the test, the FCW alert must be issued when TTC is at least 2.4 seconds. The TTC for this test, a prediction of the time it would take for the SV to collide with the POV, was calculated by considering three factors at the time of the FCW alert: (1) the speed of the SV, (2) the speed of the POV, and (3) the deceleration of the POV[1].

b. Procedure

Test 2 began with the SV and the POV traveling on a straight, flat road at a constant speed of 45.0 mph (72.4 km/h), in the center of the lane of travel. The headway from the SV to the POV was nominally maintained at 98.4 ft (30 m) until the POV braking was initiated.

The test began approximately 7 seconds before the driver of the POV started a braking maneuver in which the POV brakes were rapidly applied and modulated such that a constant deceleration of 0.3 g was achieved within 1.5 seconds after braking is initiated. The test ended when either of the following conditions was satisfied:

- The required FCW alert occurred.
- The TTC to the POV fell to less than 90% of the minimum allowable range (i.e., TTC = 2.2 sec) for the onset of the required FCW alert.

The SV driver then steered and/or braked to keep the SV from striking the POV.

[1]To simplify calculation of the TTC for Test 2, the deceleration of the POV is assumed to remain constant from the time of the FCW alert until the POV comes to a stop (i.e., a “constant” rate of slowing is assumed).

For an individual test trial to be valid, the following was required throughout the test:

- The initial POV vehicle speed could not deviate from the nominal speed by more than 1.0 mph (1.6 km/h) for a period of 3 seconds prior to the initiation of POV braking.
- The speed of the SV could not deviate from the nominal speed by more than 1.0 mph (1.6 km/h) for a period of 3 seconds prior to (1) the required FCW alert or (2) before the range fell to less than 90% of the minimum allowable range for onset of the required FCW alert.
- The lateral distance between the centerline of the SV, relative to the centerline of the POV, in road coordinates, could not exceed 2.0 ft (0.6 m).
- The yaw rates of the SV and POV could not exceed ±1 deg/sec during the test.
- The POV deceleration level was nominally required to be 0.3 g within 1.5 seconds after initiation of POV braking. The acceptable error magnitude of the POV deceleration was ±0.03g, measured at the time the FCW alert first occurred. An initial overshoot beyond the deceleration target was acceptable, however the first local deceleration peak observed during an individual trial could not exceed 0.375 g for more than 50 ms. Additionally, the deceleration could not exceed 0.33 g over a period defined from 500 ms after the first local deceleration peak occurs, to the time when the FCW alert first occurred.
- The tolerance for the headway from the SV to the POV was ±8.2 ft (±2.5 m), measured at two instants in time: (1) three seconds prior to the time the POV brake application was initiated and (2) at the time the POV brake application was initiated.
- SV driver could not apply any force to the brake pedal before (1) the required FCW alert occurred or (2) the range fell to less than 90% of the minimum allowable range for onset of the required FCW alert.

Nominally, the Test 2 series was comprised of seven individual trials. The FCW system must satisfy the TTC alert criteria for at least five of the seven test trials.

3. TEST 3 – SUBJECT VEHICLE ENCOUNTERS SLOWER PRINCIPAL OTHER VEHICLE

This test examines the ability of the FCW system to recognize a slower lead vehicle being driven with a constant speed and to issue a timely alert. As depicted in Figure 3, the scenario was conducted with a closing speed equal to 25.0 mph (40.2 km/h).

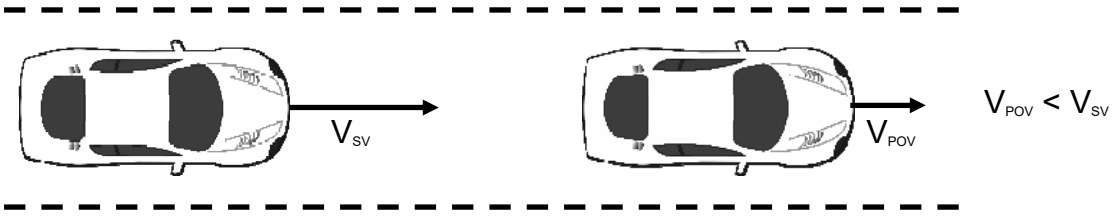


Figure 3. Depiction of Test 3

a. Alert Criteria

In order to pass the test, the FCW alert must be issued when TTC is at least 2.0 seconds. The TTC for this test, a prediction of the time it would take for the SV to collide with the POV, was calculated by considering the speeds of the SV and POV at the time of the FCW alert.

b. Procedure

Throughout the test, the POV was driven at a constant 20.0 mph (32.2 km/h) in the center of the lane of travel.

The SV was driven at 45.0 mph (72.4 km/h), in the center lane of travel, toward the slow-moving POV.

The test began when the headway from the SV to the POV was 329 ft (100 m) and ended when either of the following occurred:

- The required FCW alert occurred.
- The TTC to the POV fell to less than 90% of the minimum allowable range (i.e., TT = 1.8 sec) for the onset of the required FCW alert.

The SV driver then steered and/or braked to keep the SV from striking the POV.

For an individual test trial to be valid, the following was required throughout the test:

- The SV vehicle speed could not deviate from the nominal speed by more than 1.0 mph (1.6 km/h) for a period of 3 seconds prior to (1) the required FCW alert or (2) before the range fell to less than 90% of the minimum allowable range for onset of the required FCW alert.
- Speed of the POV could not deviate from the nominal speed by more than 1.0 mph (1.6 km/h) during the test.
- The lateral distance between the centerline of the SV, relative to the centerline of the POV, in road coordinates, could not exceed 2.0 ft (0.6 m).
- The yaw rates of the SV and POV could not exceed ±1 deg/sec during the test.
- SV driver could not apply any force to the brake pedal before (1) the required

FCW alert occurred or (2) before the range fell to less than 90% of the minimum allowable range for onset of the required FCW alert.

Nominally, the Test 3 series was comprised of seven individual trials. The FCW system must satisfy the TTC alert criteria for at least five of the seven test trials.

B. Principal Other Vehicle

The vehicle used as the Principal Other Vehicle (POV) was a 2006 Acura RL. This satisfied the test requirement that the POV be a mid-size sedan. The vehicle had a rear license plate in order to provide a suitable representative radar profile. Vehicle loading consisted of the driver plus equipment and instrumentation.

C. Automatic Braking System

The POV was equipped with an automatic braking system, which was used in Test 2. The braking system consisted of the following components:

- High pressure nitrogen bottle, strapped to the front passenger seat, with regulator and pressure gauges
- Pneumatic piston-type actuator, with solenoid valve
- “Pickle” switch to activate brakes

D. Instrumentation

Table 1 lists the sensors, signal conditioning, and data acquisition equipment used for these tests.

Table 1. Test Instrumentation and Equipment

Type	Output	Range	Accuracy, Other Primary Specs	Mfr, Model	Serial Number	Calibration Dates Last Due
Tire Pressure Gauge	Vehicle Tire Pressure	0-100 psi 0-690 kPa	< 1% error between 20 and	Omega DPG8001	17042707002	By: DRI Date: 7/3/2019 Due: 7/3/2020
Platform Scales	Vehicle Total, Wheel, and Axle Load	2200 lb/platform 5338 N/	0.5% of applied load	Intercomp SWI	1110M206352	By: DRI Date: 1/6/2020 Due: 1/6/2021
Differential Global Positioning System	Position, Velocity	Latitude: ±90 deg Longitude: ±180 deg Altitude: 0-18 km Velocity: 0-1000 knots	Horizontal Position: ±1 cm Vertical Position: ±2 cm Velocity: 0.05 km/h	Trimble GPS Receiver, 5700 (base station and in-vehicle)	00440100989	NA
Multi-Axis Inertial Sensing System	Position; Longitudinal, Lateral, and Vertical Accels; Lateral, Longitudinal and Vertical Velocities; Roll, Pitch, Yaw Rates; Roll, Pitch, Yaw Angles	Accels ± 10g, Angular Rat	Accels .01g, Angular Rate	Oxford Inertial +		By: Oxford Technical Solutions
					2258	Date: 5/3/2019 Due: 5/3/2021
					2176	Date: 4/11/2018 Due: 4/11/2020
Real-Time Calculation of Position and Velocity Relative to Lane Markings (LDW) and POV (FCW)	Distance and Velocity to lane markings (LDW) and POV (FCW)	Lateral Lane Dist: ±30 m Lateral Lane Velocity: ±20 m/sec Longitudinal Range to POV: ±200 m Longitudinal Range Rate: ±50 m/sec	Lateral Distance to Lane Marking: ±2 cm Lateral Velocity to Lane Marking: ±0.02m/sec Longitudinal Range: ±3 cm Longitudinal Range Rate: ±0.02 m/sec	Oxford Technical Solutions (OXTS), RT-Range	97	NA

Table 1. Test Instrumentation and Equipment (continued)

Type	Output	Range	Accuracy, Other Primary Specs	Mfr, Model	Serial Number	Calibration Dates Last Due
Microphone	Sound (to measure time at auditory alert)	Frequency Response: 80 Hz – 20 kHz	Signal-to-noise: 64 dB, 1 kHz at 1 Pa	Audio-Technica AT899	NA	NA
Light Sensor	Light intensity (to measure time at visual alert)	Spectral Bandwidth: 440-800 nm	Rise time < 10 msec	DRI designed and developed Light Sensor	NA	NA
Accelerometer	Acceleration (to measure time at haptic alert)	±5g	≤ 3% of full range	Silicon Designs, 2210-005	NA	NA
Coordinate Measurement Machine	Inertial Sensing System Coordinates	0-8 ft 0-2.4 m	±.0020 in. ±.051 mm (Single point articulation accuracy)	Faro Arm, Fusion	UO8-05-08-06636	By: DRI Date: 1/6/2020 Due: 1/6/2021

Type	Description	Mfr, Model	Serial Number
Data Acquisition System	Data acquisition is achieved using a dSPACE MicroAutoBox II. Data from the Oxford IMU, including Longitudinal, Lateral, and Vertical Acceleration, Roll, Yaw, and Pitch Rate, Forward and Lateral Velocity, Roll and Pitch Angle are sent over Ethernet to the MicroAutoBox. The Oxford IMUs are calibrated per the manufacturer's recommended schedule (listed above).	dSPACE Micro-Autobox II 1401/1513	
		Base Board	549068
		I/O Board	588523

For systems that implement audible or haptic alerts, part of the pre-test instrumentation verification process is to determine the tonal frequency of the audible warning or the vibration frequency of the tactile warning through use of the PSD (Power Spectral Density) function in Matlab. This is accomplished in order to identify the center frequency around which a band-pass filter is applied to subsequent audible or tactile warning data so that the beginning of such warnings can be programmatically determined. The band-pass filter used for these warning signal types is a phaseless, forward-reverse pass, elliptical (Cauer) digital filter, with filter parameters as listed in Table 2.

Table 2. Audible and Tactile Warning Filter Parameters

Warning Type	Filter Order	Peak-to-Peak Ripple	Minimum Stop Band Attenuation	Passband Frequency Range
Audible	5^{th}	3 dB	60 dB	Identified Center Frequency ± 5%
Tactile	5^{th}	3 dB	60 dB	Identified Center Frequency ± 20%

APPENDIX A

Photographs

LIST OF FIGURES

Figure A1. Front View of Subject Vehicle

Figure A2. Rear View of Subject Vehicle

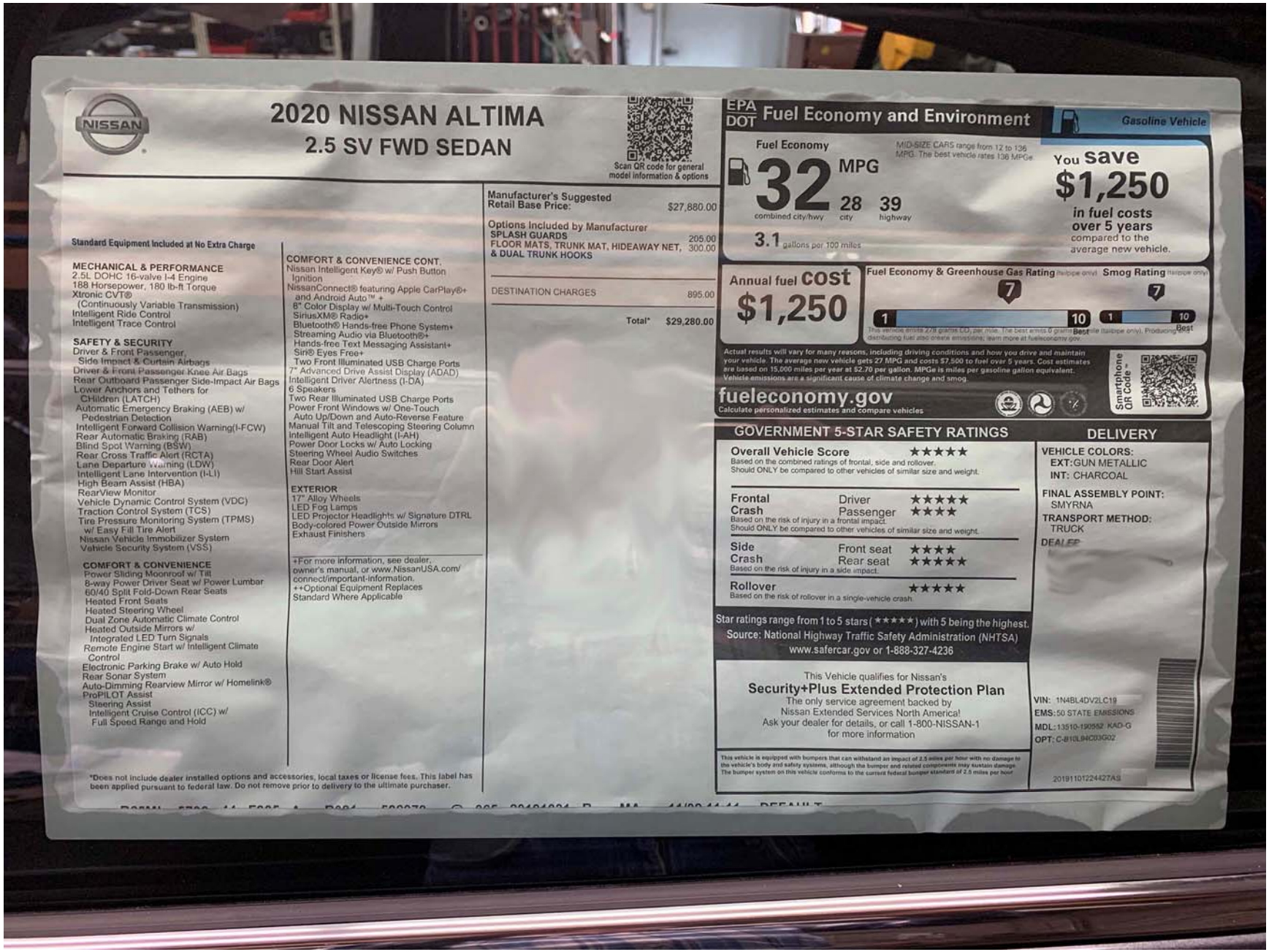


Figure A3. Window Sticker (Monroney Label)

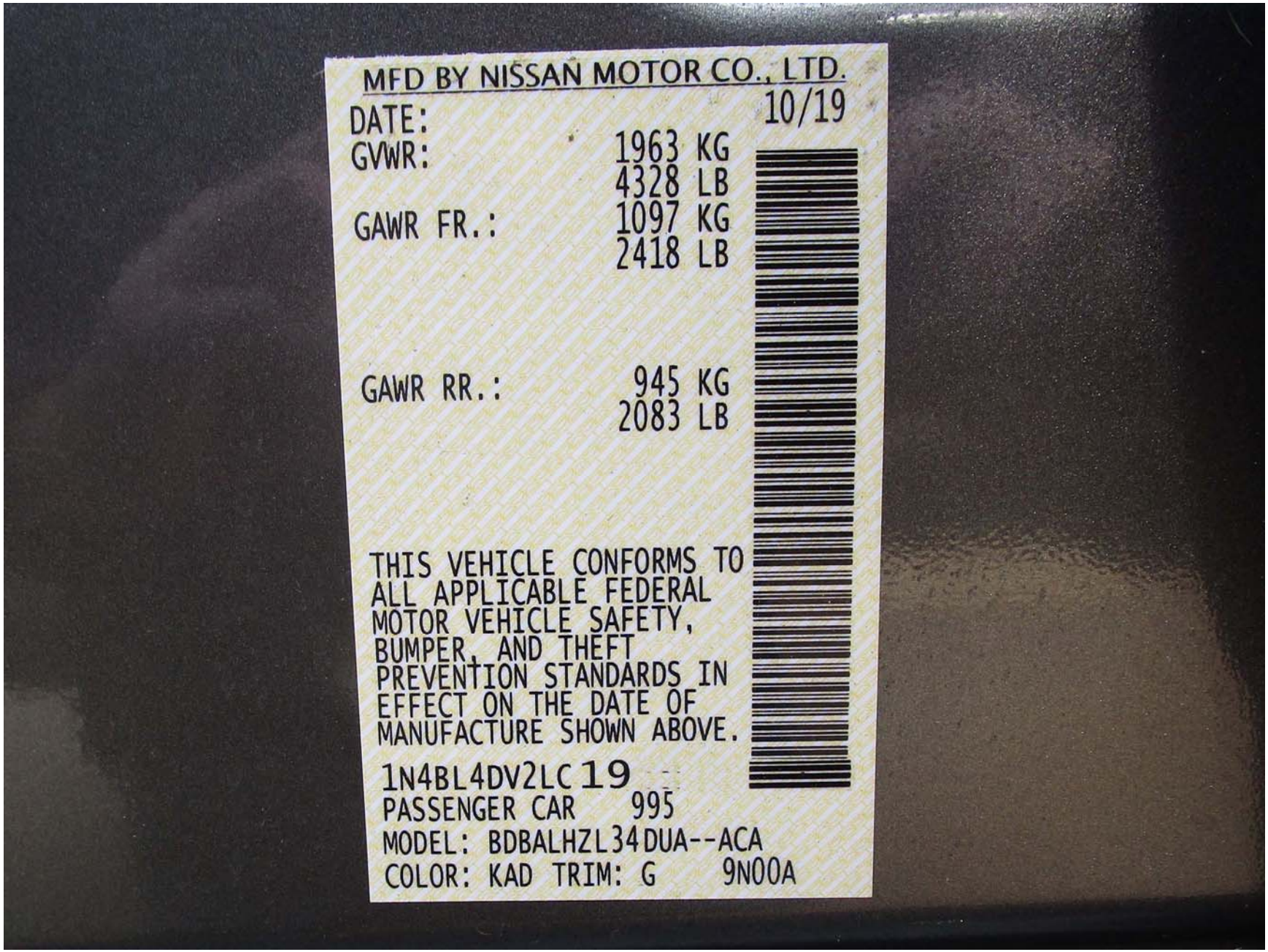


Figure A4. Vehicle Certification Label

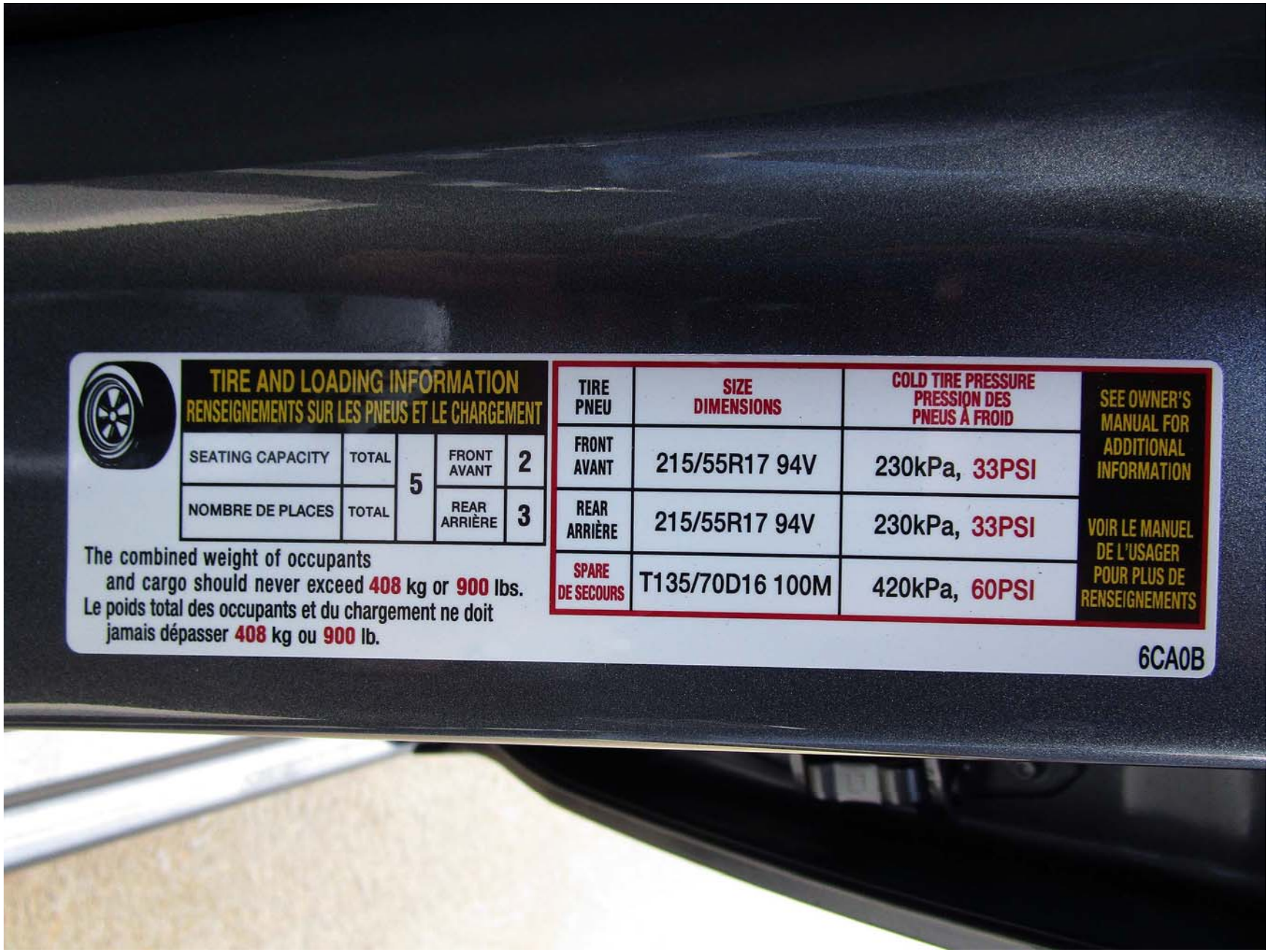


Figure A5. Tire Placard

Figure A6. Front View of Principal Other Vehicle

Figure A7. Rear View of Principal Other Vehicle

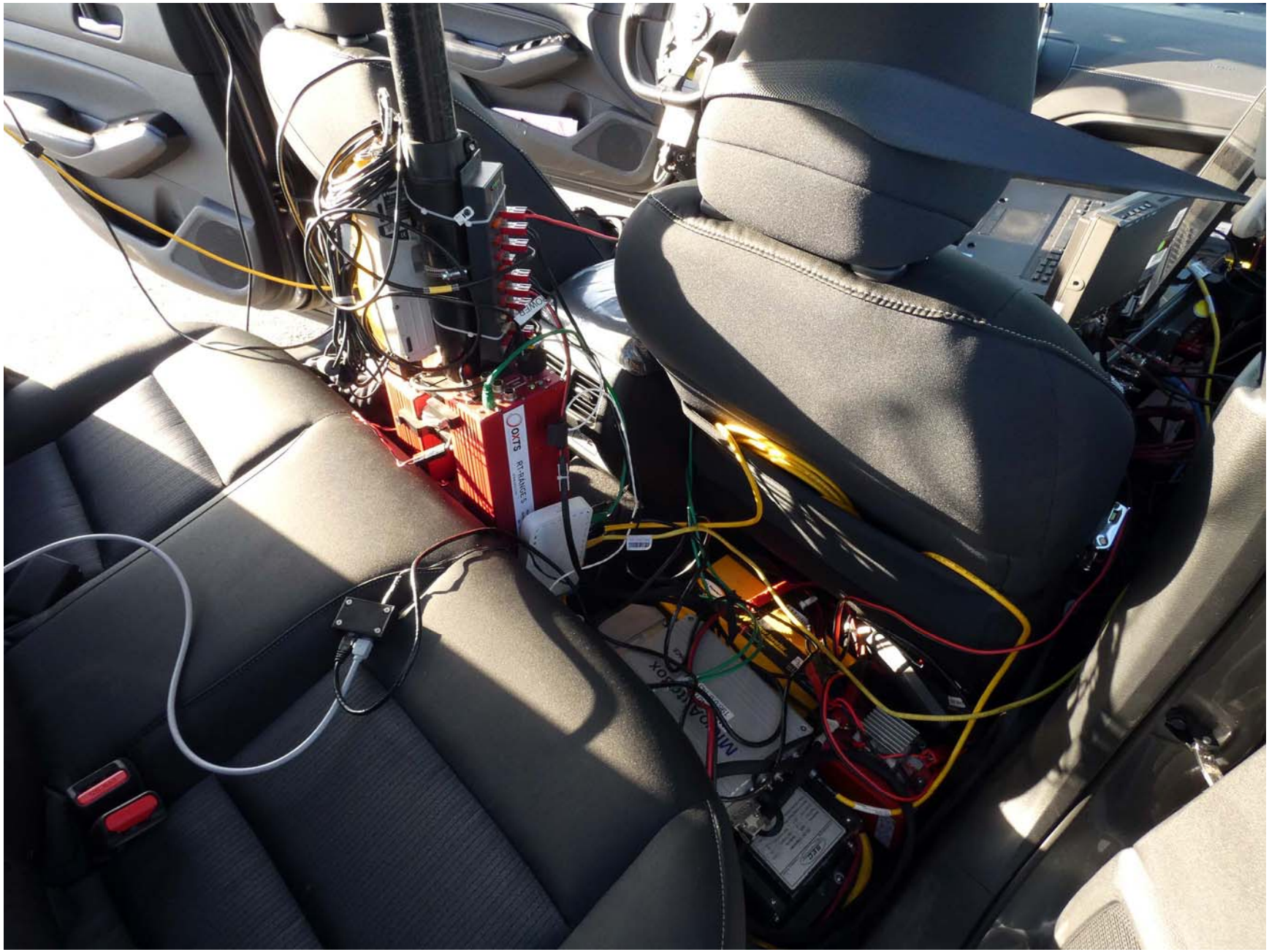


Figure A8. DGPS, Inertial Measurement Unit, and MicroAutoBox Installed in Subject Vehicle

Figure A9. Sensor for Detecting Visual Alerts

Figure A10. Sensor for Detecting Auditory Alerts

Figure A11. Computer Installed in Subject Vehicle

Figure A12. Brake Actuation System Installed in Principal Other Vehicle

Figure A13. FCW System Setting Menus

Figure A14. Control for Adjusting Settings

Figure A15. Staged Visual Alert

APPENDIX B

Excerpts from Owner’s Manual

WARNING AND INDICATOR LIGHTS

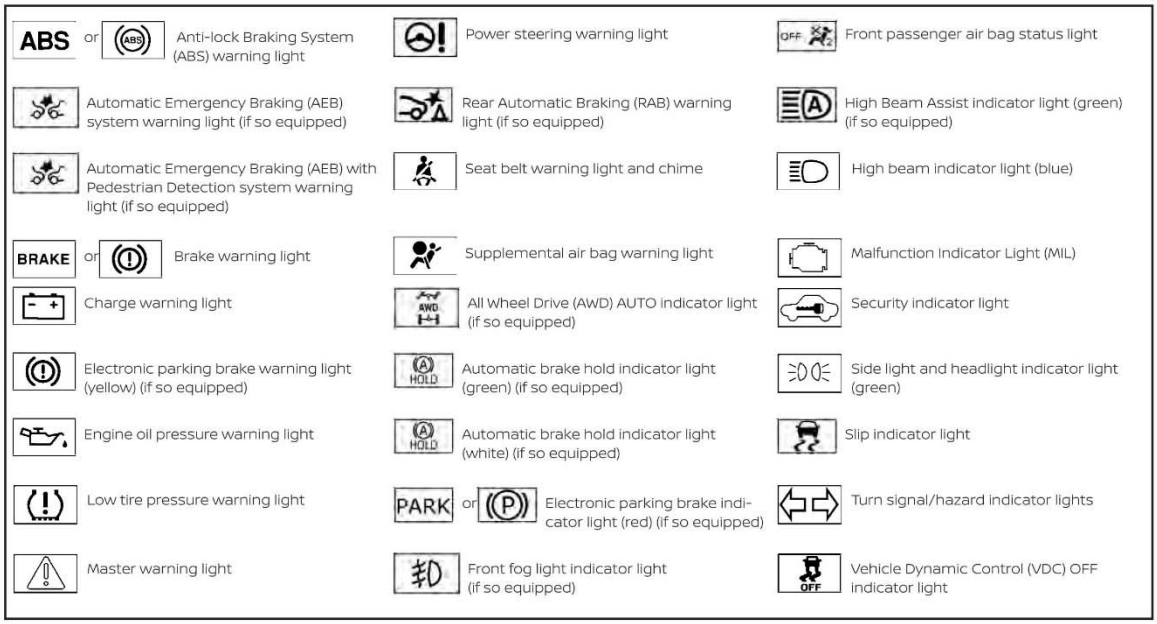
Warning light	Name	Page
	Anti-lock Braking System (ABS) warning light	2-10
	Automatic Emergency Braking (AEB) system warning light (if so equipped)	2-10
	Automatic Emergency Braking (AEB) with Pedestrian Detection system warning light (if so equipped)	2-11
	Brake warning light	2-11

Warning light	Name	Page
	Charge warning light	2-11
	Electronic parking brake warning light (yellow) (if so equipped)	2-12
	Engine oil pressure warning light	2-12
	Low tire pressure warning light	2-12
	Master warning light	2-14
	Power steering warning light	2-14
	Rear Automatic Braking (RAB) warning light (if so equipped)	2-15

Warning light	Name	Page
	Seat belt warning light and chime	2-15
	Supplemental air bag warning light	2-15

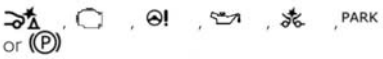
Indicator light	Name	Page
	All Wheel Drive (AWD) AUTO indicator light (if so equipped)	2-15
	Automatic brake hold indicator light (green) (if so equipped)	2-16
	Automatic brake hold indicator light (white) (if so equipped)	2-16

WARNING LIGHTS, INDICATOR LIGHTS AND AUDIBLE REMINDERS



CHECKING LIGHTS

With all doors closed, apply the parking brake, fasten the seat belts and place the ignition switch in the ON position without starting the engine. The following lights (if so equipped) will come on:



The following lights (if so equipped) come on briefly and then go off:

If any light fails to come on or operate in a way other than described, it may indicate a burned-out bulb and/or a system malfunction. Have the system checked. It is recommended that you visit a NISSAN dealer for this service.

Some indicators and warnings are also displayed in the vehicle information display between the speedometer and tachometer. For additional information, refer to "Vehicle information display" in this section.

WARNING LIGHTS

For additional information on warnings and indicators, refer to "Vehicle information display" in this section.

Anti-lock Braking System (ABS) warning light

When the ignition switch is placed in the ON position, the ABS warning light illuminates and then turns off. This indicates the ABS is operational.

If the ABS warning light illuminates while the engine is running or while driving, it may indicate the ABS is not functioning properly. Have the system checked. It is recommended that you visit a NISSAN dealer for this service.

If an ABS malfunction occurs, the anti-lock function is turned off. The brake system then operates normally but without anti-lock assistance. For additional information, refer to "Brake system" in the "Starting and driving" section of this manual.

Automatic Emergency Braking (AEB) system warning light (if so equipped)

This light comes on when the ignition switch is placed in the ON position. It turns off after the vehicle is started.

This light illuminates when the AEB system is set to OFF on the meter display.

If the light illuminates when the AEB system is on, it may indicate that the system is unavailable. For additional information, refer to "Automatic Emergency Braking (AEB)" and "Intelligent Forward Collision Warning (I-FCW)" in the "Starting and driving" section of this manual.

Automatic Emergency Braking (AEB) with Pedestrian Detection system warning light (if so equipped)

This light comes on when the ignition switch is placed in the ON position. It turns off after the engine is started.

This light illuminates when the AEB with Pedestrian Detection system is set to OFF in the vehicle information display.

If the light illuminates when the AEB with Pedestrian Detection system is on, it may indicate that the system is unavailable. For additional information, refer to "Automatic Emergency Braking (AEB) with Pedestrian Detection" and "Intelligent Forward Collision Warning (I-FCW)" in the "Starting and driving" section of this manual.

BRAKE or Brake warning light

This light functions for both the parking brake and the foot brake systems.

Parking brake indicator (if so equipped)

When the ignition switch is placed in the ON position, the light comes on when the parking brake is applied.

Low brake fluid warning light

When the ignition switch is placed in the ON position, the light warns of a low brake fluid level. If the light comes on while the engine is running with the parking brake not applied, stop the vehicle and perform the following:

1. Check the brake fluid level. Add brake fluid as necessary. For additional information, refer to "Brake fluid" in the "Do-it-yourself" section of this manual.
2. If the brake fluid level is correct, have the warning system checked. It is recommended that you visit a NISSAN dealer for this service.

⚠ WARNING

- **Your brake system may not be working properly if the warning light is on. Driving could be dangerous. If you judge it to be safe, drive carefully to the nearest service station for repairs. Otherwise, have your vehicle towed because driving it could be dangerous.**
- **Pressing the brake pedal with the engine stopped and/or a low brake fluid level may increase your stopping distance and braking will require greater pedal effort as well as pedal travel.**
- **If the brake fluid level is below the MINIMUM or MIN mark on the brake fluid reservoir, do not drive until the brake system has been checked. It is recommended that you visit a NISSAN dealer for this service.**

Charge warning light

If this light comes on while the engine is running, it may indicate the charging system is not functioning properly. Turn the engine off and check the generator belt. If the belt is loose, broken, or missing, or if the light remains on, have the system checked.

Driver Assistance

The driver assistance menu allows the user to change the settings for driving, parking, and braking aids.

Menu item		Result
Steering Assist (if so equipped)		Allows user to turn the Steering Assist of the ProPILOT Assist system on or off. For additional information, please refer to "ProPILOT Assist" in the "Starting and driving" section of this manual.
Emergency Brake		Displays available emergency braking options.
	Front	Allows user to turn the front emergency braking system on or off. For additional information, refer to "Automatic Emergency Braking (AEB)" , "Automatic Emergency Braking (AEB) with Pedestrian Detection" and "Intelligent Forward Collision Warning (I-FCW)" in the "Starting and driving" section of this manual.
	Rear (if so equipped)	Allows user to turn the rear emergency braking system on or off. For additional information, refer to "Rear Automatic Braking (RAB)" in the "Starting and driving" section of this manual.
Lane (if so equipped)		Displays available lane options.
	Lane Departure Warning	Allows user to turn the Lane Departure Warning (LDW) system on or off. For additional information, refer to "Lane Departure Warning (LDW)" in the "Starting and driving" section of this manual.
	Lane Departure Prevention (if so equipped)	Allows user to turn Intelligent Lane Intervention (I-LI) system on or off. For additional information, refer to "Intelligent Lane Intervention (I-LI)" in the "Starting and driving" section of this manual.
Blind Spot (if so equipped)		Displays available blind spot options.
	Blind Spot Warning	Allows user to turn the Blind Spot Warning (BSW) system on or off. For additional information, refer to "Blind Spot Warning (BSW)" in the "Starting and driving" section of this manual.
	Side Indicator Brightness	Allows user to change the brightness of the side indicator.
Speed Limit Sign (if so equipped)		Allows user to turn the Speed Limit Sign recognition on or off. For additional information, refer to "Traffic Sign Recognition" in the "Starting and driving" section of this manual.
Parking Aids (if so equipped)		Displays available parking aids.
	Auto Show Sonar	Allows user to auto display the sonar. For additional information, refer to "Rear Sonar System (RSS)" in the "Starting and driving" section of this manual.
	Rear	Allows user to turn the rear sonar on or off.
	Distance	Allows user to set the distance sensor range to Long/Medium/Short.

VEHICLE INFORMATION DISPLAY INDICATORS

Indicator	Name
	Automatic Emergency Braking (AEB) emergency warning indicator
	Blind Spot Warning (BSW) indicator (if so equipped)
	Cruise control indicator (if so equipped)
	Drive sport mode indicator (if so equipped)
	Intelligent Lane Intervention (I-LI) indicator (if so equipped)
	Lane Departure Warning indicator (if so equipped)

Indicator	Name
	Rear Automatic Braking (RAB) indicator (if so equipped)
	Steering Assist Alert (if so equipped)
	Steering Assist indicator (if so equipped)
	Transmission Shift position indicator
	Vehicle ahead detection indicator

Automatic Emergency Braking (AEB) emergency warning indicator

This indicator illuminates along, with an audible warning, when the system detects the possibility of a forward collision.

For additional information, refer to "Automatic Emergency Braking (AEB)" and "Automatic Emergency Braking (AEB) with Pedestrian Detection" in the "Starting and driving" section of this manual.

Blind Spot Warning (BSW) indicator (if so equipped)

This indicator shows when the BSW system is engaged.

For additional information, refer to "Blind Spot Warning (BSW)" in the "Starting and driving" section of this manual.

Cruise control indicator (if so equipped)

This indicator shows the cruise control system status.

When cruise control is activated, a green circle will illuminate to indicate it is set. The vehicle information display will also display the speed the cruise control was set at. If you accelerate past the set speed, the speed will blink until you either cancel cruise control or go back to the set speed. If cruise control is on and canceled, the speed will be displayed to show the speed the vehicle will return to if the resume button is activated.

Drive sport mode indicator (if so equipped)

A small "S" appears to the right of the Transmission Shift Position indicator in the vehicle information display when the drive sport mode is engaged.

Activate the drive sport mode by pushing the switch on the shift lever while the shift lever is in the D (Drive) position.

For additional information, refer to "Driving the vehicle" in the "Starting and driving" section of this manual.

Intelligent Lane Intervention (I-LI) indicator (if so equipped)

This indicator shows when the I-LI system is engaged.

For additional information, refer to "Intelligent Lane Intervention (I-LI)" in the "Starting and driving" section of this manual.

Lane Departure Warning (LDW) indicator (if so equipped)

This indicator shows when the LDW system is engaged.

For additional information, refer to "Lane Departure Warning (LDW)" and "Intelligent Lane Intervention (I-LI)" in the "Starting and driving" section of this manual.

Rear Automatic Braking (RAB) indicator (if so equipped)

This indicator illuminates to indicate the status of the Rear Automatic Braking (RAB) system. For additional information, refer to "Rear Automatic Braking (RAB)" in the "Starting and driving" section of this manual.

Steering Assist Alert (if so equipped)

This message may appear when the Steering Assist system is engaged.

It will be displayed under the following condition:

- When not holding the steering wheel or when there is no steering wheel operation

Please hold on the steering wheel immediately. When the steering operation is detected, the warning turns off and the steering assist function is automatically restored.

Steering Assist indicator (if so equipped)

This indicator appears when the Steering Assist system is engaged.

For additional information, refer to "ProPILOT Assist" in the "Starting and driving" section of this manual.

Transmission Shift Position indicator

This indicator shows the transmission shift position.

Vehicle ahead detection indicator

This indicator shows when the Automatic Emergency Braking (AEB) system is engaged and has detected a vehicle.

For additional information, refer to "Automatic Emergency Braking (AEB)" or "Automatic Emergency Braking (AEB) with Pedestrian Detection" in the "Starting and driving" section of this manual.

Malfunction (if so equipped)

This warning appears when one or more of the following systems (if so equipped) is not functioning properly:

- Automatic Emergency Braking (AEB)
- Automatic Emergency Braking (AEB) with Pedestrian Detection
- Intelligent Forward Collision Warning (I-FCW)

If one or more of these warning appears, have the system checked. It is recommended that you visit a NISSAN dealer for this service.

For additional information, refer to "Automatic Emergency Braking (AEB)", "Automatic Emergency Braking (AEB) with Pedestrian Detection" or "Intelligent Forward Collision Warning (I-FCW) in the "Starting and driving" section of this manual.

Shipping Mode On Push Storage Fuse

This warning may appear if the extended storage switch is not pushed in. When this warning appears, push in the extended storage switch to turn off the warning. For additional information, refer to "Extended storage switch" in this section.

Not Available Parking Brake On (if so equipped)

This message may appear when the Intelligent Cruise Control (ICC) (for vehicles with ProPILOT Assist) is engaged.

Under the following condition, the ICC (for vehicles with ProPILOT Assist) system is automatically canceled:

- The electronic parking brake is applied.

The above system cannot be used when the electronic parking is activated.

For additional information, refer to "Intelligent Cruise Control (ICC) (for vehicles with ProPILOT Assist)" and "Parking brake" in the "Starting and driving" section of this manual.

Rear Door Alert is activated

When the system is enabled, this message appears when the Rear Door Alert system is active and can remind the driver to check the back seat.

- Using the steering wheel switch, a driver can select "Dismiss Message" to clear the display for a period of time. If no selection is made, this message automatically turns off after a period of time.
- Using the steering wheel switch, a driver can select "Disable Alert" to disable the horn alert for the remainder of the current trip.

⚠ WARNING

Selecting "Dismiss Message" during a stop within a trip temporarily dismisses the message for that stop without turning the system off. Alerts can be provided for other stops during the trip. Selecting "Disable Alert" turns off the Rear Door Alert system for the remainder of a trip and no audible alert will be provided.

NOTE:

This system is disabled until a driver enables it using the vehicle information display. For additional information, refer to "How to use the vehicle information display" in this section.

For additional information, refer to "Rear Door Alert" in this section.

Check Rear Seat For All Articles

When the system is enabled, this message appears when the vehicle comes to a complete stop, the vehicle is transitioned from

The above system cannot be used when the driver's seat belt is not fastened.

Not Available: Front Radar Blocked (if so equipped)

This message appears when the Intelligent Cruise Control (ICC) systems, the Automatic Emergency Braking (AEB) system, the Automatic Emergency Braking (AEB) with Pedestrian Detection system, or the Intelligent Forward Collision Warning (I-FCW) system becomes unavailable because the front radar is obstructed. For additional information, refer to "Intelligent Cruise Control (ICC) (for vehicles without ProPILOT Assist)", "Intelligent Cruise Control (ICC) (for vehicles with ProPILOT Assist)", "Automatic Emergency Braking (AEB)", "Automatic Emergency Braking (AEB) with Pedestrian Detection" or "Intelligent Forward Collision Warning (I-FCW)" in the "Starting and driving" section of this manual.

Currently not available (if so equipped)

This message may appear when the Intelligent Cruise Control (ICC) (with ProPILOT Assist) system , the ICC system or the Intelligent Lane Intervention (I-LI) system is engaged.

Under the following conditions, the ICC (with ProPILOT Assist) , the ICC system or the Intelligent Lane Intervention (I-LI) system is automatically canceled:

- When the VDC operates
- When a wheel slips
- When the VDC system is turned off

The above system cannot be used in some situations (VDC operates, wheel slip and VDC system is off.)

Not Available Poor Road Conditions (if so equipped)

This message may appear when the Intelligent Cruise Control (ICC) (with ProPILOT Assist) system , the ICC system or the Intelligent Lane Intervention (I-LI) system is engaged.

Under the following conditions, the ICC (with ProPILOT Assist) , the ICC system or the Intelligent Lane Intervention (I-LI) system is automatically canceled:

- When the VDC operates
- When a wheel slips

The above system cannot be used in some situations (VDC operates and wheel slip.)

AWD Error: See Owner's Manual (if so equipped)

This warning appears when the all-wheel drive system is not functioning properly while the engine is running.

AWD High Temp. Stop vehicle (if so equipped)

This warning may appear while trying to free a stuck vehicle due to increased oil temperature. The driving mode may change to 2-Wheel Drive (2WD). If this warning is displayed, stop the vehicle with the engine idling, as soon as it is safe to do so. Then if the warning turns off, you can continue driving.

AWD Tire Size Incorrect: See Owner's Manual (if so equipped)

This warning may appear if there is a large difference between the diameters of the front and rear wheels. Pull off the road in a safe area, with the engine idling. Check that all the tire sizes are the same, that the tire pressure is correct and that the tires are not excessively worn.

⚠ CAUTION

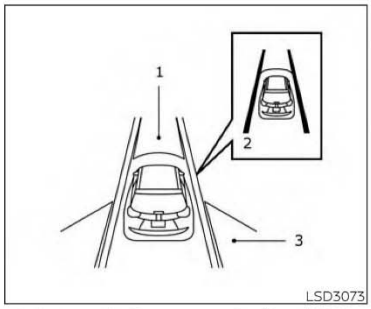
- **Except in an emergency, do not shift to the N (Neutral) position while driving. Coasting with the transmission in the N (Neutral) position may cause serious damage to the transmission.**
- **To avoid possible damage to your vehicle, when stopping the vehicle on an uphill grade, do not hold the vehicle by depressing the accelerator pedal. The foot brake should be used for this purpose.**

The CVT in your vehicle is electronically controlled to produce maximum power and smooth operation.

Follow these procedures for maximum vehicle performance and driving enjoyment.

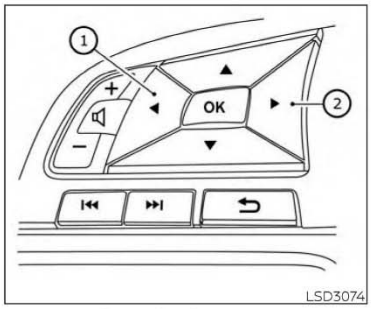
NOTE:

Engine power may be automatically reduced to protect the CVT if the engine speed increases quickly when driving on slippery roads or while being tested on some dynamometers.



LSD3073

1. Automatic Emergency Braking (AEB)
2. Lane Departure Warning (LDW) when shaded and Intelligent Lane Intervention (I-LI) when solid
3. Blind Spot Warning (BSW)



LSD3074

Starting the vehicle

1. After starting the engine, fully depress the foot brake pedal before moving the shift lever out of the P (Park) position. **The Continuously Variable Transmission is designed so the foot brake pedal MUST be depressed before shifting from P (Park) to any drive position while the ignition switch is in the ON position.The shift lever cannot be moved out of P (Park) and into any of the other gear positions if the ignition switch is placed in the LOCK position.**

- **Vehicle-to-vehicle distance control mode:** The ICC system maintains a selected distance from the vehicle in front of you within the speed range of 0 to 90 mph (0 to 144 km/h) up to the set speed. The set speed can be selected by the driver between 20 to 90 mph (32 to 144 km/h). When the vehicle ahead slows to a stop, your vehicle gradually decelerates to a standstill. When the vehicle is stopped, the ICC system maintains braking force to keep your vehicle stopped.

NOTE:

When your vehicle is stopped for less than 3 seconds and the vehicle ahead begins to move, your vehicle will start moving again automatically.

- When your vehicle is at a standstill for more than 3 seconds and the vehicle ahead begins to accelerate, push the RES+ switch or lightly depress the accelerator pedal. The ICC system starts to follow the vehicle ahead.
- When no vehicle is detected ahead within the driver selected distance, the vehicle travels at the speed set by the driver. The speed must be above 20 mph (32 km/h) to use this function.

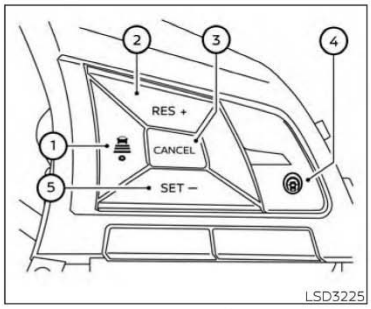
NOTE:

Even if the Automatic Emergency Braking (AEB) setting is turned off by the driver using the "Settings" menu in the vehicle information display, AEB will be automatically turned on when ICC is used.

2. **Steering Assist**

   The Steering Assist function controls the steering system to help keep your vehicle within the traveling lane.

   When there is no vehicle ahead, Steering Assist is not available at speeds under 37 mph (60 km/h).



ProPILOT Assist switches

① **DISTANCE switch:**

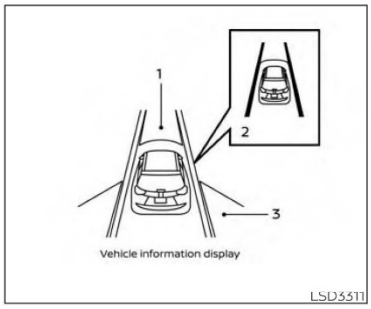
- Long
- Middle
- Short

② **RES+ switch:**

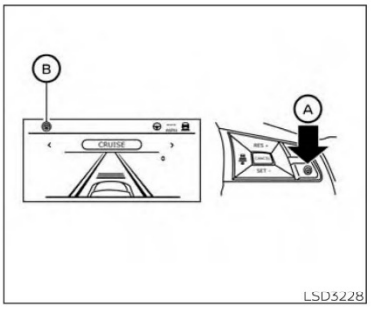
Resumes set speed or increases speed incrementally

③ **CANCEL switch:**

Deactivates the ProPILOT Assist system

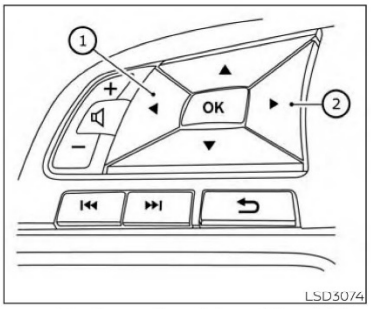


1. Automatic Emergency Braking (AEB)
2. Lane Departure Warning (LDW) when shaded and Intelligent Lane Intervention (I-LI) when solid
3. Blind Spot Warning (BSW)

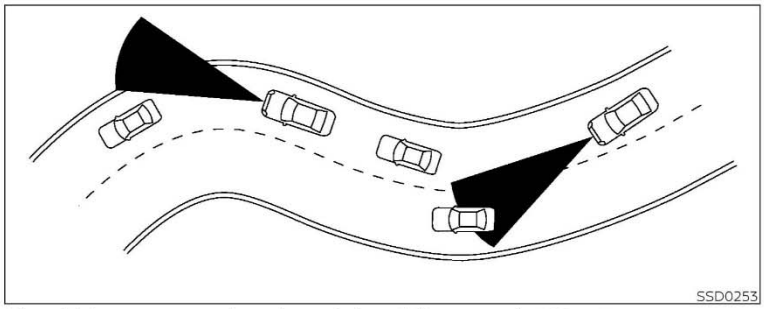


OPERATING PROPILOT ASSIST

1. Push the ProPILOT Assist switch Ⓐ. This turns on the ProPILOT Assist system.
2. A screen is displayed for a period of time that indicates the status of the driving aid functions.
   - AEB, LDW, and BSW are enabled when the specified driving aid is shaded.
   - I-LI is enabled when the driving aid is solid.



   - To change the status of the driving aids, use the ① ◄ or ② ► button to navigate the settings screen. For additional information, refer to "How to use the vehicle information display" in the "Instruments and controls" section of this manual.
3. The status of the ProPILOT Assist system is displayed in the vehicle information display Ⓑ.
4. Accelerate or decelerate your vehicle to the desired speed.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When driving on some roads, such as winding, hilly, curved, narrow roads, or roads which are under construction, the radar sensor may detect vehicles in a different lane, or may temporarily not detect a vehicle traveling ahead. This may cause the radar system to decelerate or accelerate the vehicle.

The detection of vehicles may also be affected by vehicle operation (steering maneuver or traveling position in the lane, etc.) or vehicle condition.

If this occurs, the ICC system may warn you by blinking the system indicator and sounding the chime unexpectedly. You will have to manually control the proper distance away from the vehicle traveling ahead.

Automatic cancellation

The following are conditions in which the ICC system may be temporarily unavailable. In these instances, the ICC system may not cancel and may not be able to maintain the selected following distance from the vehicle ahead.

Condition A

Under the following conditions, the ICC system is automatically canceled. A chime will sound and the system will not be able to be set:

- Any door is open.
- The driver's seat belt is not fastened.
- The vehicle ahead is not detected and your vehicle is traveling below the speed of 15 mph (24 km/h).
- Your vehicle has been stopped by the ICC system for approximately 3 minutes or longer.
- The shift lever is not in the D (Drive) position or manual shift mode.
- The electronic parking brake is applied.
- The VDC system is turned off.
- The AEB applies harder braking.
- VDC (including the traction control system) operates.
- A wheel slips.
- When distance measurement becomes impaired due to adhesion of dirt or obstruction to the sensor.

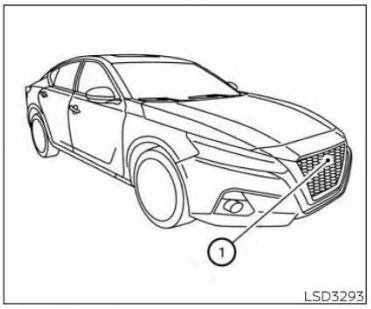
AUTOMATIC EMERGENCY BRAKING (AEB) (if so equipped)

⚠ WARNING

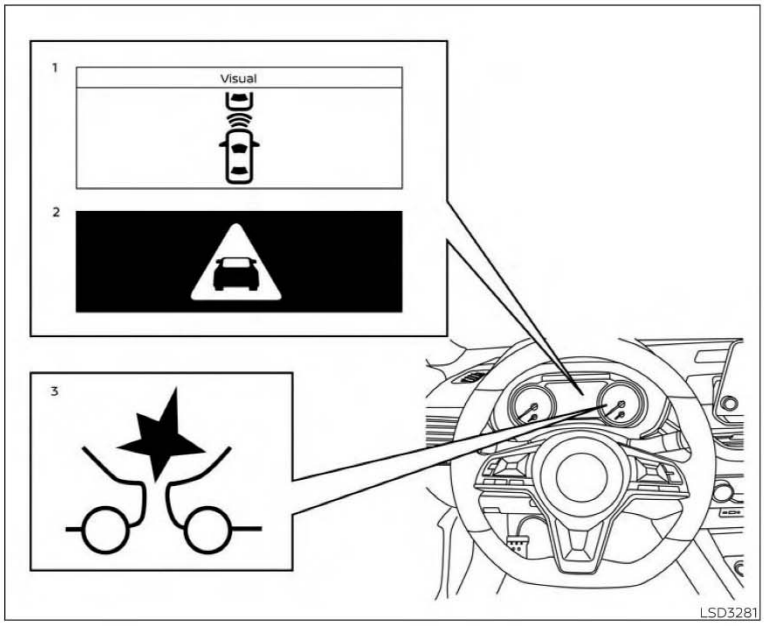
Failure to follow the warnings and instructions for proper use of the AEB system could result in serious injury or death.

- **The AEB system is a supplemental aid to the driver. It is not a replacement for the driver's attention to traffic conditions or responsibility to drive safely. It cannot prevent accidents due to carelessness or dangerous driving techniques.**
- **The AEB system does not function in all driving, traffic, weather and road conditions.**

The AEB system can assist the driver when there is a risk of a forward collision with the vehicle ahead in the traveling lane.



The AEB system uses a radar sensor ① located on the front of the vehicle to measure the distance to the vehicle ahead in the same lane.



1. Vehicle ahead detection indicator
2. AEB emergency warning indicator
3. AEB system warning light

AEB SYSTEM OPERATION

The AEB system will function when your vehicle is driven at speeds above approximately 3 mph (5 km/h).

If a risk of a forward collision is detected, the AEB system will provide an initial warning to the driver by both a visual and audible alert.

If the driver applies the brakes quickly and forcefully after the warning, and the AEB system detects that there is still the possibility of a forward collision, the system will automatically increase the braking force. If the driver does not take action, the AEB system issues the second visual warning and audible warning and also applies partial braking.

If the risk of a collision becomes imminent, the AEB system applies harder braking automatically.

While the AEB system is operating, you may hear the sound of brake operation. This is normal and indicates that the AEB system is operating properly.

NOTE:

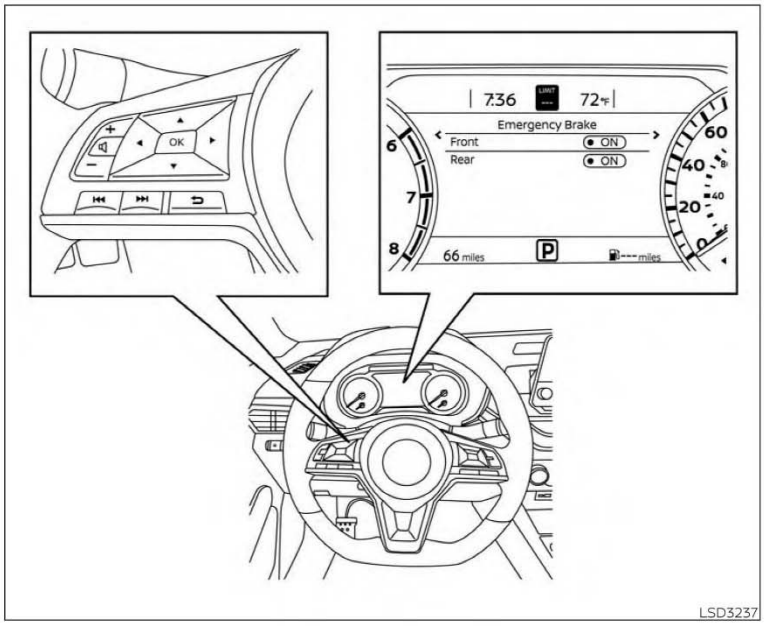
The vehicle's brake lights come on when braking is performed by the AEB system.

Depending on vehicle speed and distance to the vehicle ahead, as well as driving and roadway conditions, the system may help the driver avoid a forward collision or may help mitigate the consequences of a collision, should one be unavoidable. If the driver is handling the steering wheel, accelerating or braking, the AEB system will function later or will not function.

The automatic braking will cease under the following conditions:

- When the steering wheel is turned as far as necessary to avoid a collision.
- When the accelerator pedal is depressed.
- When there is no longer a vehicle detected ahead.

If the AEB system has stopped the vehicle, the vehicle will remain at a standstill for approximately 2 seconds before the brakes are released.



TURNING THE AEB SYSTEM ON/OFF

Perform the following steps to turn the AEB system ON or OFF.

1. Press the ◀▶ button until "Settings" displays in the vehicle information display. Use the ▲▼ button to select "Driver Assistance." Then press the OK button.
2. Select "Emergency Brake" and press the OK button.
3. Select "Front" and press the OK button to turn the system on or off.

When the AEB system is turned off, the AEB system warning light illuminates.

NOTE:

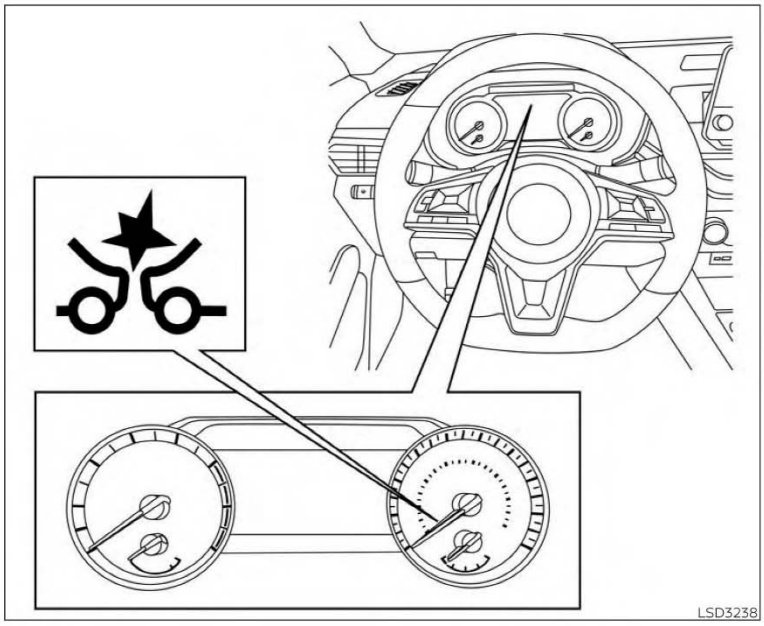
- **The AEB system will be automatically turned on when the engine is restarted.**
- **The I-FCW system is integrated into the AEB system There is not a separate selection in the vehicle information display for the I-FCW system. When the AEB is turned off, the I-FCW system is also turned off.**

AEB SYSTEM LIMITATIONS

⚠ WARNING

Listed below are the system limitations for the AEB system. Failure to operate the vehicle in accordance with these system limitations could result in serious injury or death.

- **The AEB system cannot detect all vehicles under all conditions.**
- **The radar sensor does not detect the following objects:**
  - **Pedestrians, animals or obstacles in the roadway.**
  - **Oncoming vehicles.**
  - **Crossing vehicles.**
- **The radar sensor has some performance limitations. If a stationary vehicle is in the vehicles's path, the AEB system will not function when the vehicle is driven at speeds over approximately 50 mph (80 km/h).**
- **The radar sensor may not detect a vehicle ahead in the following conditions:**
  - **Dirt, ice, snow or other material covering the radar sensor.**
  - **Interference by other radar sources.**
  - **Snow or road spray from traveling vehicles.**
  - **If the vehicle ahead is narrow (e.g. motorcycle).**
  - **When driving on a steep downhill slope or roads with sharp curves.**
- **In some road or traffic conditions, the AEB system may unexpectedly apply partial braking. When acceleration is necessary, continue to depress the accelerator pedal to override the system.**
- **Braking distances increase on slippery surfaces.**
- **The system is designed to automatically check the sensor's functionality, within certain limitations. The system may not detect some forms of obstructions of the sensor area such as ice, snow, stickers, etc. In these cases, the system may not be able to worn the driver properly. Be sure that you check, clean and clear the sensor area regularly.**
- **Excessive noise will interfere with the warning chime sound, and the chime may not be heard.**



SYSTEM TEMPORARILY UNAVAILABLE

Condition A

When the radar sensor picks up interference from another radar source, making it impossible to detect a vehicle ahead, the AEB system is automatically turned off.

The AEB system warning light (orange) will illuminate.

Action to take:

When the above conditions no longer exist, the AEB system will resume automatically.

Condition B

When the radar sensor of the front bumper is covered with dirt or is obstructed, the AEB system will automatically be canceled. The chime will sound and the "Not Available: Front Radar Blocked" warning message will appear in the vehicle information display.

Action to take:

If the warning message appears, stop the vehicle in a safe place, place the shift lever in the P (Park) position, and turn the engine off. When the radar signal is temporarily interrupted, clean the sensor area of the

front bumper and restart the engine. If the "Not Available: Front Radar Blocked" warning message continues to be displayed, have the system checked. It is recommended that you visit a NISSAN dealer for this service.

Condition C

When driving on roads with limited road structures or buildings (for example, long bridges, deserts, snowfields, driving next to long walls), the system may illuminate the system warning light and display the "Not Available: Front Radar Blocked" message.

Action to take:

When the above driving conditions no longer exist, turn the system back on.

NOTE:

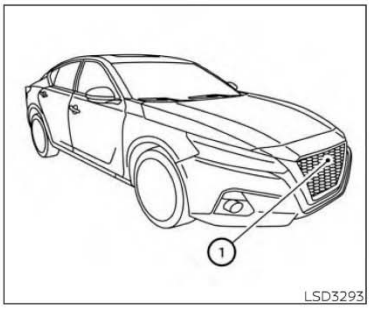
If the AEB system stops working, the I-FCW system will also stop working.

SYSTEM MALFUNCTION

If the AEB system malfunctions, it will be turned off automatically, a chime will sound, the AEB warning light (orange) will illuminate and the warning message [Malfunction] will appear in the vehicle information display.

Action to take

If the warning light (orange) comes on, stop the vehicle in a safe location, turn the engine off and restart the engine. If the warning light continues to illuminate, have the AEB system checked. It is recommended that you visit a NISSAN dealer for this service.



SYSTEM MAINTENANCE

The sensor ① for the AEB is located on the front of the vehicle.

To keep the system operating properly, be sure to observe the following:

- Always keep the sensor area of the front bumper clean.
- Do not strike or damage the areas around the sensor.
- Do not cover or attach stickers or similar objects on the front bumper near the sensor area. This could cause failure or malfunction.

- Do not attach metallic objects near the sensor area (brush guard, etc.). This could cause failure or malfunction.
- Do not alter, remove or paint the front bumper. Before customizing or restoring the front bumper, it is recommended that you visit a NISSAN dealer.

Radio frequency statement

For USA

FCC ID OAYARS4B

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

FCC Warning

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Radio frequency radiation exposure information:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

The transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

For Canada

Model: ARS4-B

IC: 4135A-ARS4B

FCC ID: OAYARS4B

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference,
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage, et
2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Radio frequency radiation exposure information:

This equipment complies with FCC and IC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance of 30 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé.

Cet équipement doit être installé et utilisé avec un minimum de 30 cm de distance entre la source de rayonnement et votre corps.

FCC Notice

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

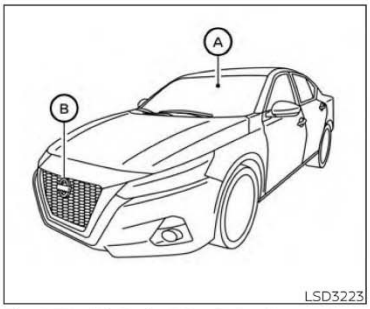
AUTOMATIC EMERGENCY BRAKING (AEB) WITH PEDESTRIAN DETECTION (if so equipped)

⚠ WARNING

Failure to follow the warnings and instructions for proper use of the AEB with Pedestrian Detection system could result in serious injury or death.

- **The AEB with Pedestrian Detection system is a supplemental aid to the driver. It is not a replacement for the driver's attention to traffic conditions or responsibility to drive safely. It cannot prevent accidents due to carelessness or dangerous driving techniques.**
- **The AEB with Pedestrian Detection system does not function in all driving, traffic, weather and road conditions.**

The AEB with Pedestrian Detection system can assist the driver when there is a risk of a forward collision with the vehicle ahead in the traveling lane or with a pedestrian ahead in the traveling lane.



The AEB with Pedestrian Detection system uses a radar sensor located on the front of the vehicle Ⓑ to measure the distance to the vehicle ahead in the same lane. For pedestrians, the AEB with Pedestrian Detection system uses a camera installed behind the windshield Ⓐ in addition to the radar sensor.

APPENDIX C

Run Log

Subject Vehicle: **2020 Nissan Altima** Test Date: **2/11/2020**

Principal Other Vehicle: **2006 Acura RL**

Run	Test Type	Valid Run?	TTCW Sound (sec)	TTCW Light (sec)	TTCW Margin (sec)	Pass/Fail	Notes
1	**Stopped POV**	Y	2.67	2.62	0.57	Pass	
2		Y	2.67	2.62	0.57	Pass	
3		Y	2.66	2.64	0.56	Pass	
4		Y	2.66	2.61	0.56	Pass	
5		Y	2.63	2.59	0.53	Pass	
6		Y	2.65	2.60	0.55	Pass	
7		Y	1.99	1.95	-0.11	Fail	
15	**Decelerating POV, 45**	Y	2.45	2.40	0.05	Pass	
16		Y	2.61	2.58	0.21	Pass	
17		Y	2.42	2.38	0.02	Pass	
18		Y	2.50	2.46	0.10	Pass	
19		N					Lateral offset
20		Y	2.06	2.04	-0.34	Fail	
21		N					POV Speed
22		Y	2.60	2.59	0.20	Pass	
23		Y	2.62	2.58	0.22	Pass	

Run	Test Type	Valid Run?	TTCW Sound (sec)	TTCW Light (sec)	TTCW Margin (sec)	Pass/Fail	Notes
8	**Slower POV, 45 vs 20**	Y	2.60	2.56	0.60	Pass	
9		Y	2.60	2.56	0.60	Pass	
10		Y	2.63	2.60	0.63	Pass	
11		Y	2.62	2.56	0.62	Pass	
12		Y	2.59	2.53	0.59	Pass	
13		Y	2.56	2.52	0.56	Pass	
14		Y	2.61	2.56	0.61	Pass	

APPENDIX D

Time History Plots

LIST OF FIGURES

Description of Time History Plots

A set of time history plots is provided for each valid run in the test series. Each set of plots comprises time varying data from both the Subject Vehicle (SV) and the Principal Other Vehicle (POV), as well as pass/fail envelopes and thresholds. The following is a description of data types shown in the time history plots, as well as a description of the color code indicating to which vehicle the data pertain.

Each time history plot consists of data pertinent to the test type under consideration, and therefore the data channels plotted vary according to test type. The test types (shown in the plot titles) include:

- FCW Test 1 – Stopped POV (SV at 45 mph)
- FCW Test 2 – Decelerating POV (Both vehicles at 45 mph with a 30 m gap, POV brakes at 0.3 g)
- FCW Test 3 – Slower Moving POV (SV at 45 mph, POV at 20 mph)

Time history figures include the following sub-plots:

- Warning – Displays the Forward Collision Warning Alert (which can be audible, visual, or haptic). Depending on the type of FCW alert or instrumentation used to measure the alert, this can be any of the following:
    - Filtered, rectified, and normalized sound signal. The vertical scale is 0 to 1.
    - Filtered, rectified, and normalized acceleration (e.g., haptic alert, such as steering wheel vibration). The vertical scale is 0 to 1.
    - Light sensor signal
- TTC (sec) – Indicates the Time to Collision as calculated up to the point of FCW alert issuance. The value of TTCW (Time to Collision at Warning) is given numerically on the right side of the figure. A passing value is indicated in green, while a failing value is indicated in red.
- SV Speed (mph) – Speed of the Subject Vehicle
- POV Speed (mph) – Speed of the Principal Other Vehicle
- Yaw Rate (deg/sec) – Yaw rate of both the Subject Vehicle and Principal Other Vehicle

- Lateral Offset (ft) – Lateral offset within the lane from the Subject Vehicle to the Principal Other Vehicle
- Ax (g) – Longitudinal acceleration of both the Subject Vehicle and Principal Other Vehicle
- Headway (ft) – Longitudinal separation between front of Subject Vehicle to rear of Principal Other Vehicle (Exclusive to test type 2)

Note that the minimum (worst) GPS fix type is displayed in the lower right corner of each page. The only valid fix type is RTK fixed (displayed in green). If the fix type during any portion of the test was anything other than RTK fixed, then "RTK Fixed OR LESS!!" is displayed in red.

Envelopes and Thresholds

Each of the time history plot figures can contain either green or yellow envelopes and/or black threshold lines. These envelopes and thresholds are used to programmatically and visually determine the validity of a given test run. Envelope and threshold exceedances are indicated with either red shading or red asterisks, and red text is placed to the right side of the plot indicating the type of exceedance.

Green envelopes indicate that the time-varying data should not exceed the envelope boundaries at any time within the envelope. Exceedances of a green envelope are indicated by red shading in the area between the measured time-varying data and the envelope boundaries.

Yellow envelopes indicate that the time-varying data should not exceed the envelope only at the left and/or right ends. Exceedances at the left or right extent of a yellow envelope are indicated by red asterisks.

For the warning plot, a dashed black threshold line indicates the threshold used to determine the onset of the FCW alert. The alert is considered on the first time the alert signal crosses this threshold line.

For the TTC plot, a dashed black threshold line indicates the minimum allowable TTC for the given test scenario. If the FCW alert occurs before this minimum allowable TTC, a green dot appears. However, if there is no alert or the alert occurs after the minimum allowable TTC, a red asterisk is shown on the plot.

For the Ax plot, a dashed black threshold line is given for at a value of -0.05 g. For a test run to be valid, the longitudinal acceleration of the Subject Vehicle must not fall below this threshold (i.e. the driver cannot apply any brakes). Additionally, for test type 2, the plot indicating the longitudinal acceleration of the Principal Other Vehicle

includes a yellow envelope indicating the deceleration (0.3 g ± 0.03 g) allowed while braking. Exceedance of this threshold is indicated with red asterisks at the beginning and/or end of the threshold boundary.

Color Codes

Color codes have been adopted to easily identify which data correspond to which vehicle, as well as to indicate the types of envelopes and thresholds used in the plots.

Color codes can be broken into four categories:

1. Time-varying data
2. Validation envelopes and thresholds
3. Instantaneous samplings
4. Text

1. Time-varying data color codes:
   - Blue = Subject Vehicle data
   - Magenta = Principal Other Vehicle data
   - Brown = Relative data between SV and POV (i.e., TTC, lateral offset and headway distance)

2. Validation envelope and threshold color codes:
   - Green envelope = time varying data must be within the envelope at all times in order to be valid
   - Yellow envelope = time varying data must be within limits at left and/or right ends
   - Black threshold (Solid) = time varying data must not exceed this threshold in order to be valid
   - Black threshold (Dashed) = for reference only – this can include warning level thresholds, TTC thresholds, and acceleration thresholds

3. Instantaneous sampling color codes:
   - Green circle = passing or valid value at a given moment in time
   - Red asterisk = failing or invalid value at a given moment in time

4. Text color codes:
   - Green = passing or valid value
   - Red = failing or invalid value

Other Notations

- ENV – For Ax plots only, indicates that the envelope for the POV braking was exceeded.
- NG – Indicates that the value for that variable was outside of bounds and therefore “No Good”.
- No Wng – No warning was detected.
- POV – Indicates that the value for the Principal Other Vehicle was out of bounds.
- SV – Indicates that the value for the Subject Vehicle was out of bounds.
- SR – Shows the speed reduction value.
- Thr – Indicates that the requirements for the throttle were not met.

The minimum (worst) GPS fix type is displayed in the lower right corner of each page. The only valid fix type is RTK fixed (displayed in green). If the fix type during any portion of the test was anything other than RTK fixed, then “RTK Fixed OR LESS!!” is displayed in red.

Examples of time history plots for each test type (including passing, failing and invalid runs) are shown in Figure D1 through Figure D6. Actual time history data plots for the vehicle under consideration are provided subsequently.

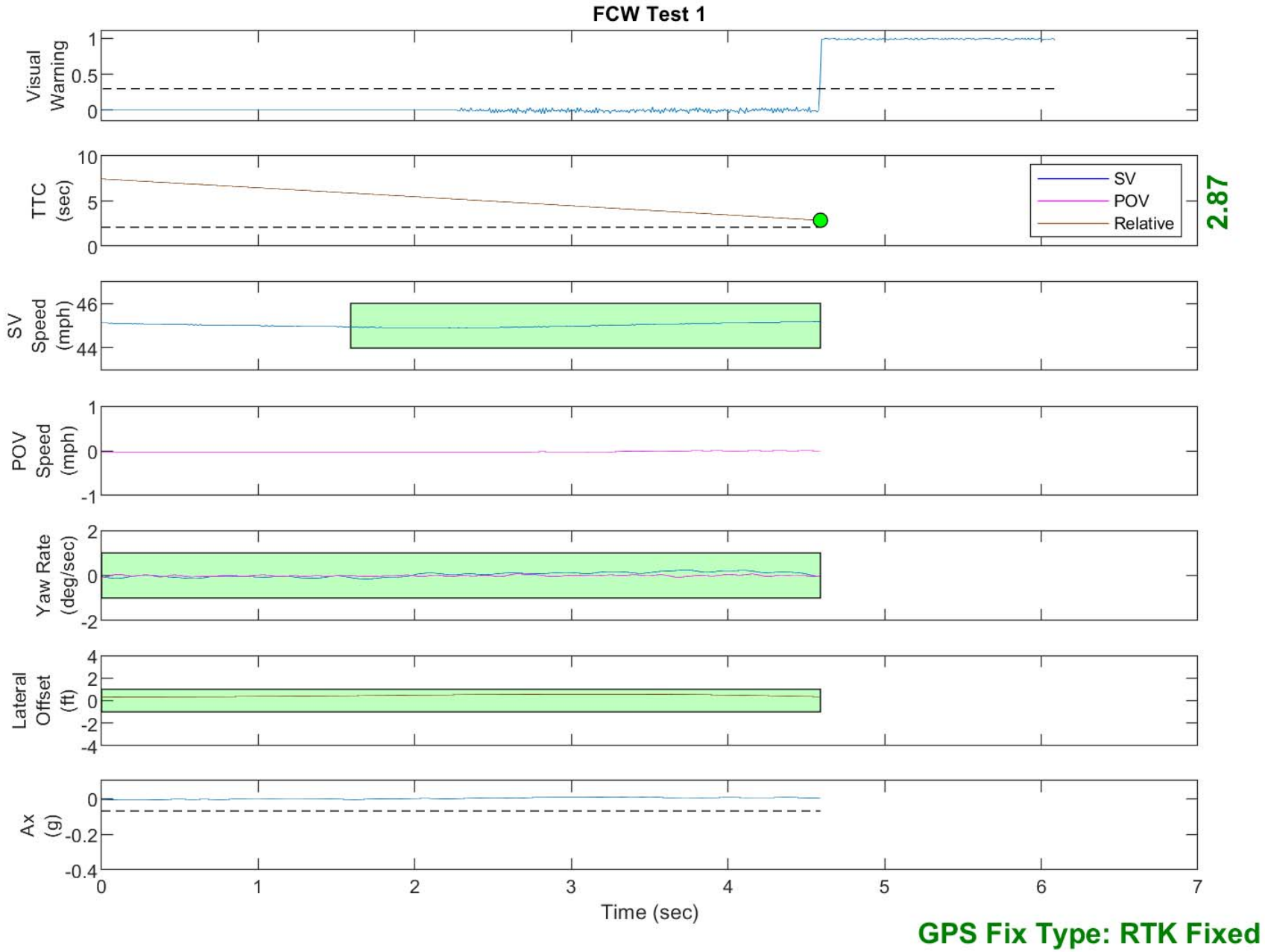


Figure D1. Example Time History for Test Type 1, Passing

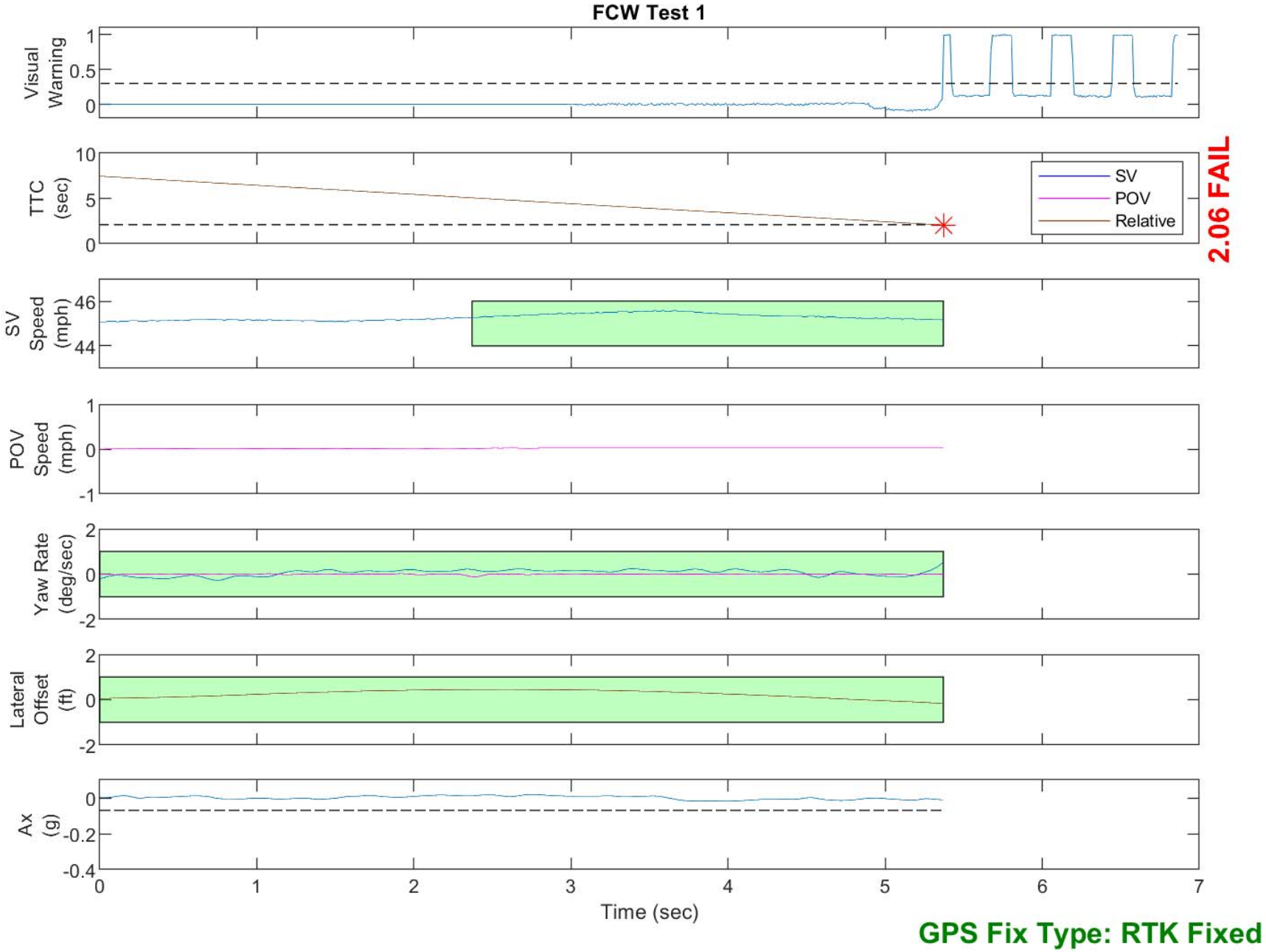


Figure D2. Example Time History for Test Type 1, Failing

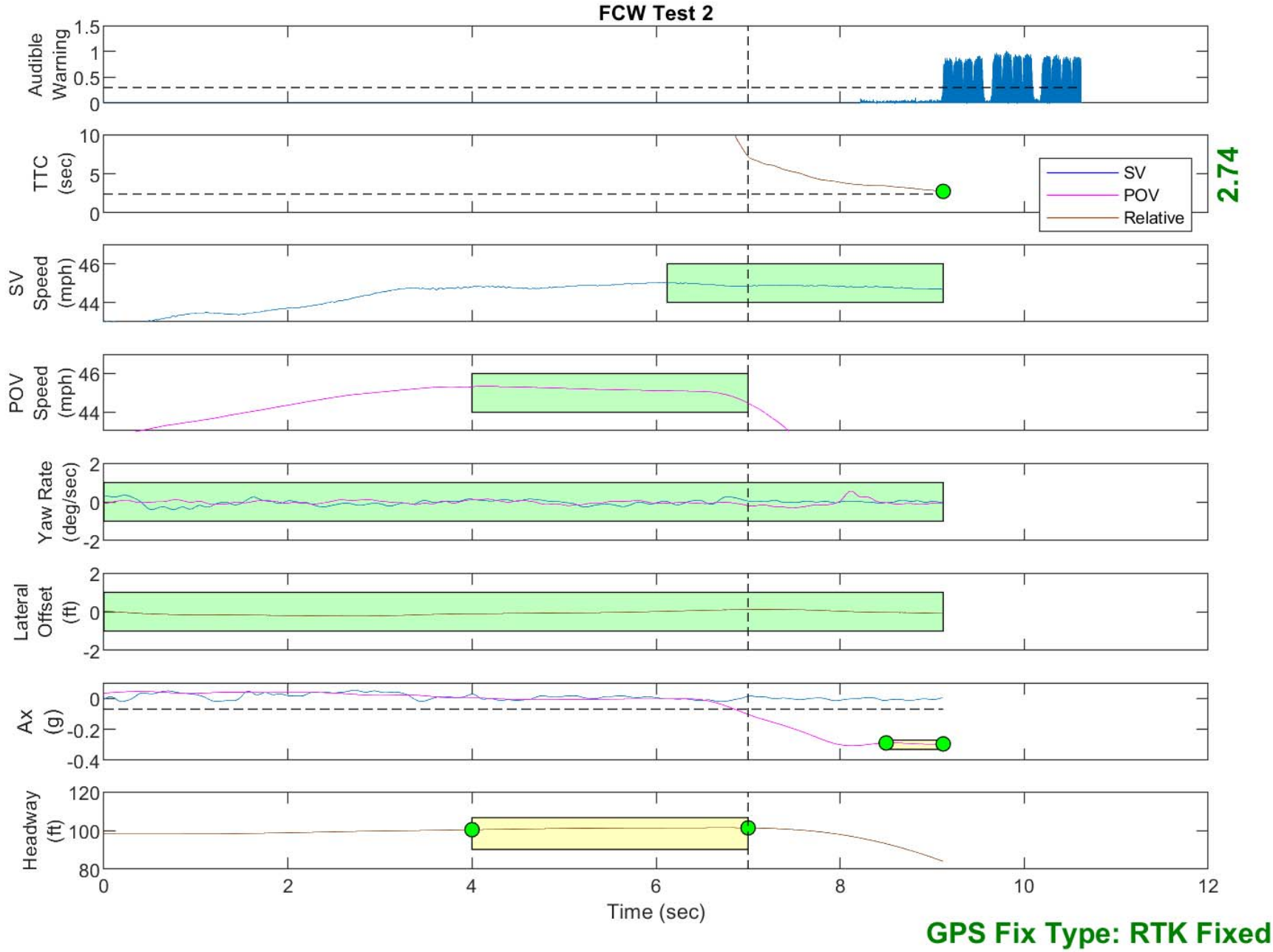


Figure D3. Example Time History for Test Type 2, Passing

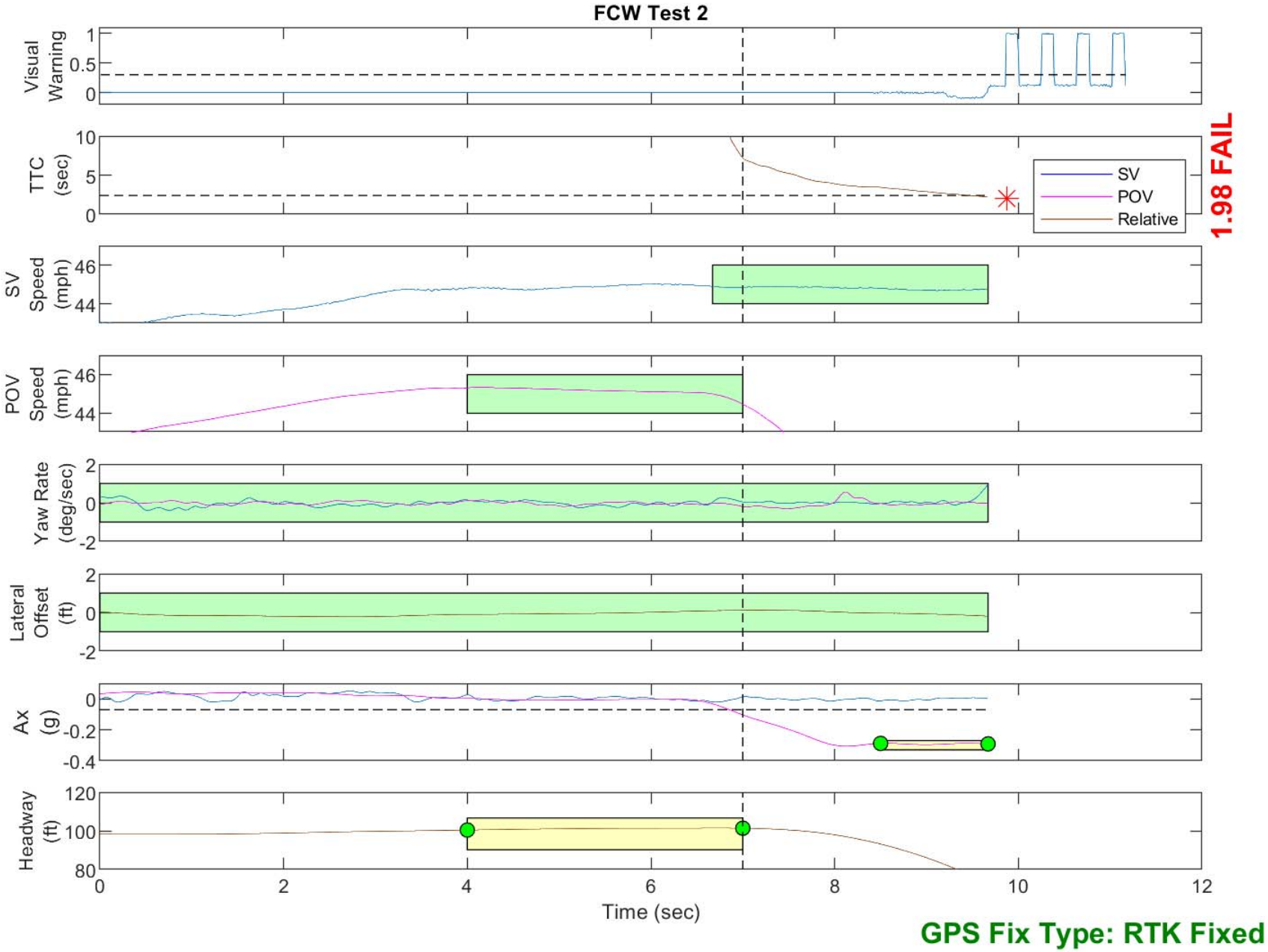


Figure D4. Example Time History for Test Type 2, Failing

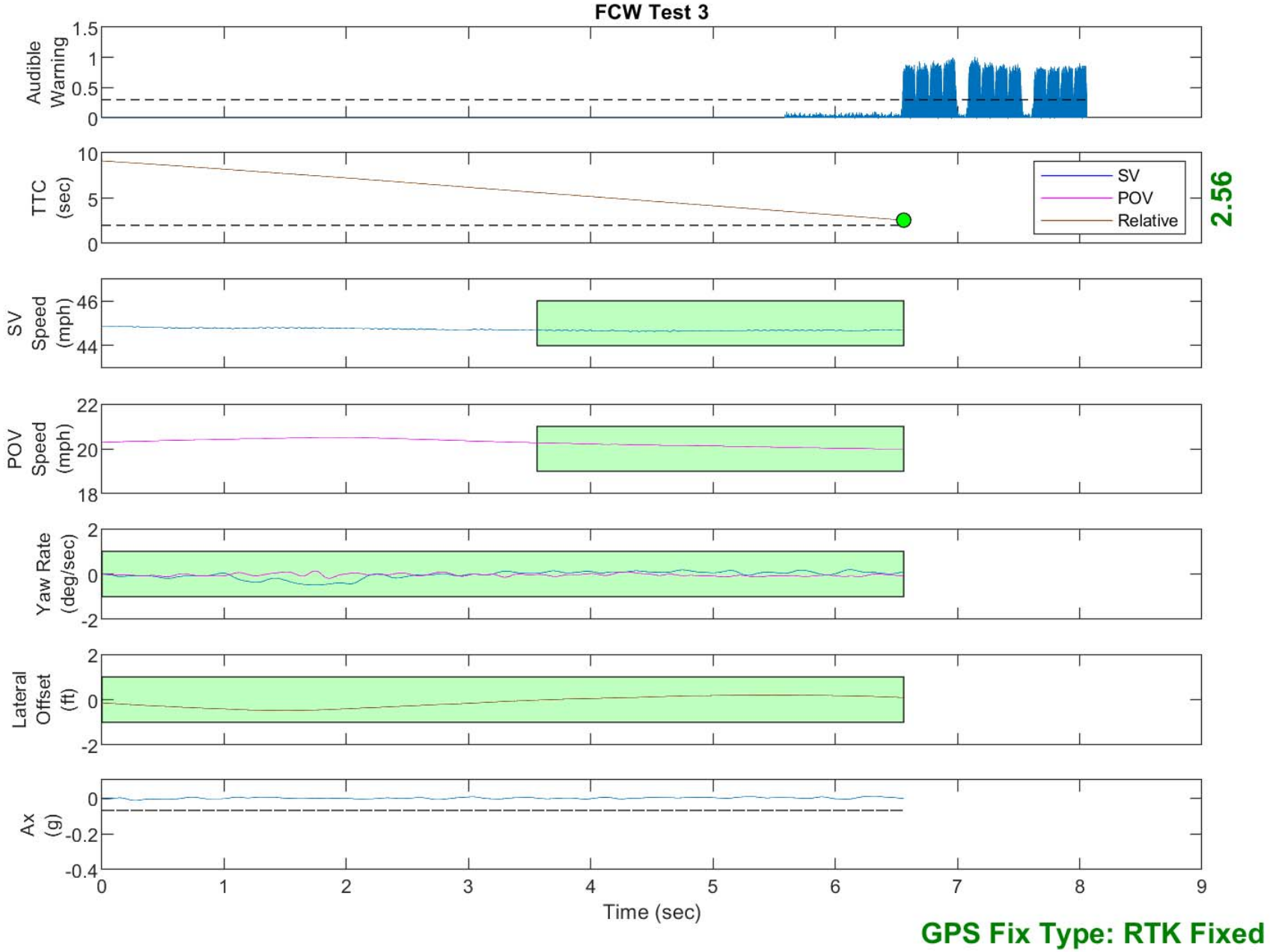


Figure D5. Example Time History for Test Type 3, Passing

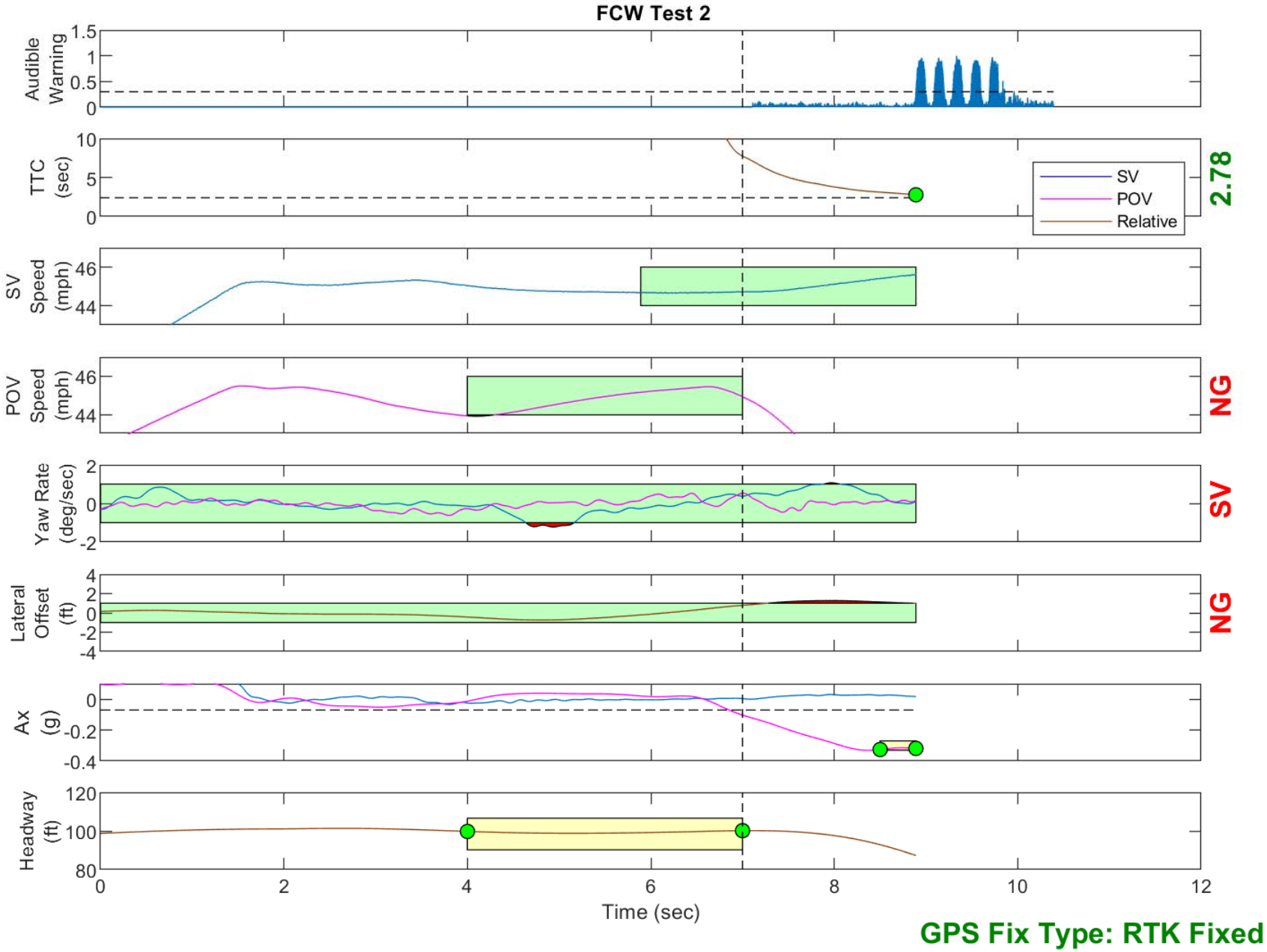


Figure D6. Example Time History Displaying Various Invalid Criteria

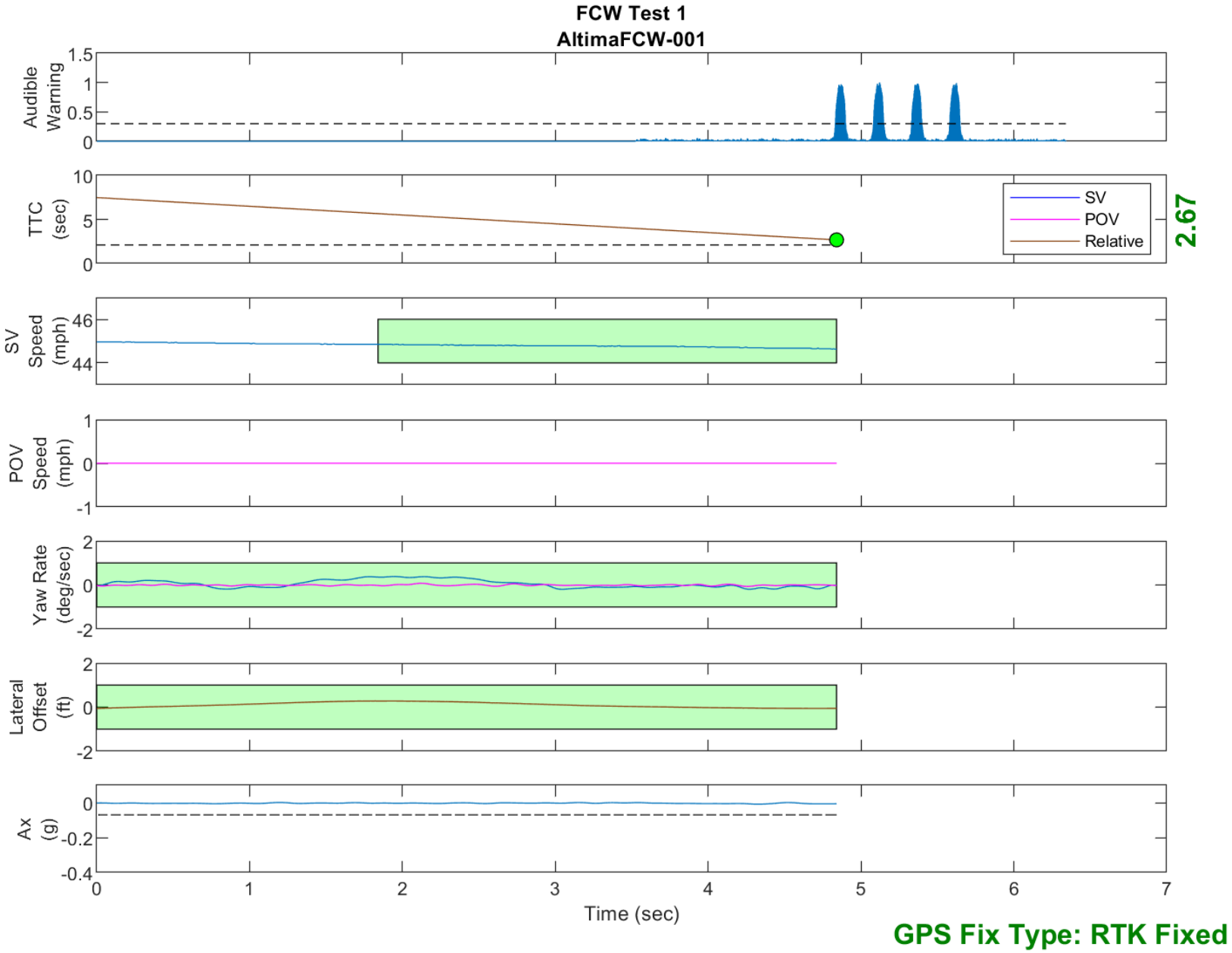


Figure D7. Time History for Run 1, FCW Test 1, Audible Warning

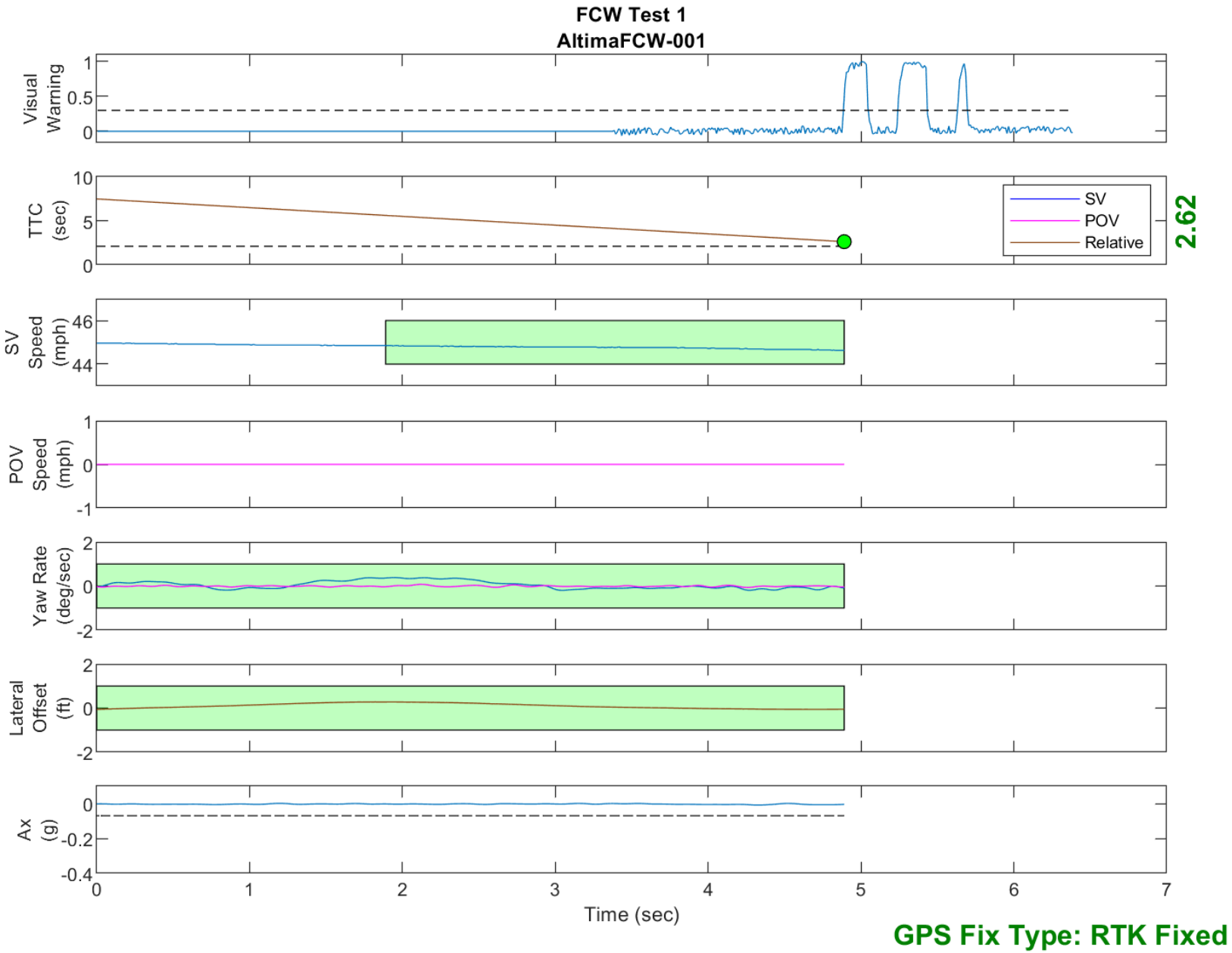


Figure D8. Time History for Run 1, FCW Test 1, Visual Warning

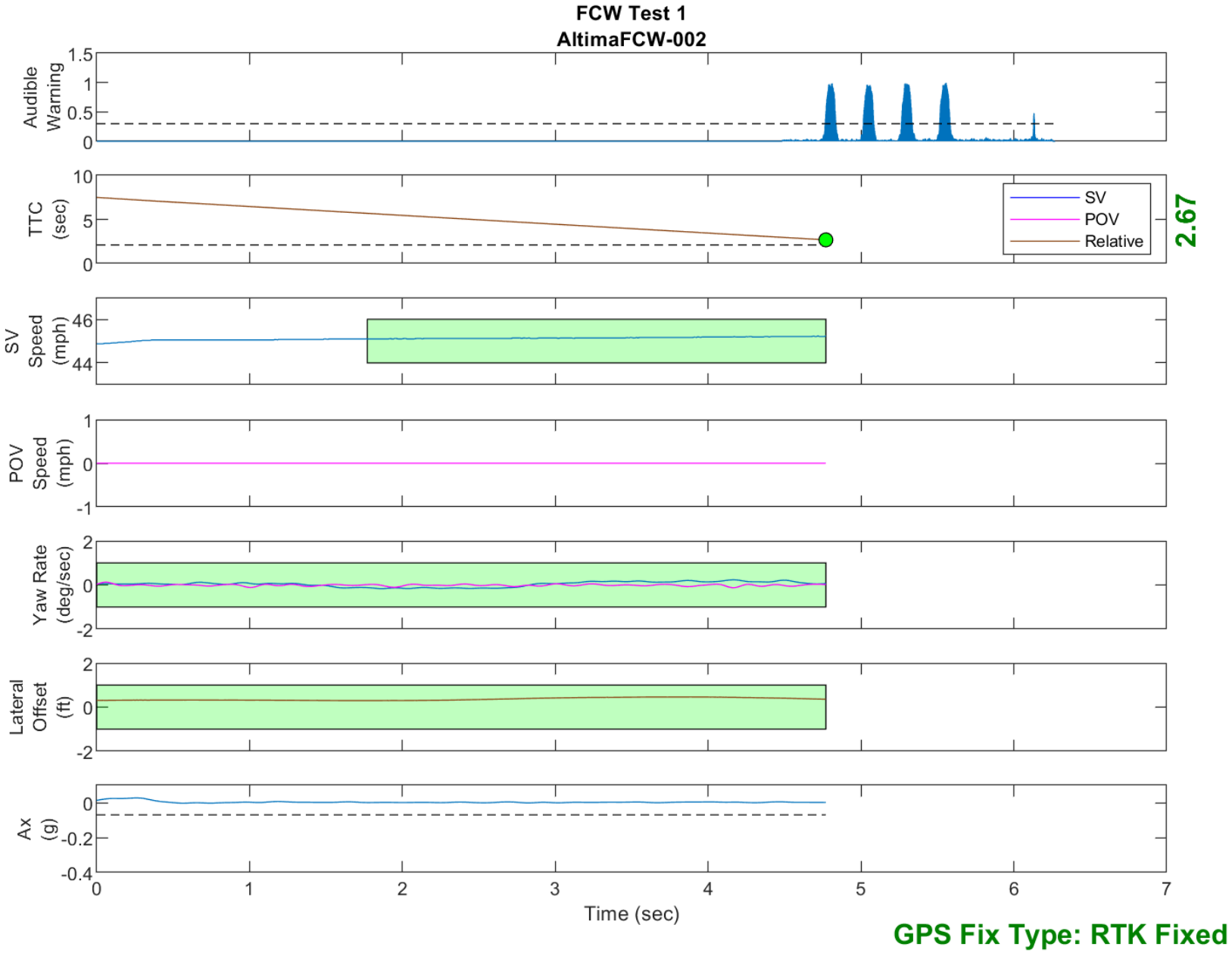


Figure D9. Time History for Run 2, FCW Test 1, Audible Warning

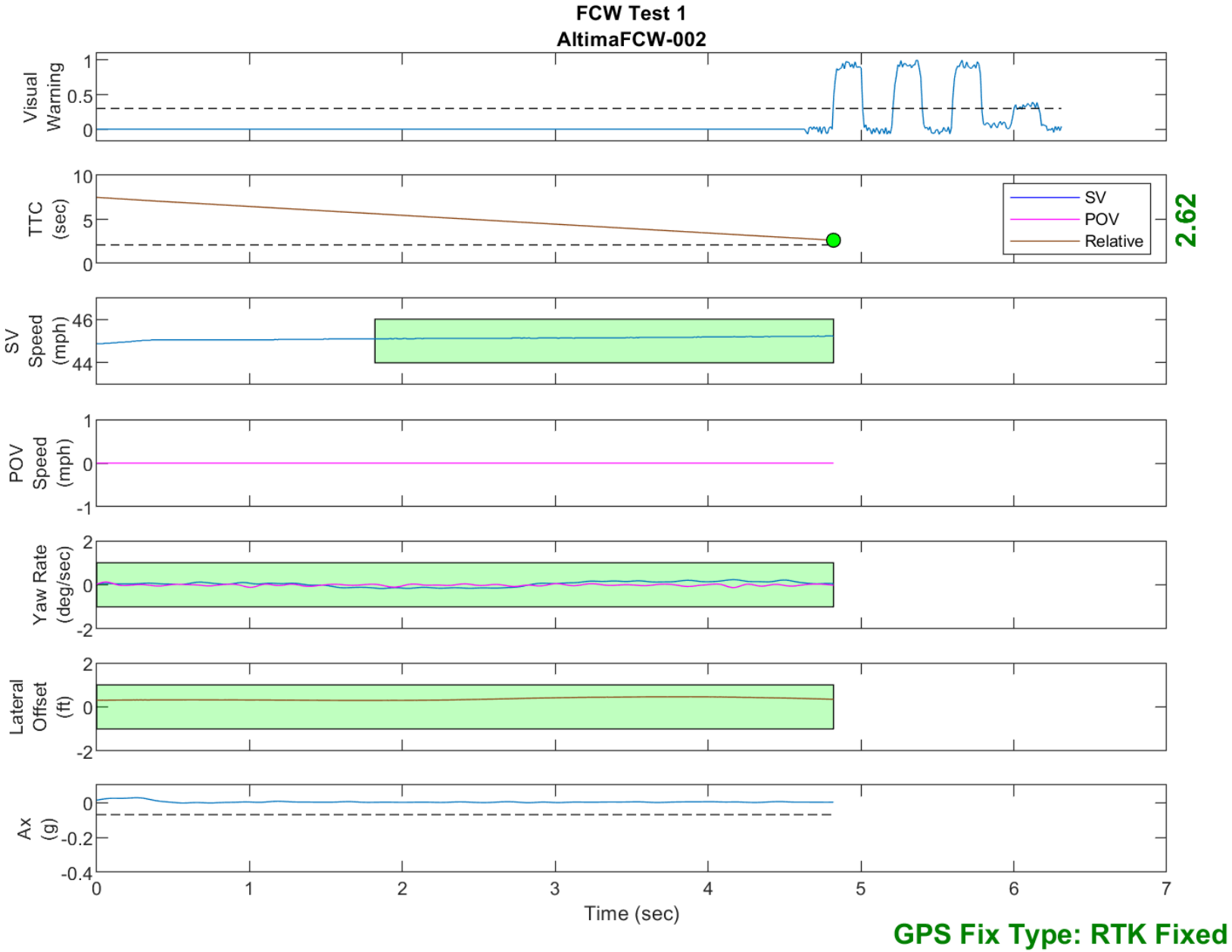


Figure D10. Time History for Run 2, FCW Test 1, Visual Warning

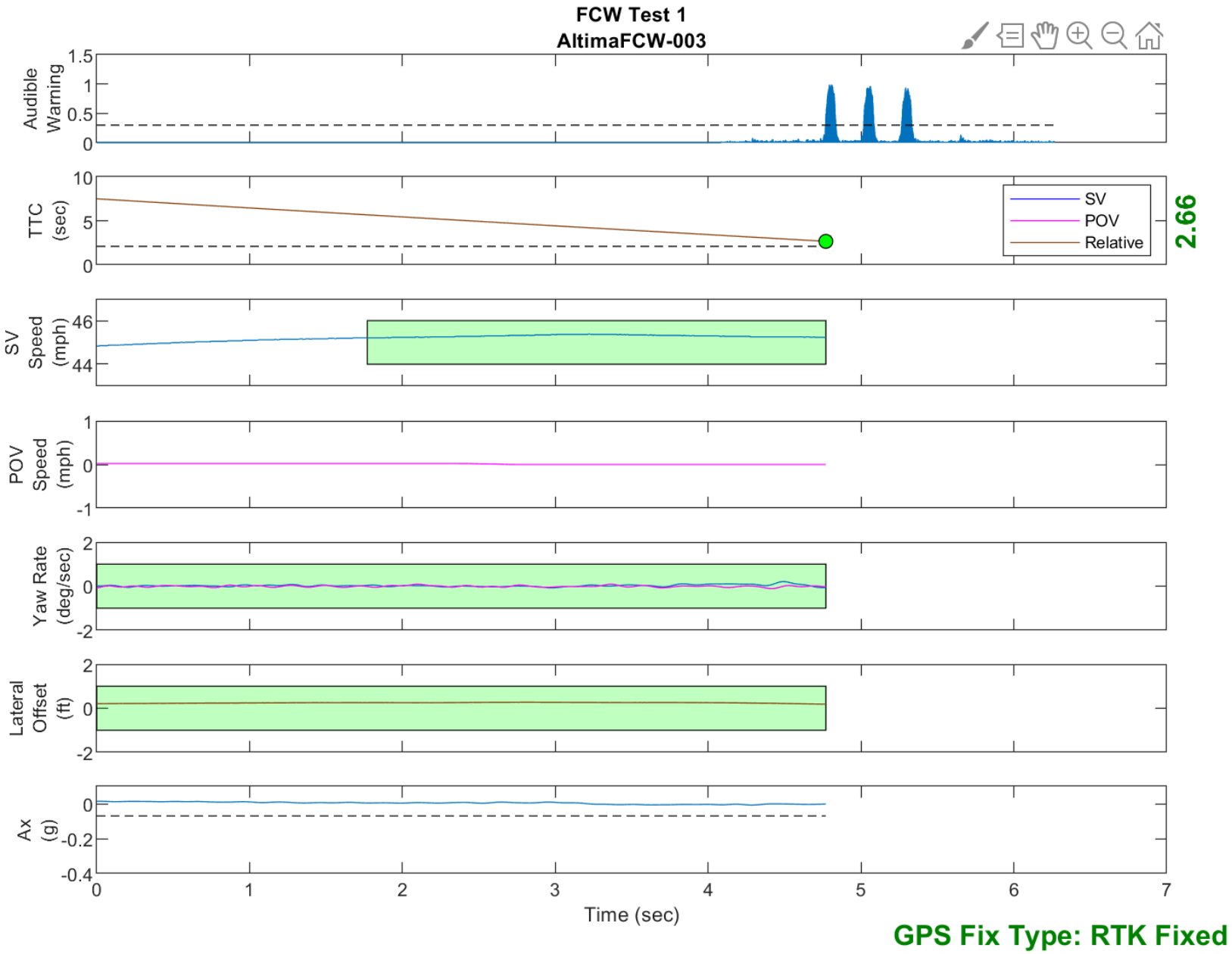


Figure D11. Time History for Run 3, FCW Test 1, Audible Warning

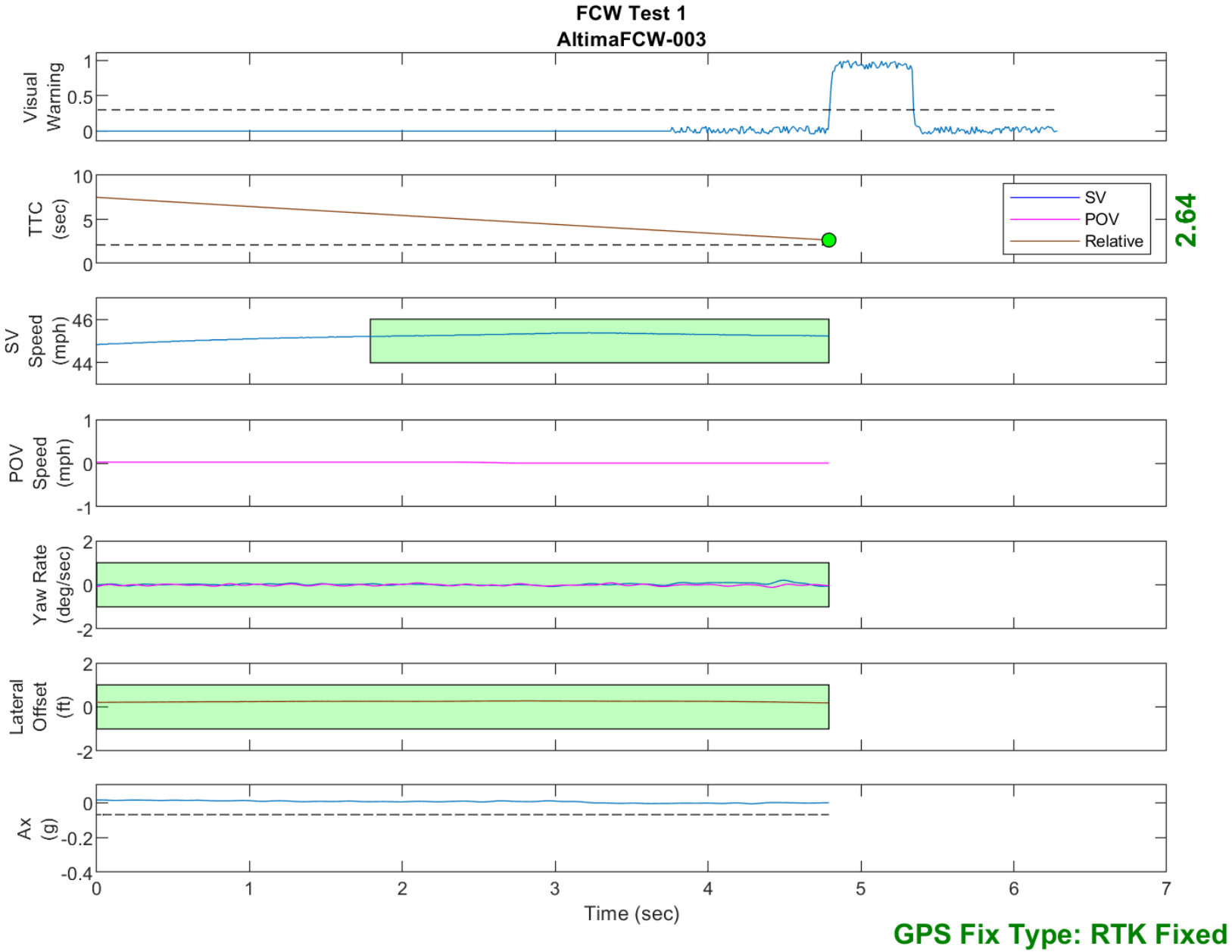


Figure D12. Time History for Run 3, FCW Test 1, Visual Warning

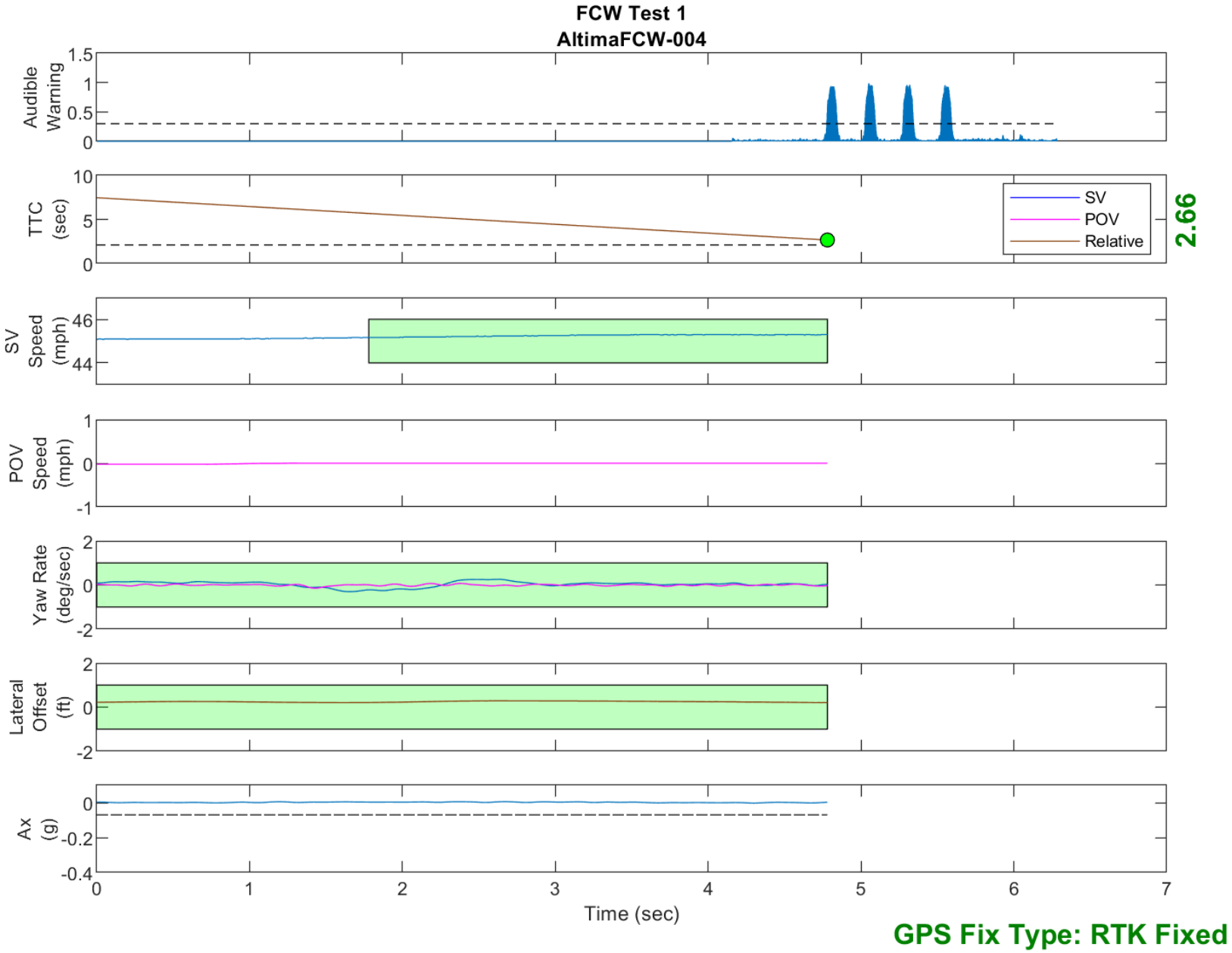


Figure D13. Time History for Run 4, FCW Test 1, Audible Warning

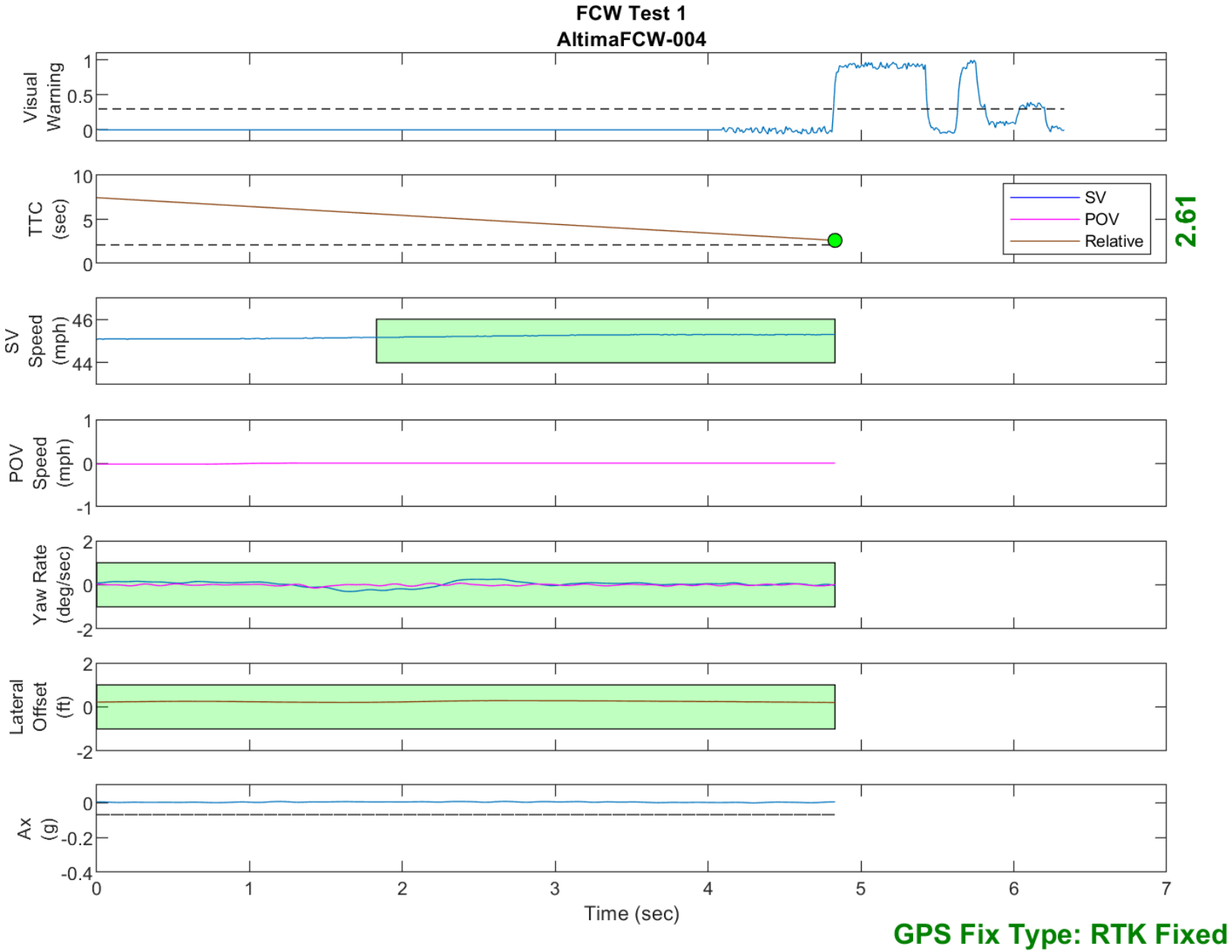


Figure D14. Time History for Run 4, FCW Test 1, Visual Warning

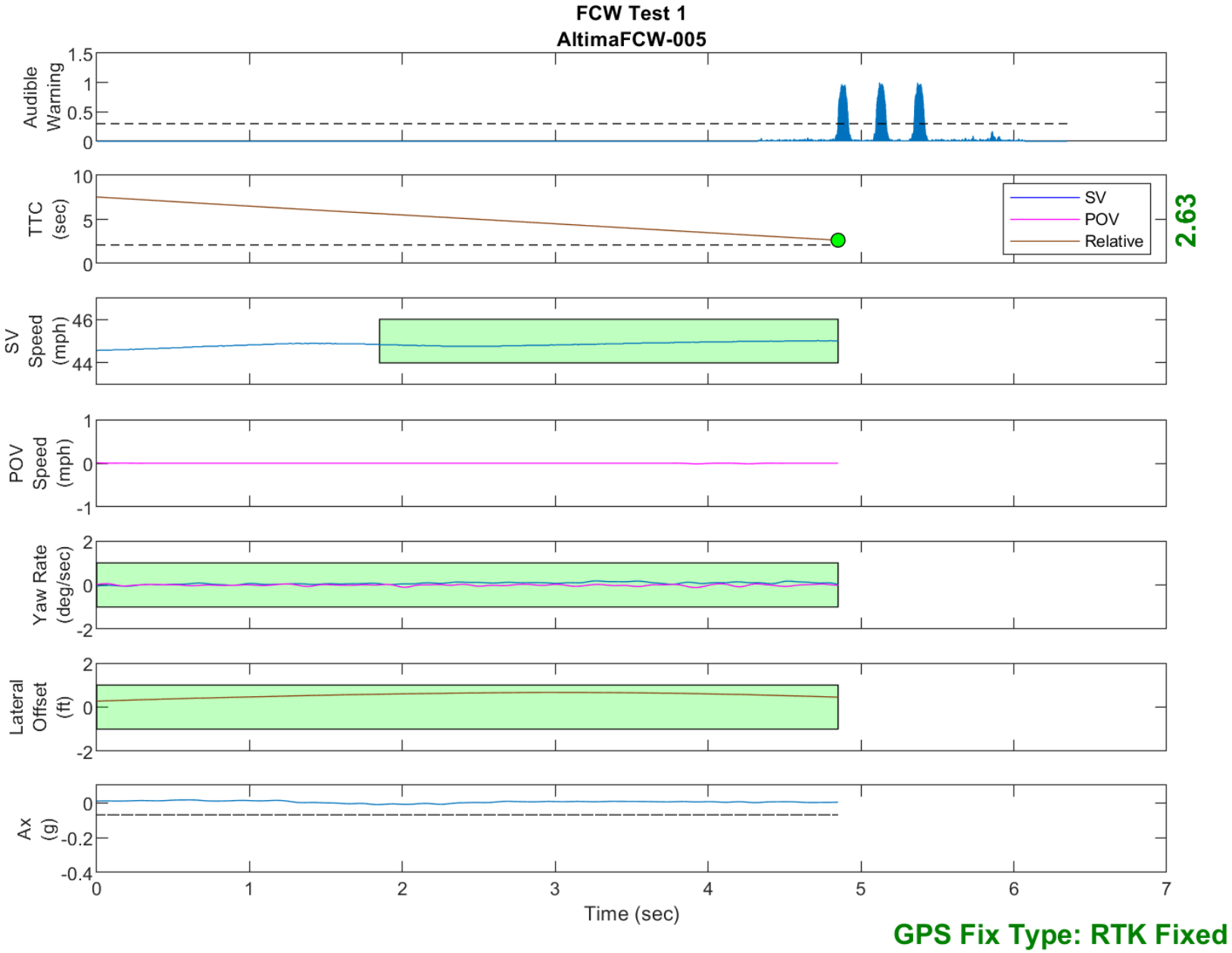


Figure D15. Time History for Run 5, FCW Test 1, Audible Warning

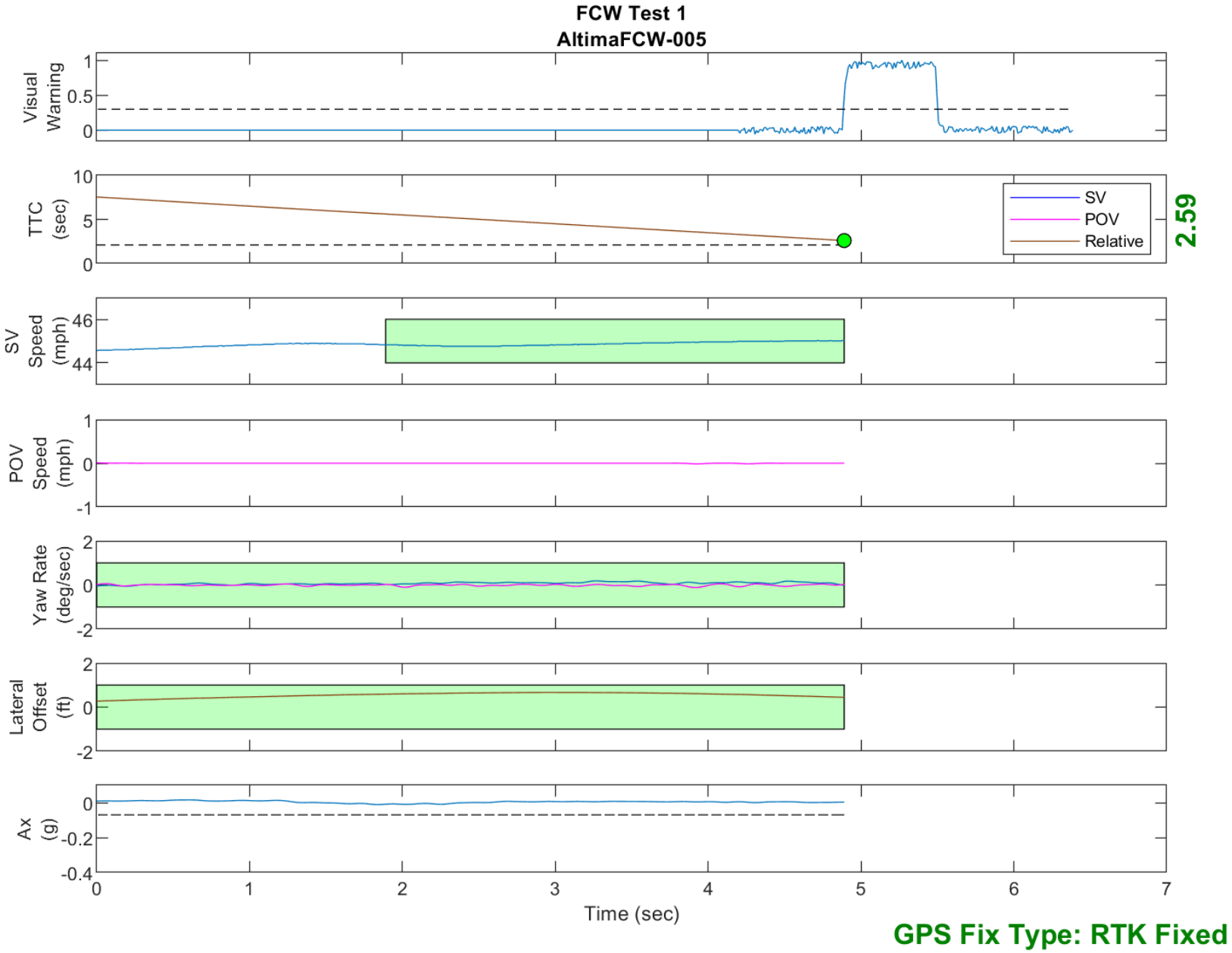


Figure D16. Time History for Run 5, FCW Test 1, Visual Warning

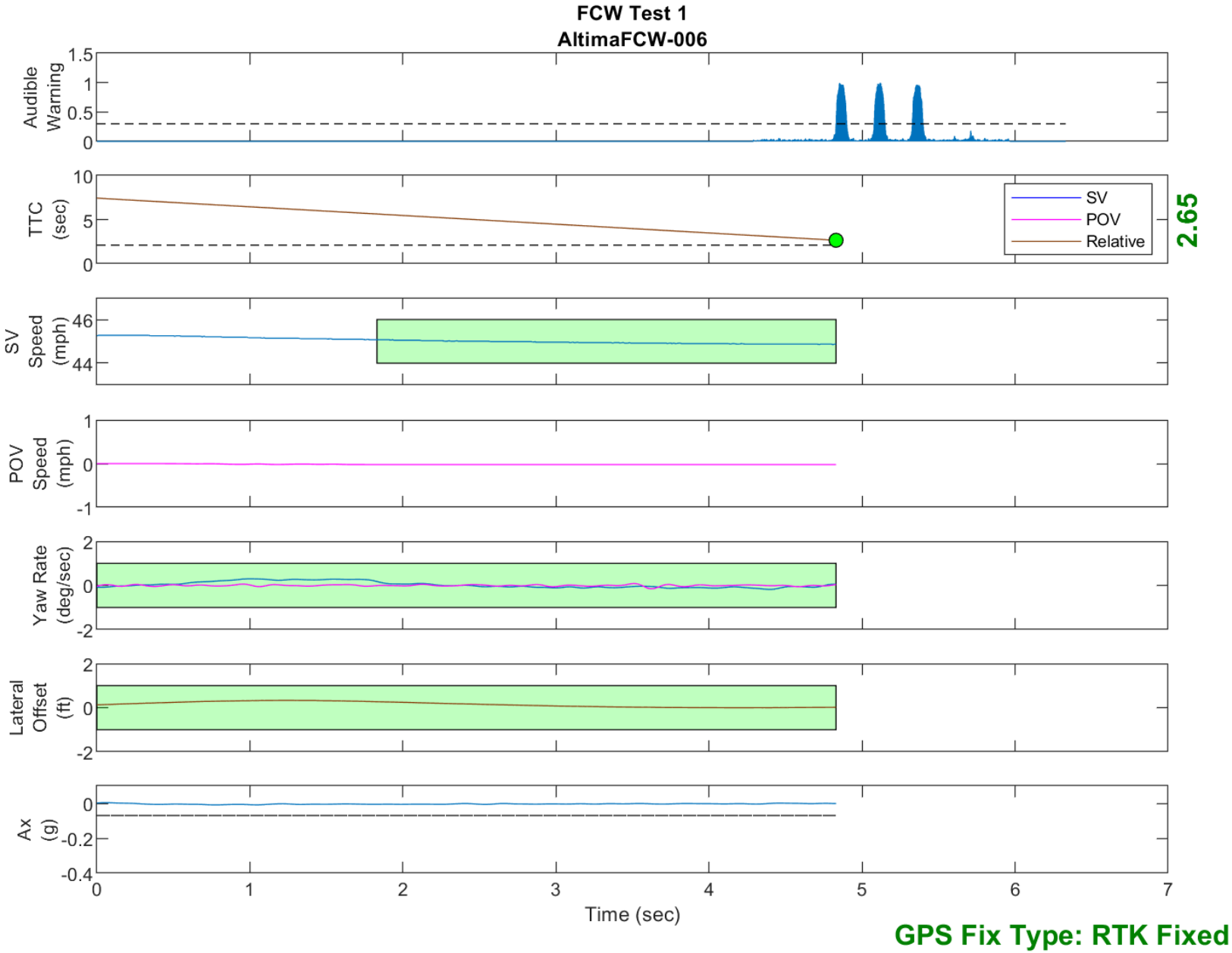


Figure D17. Time History for Run 6, FCW Test 1, Audible Warning

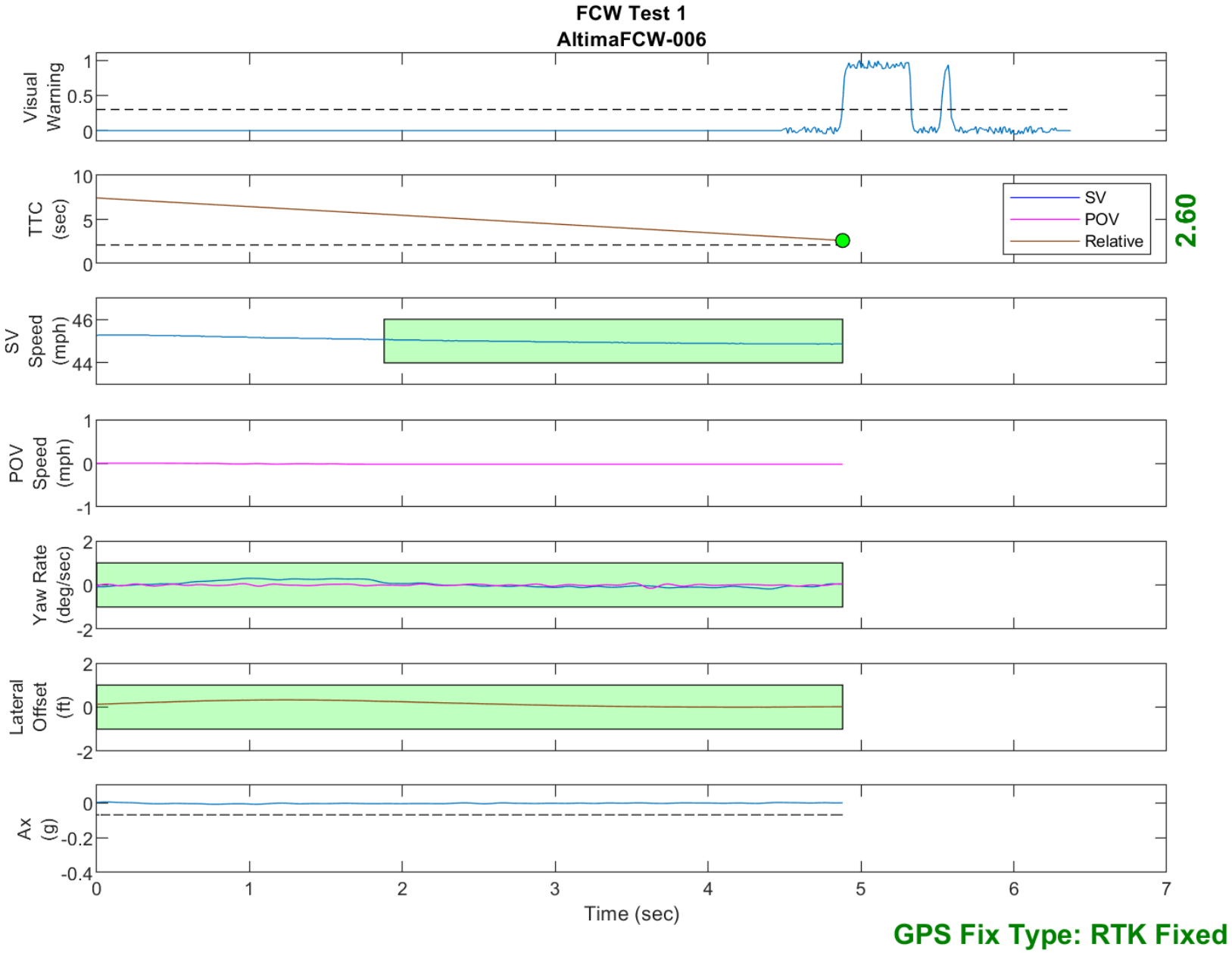


Figure D18. Time History for Run 6, FCW Test 1, Visual Warning

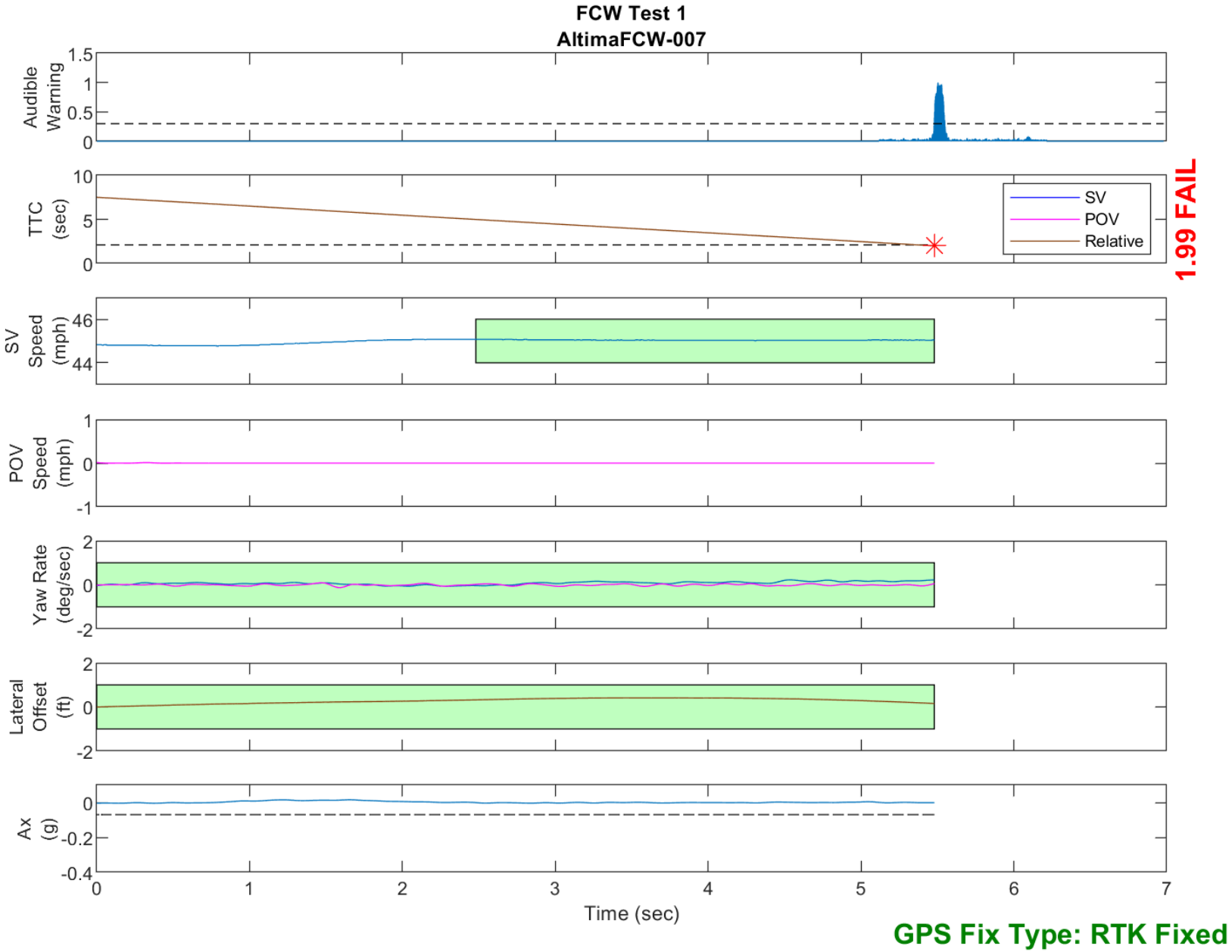


Figure D19. Time History for Run 7, FCW Test 1, Audible Warning

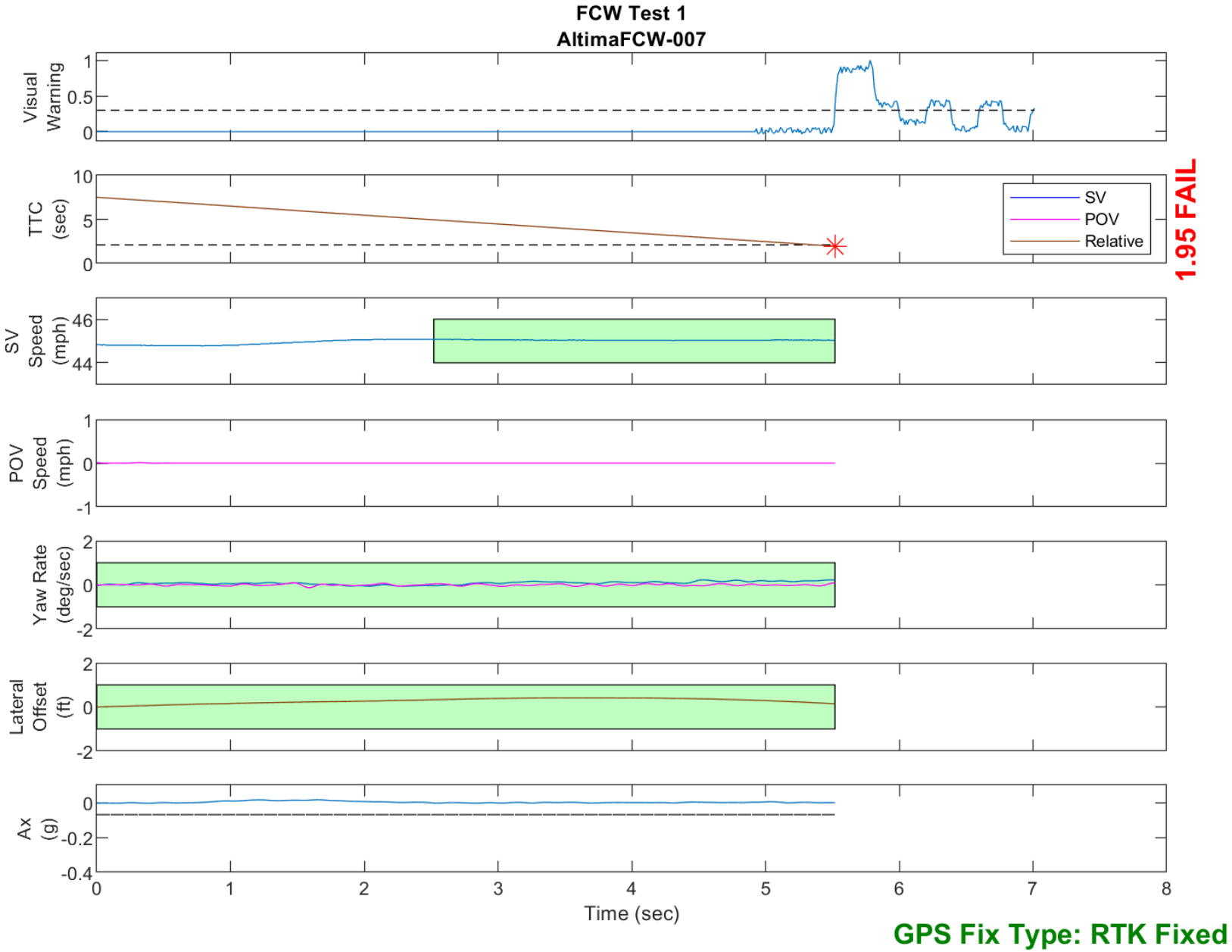


Figure D20. Time History for Run 7, FCW Test 1, Visual Warning

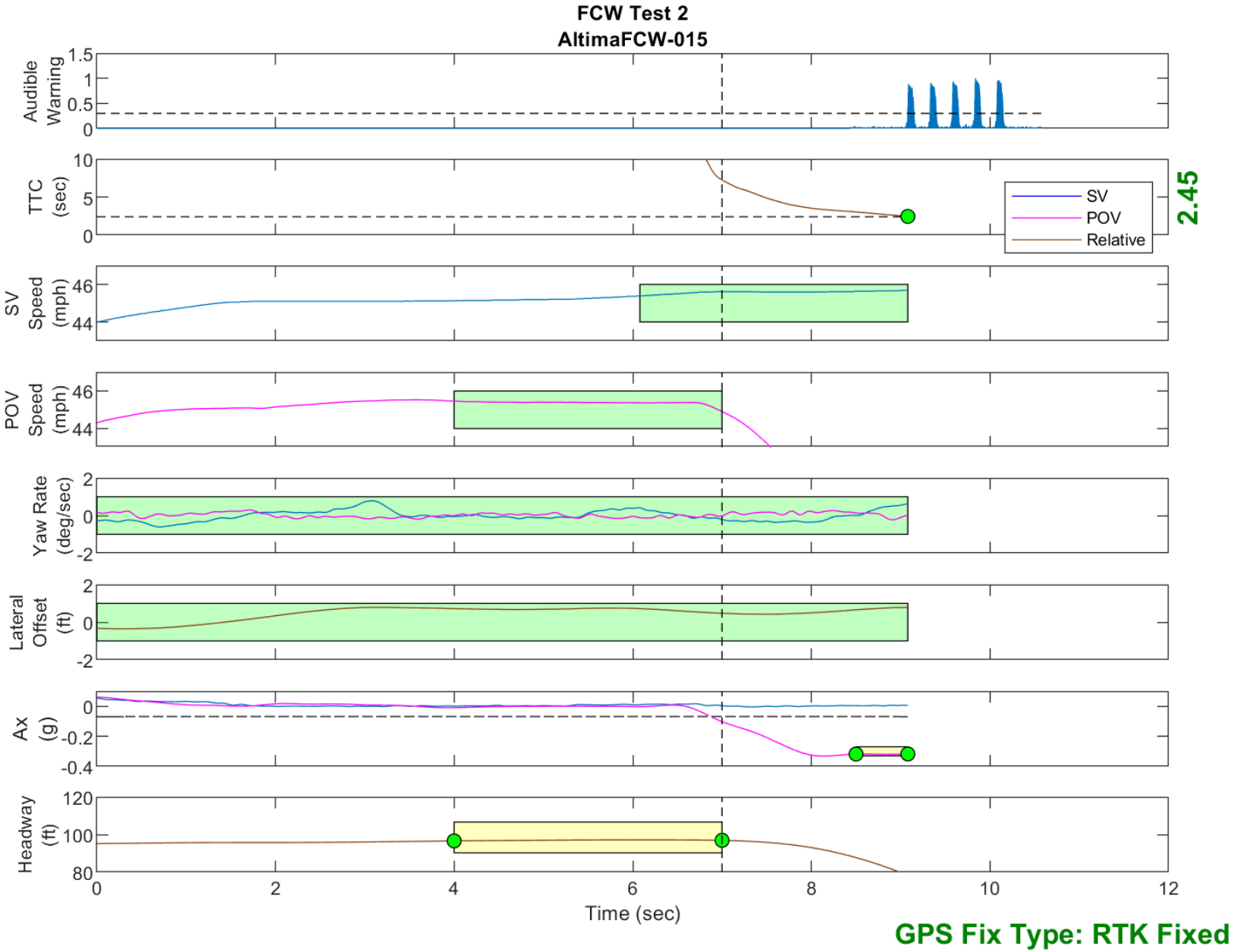


Figure D21. Time History for Run 15, FCW Test 2, Audible Warning

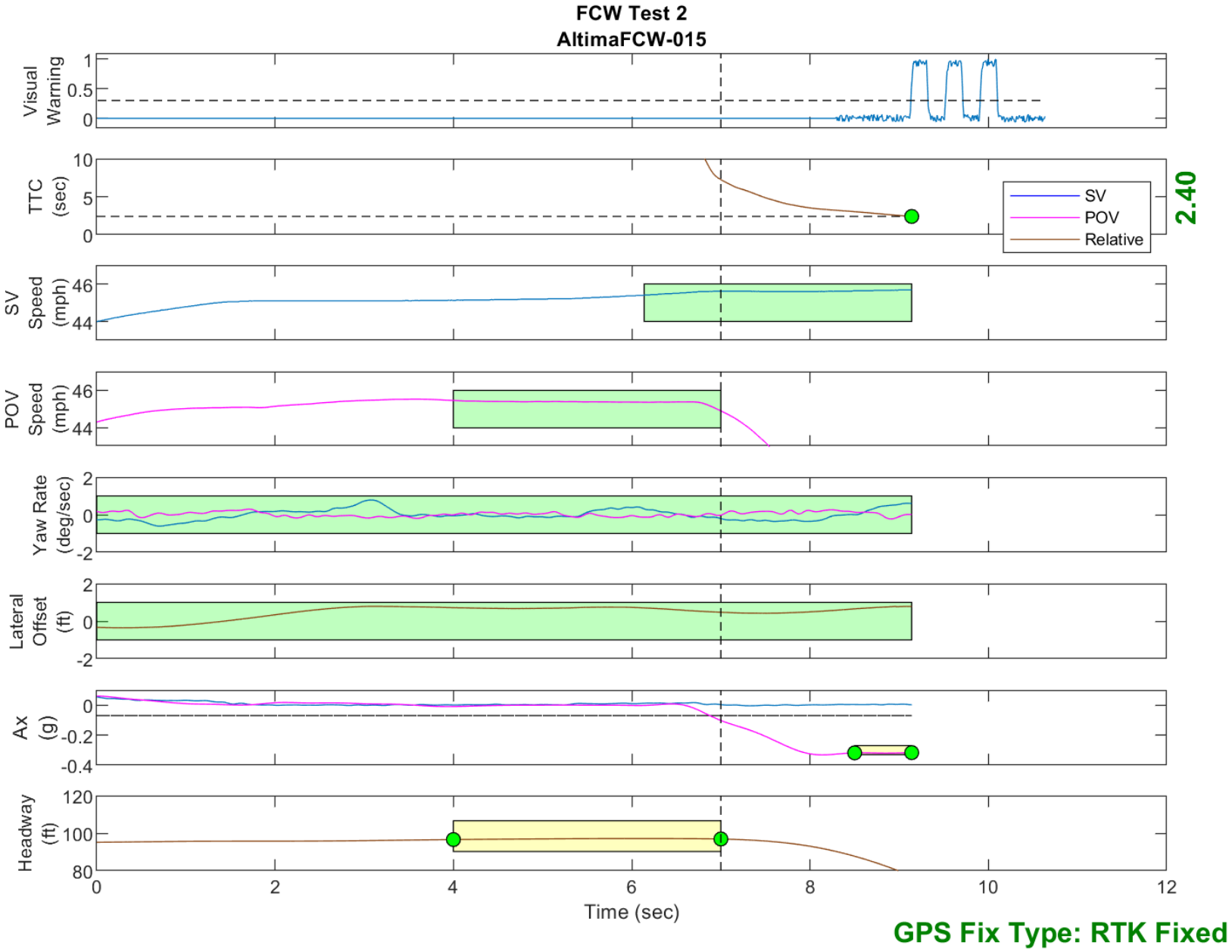


Figure D22. Time History for Run 15, FCW Test 2, Visual Warning

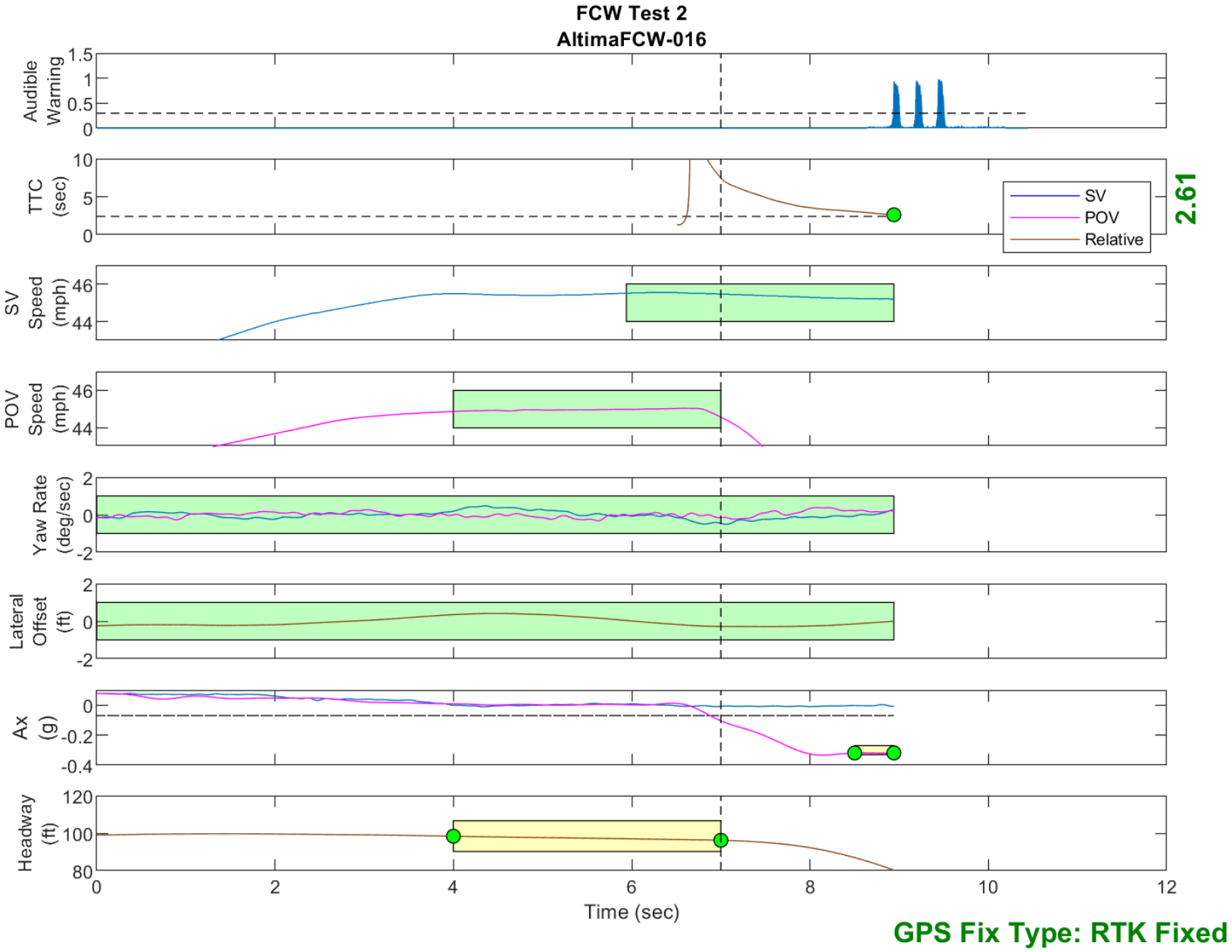


Figure D23. Time History for Run 16, FCW Test 2, Audible Warning

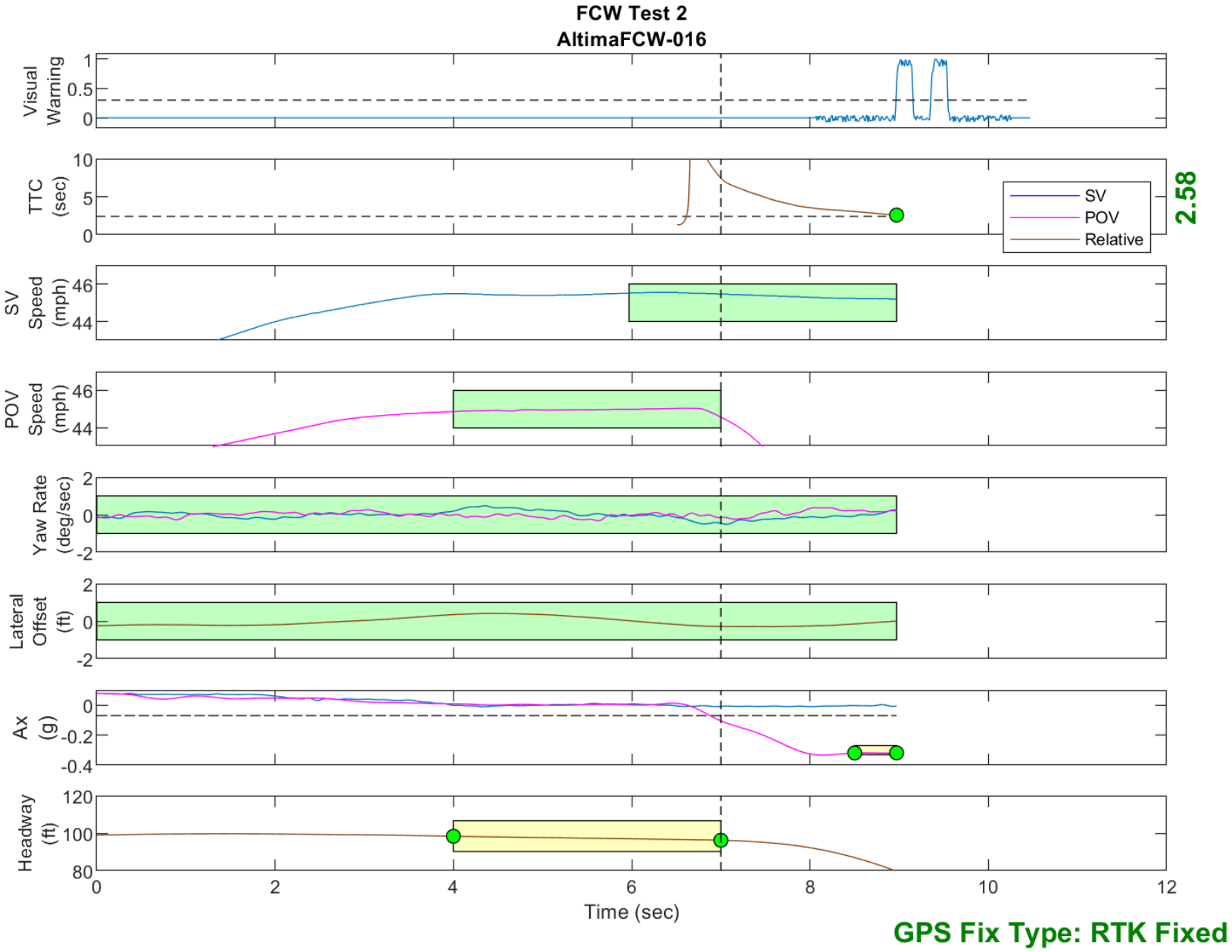


Figure D24. Time History for Run 16, FCW Test 2, Visual Warning

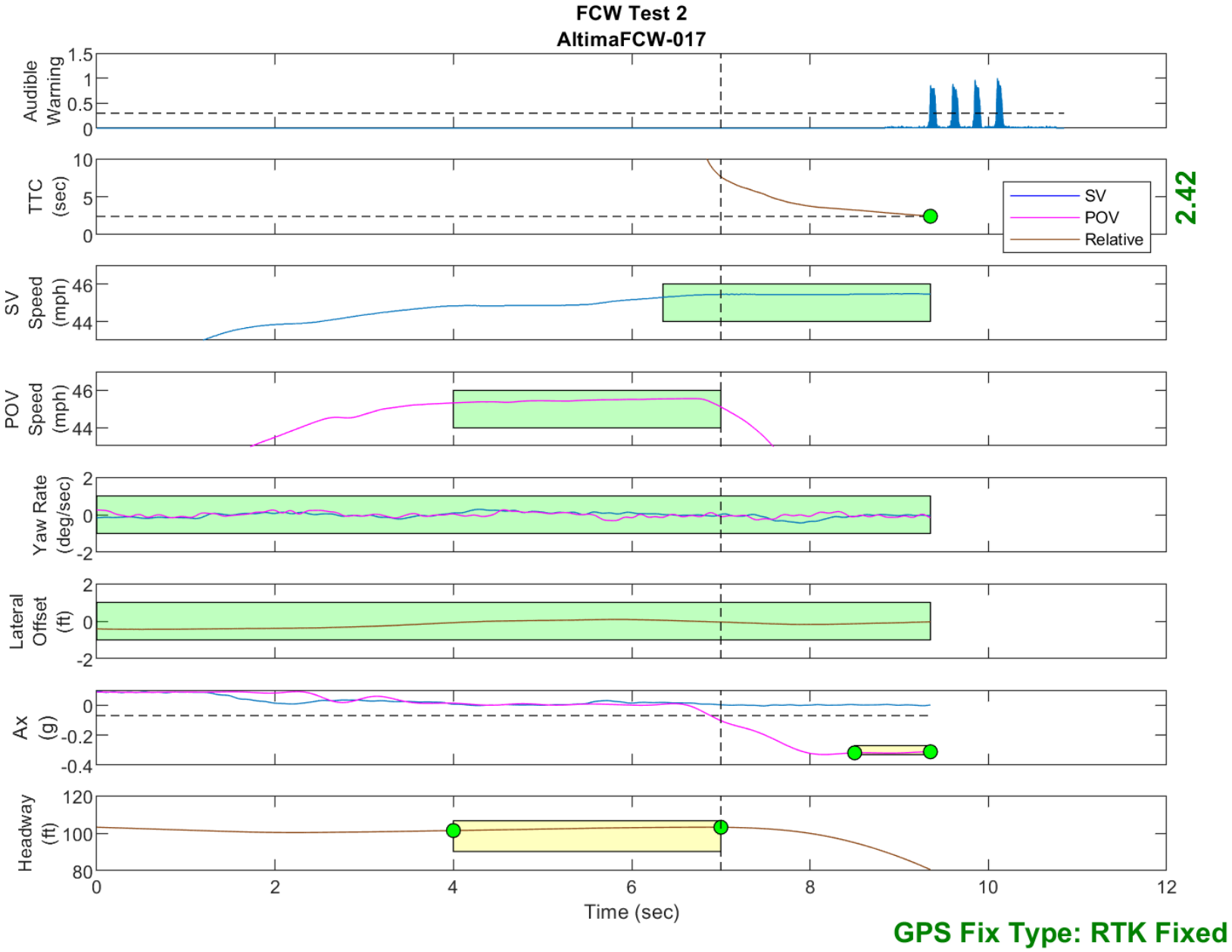


Figure D25. Time History for Run 17, FCW Test 2, Audible Warning

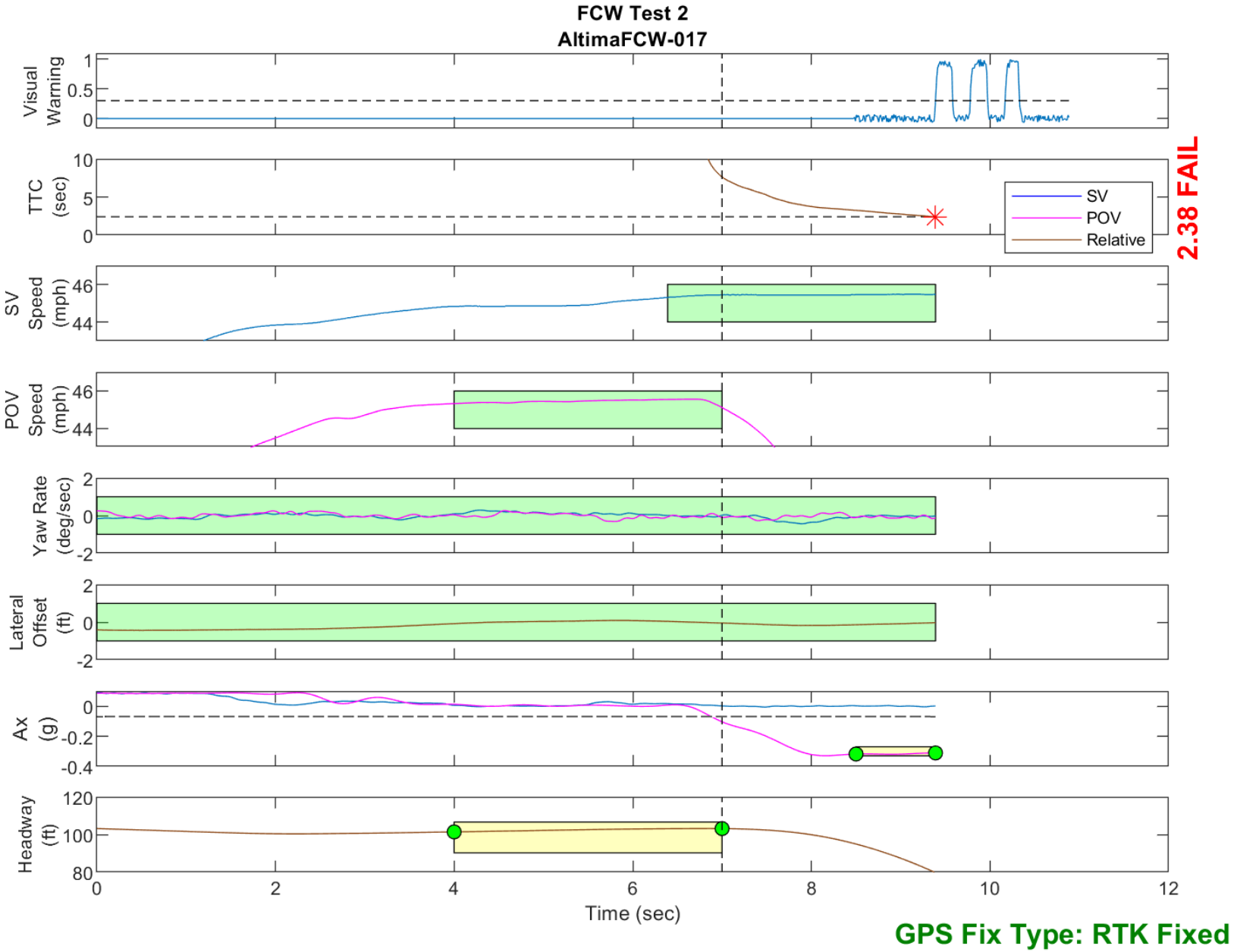


Figure D26. Time History for Run 17, FCW Test 2, Visual Warning

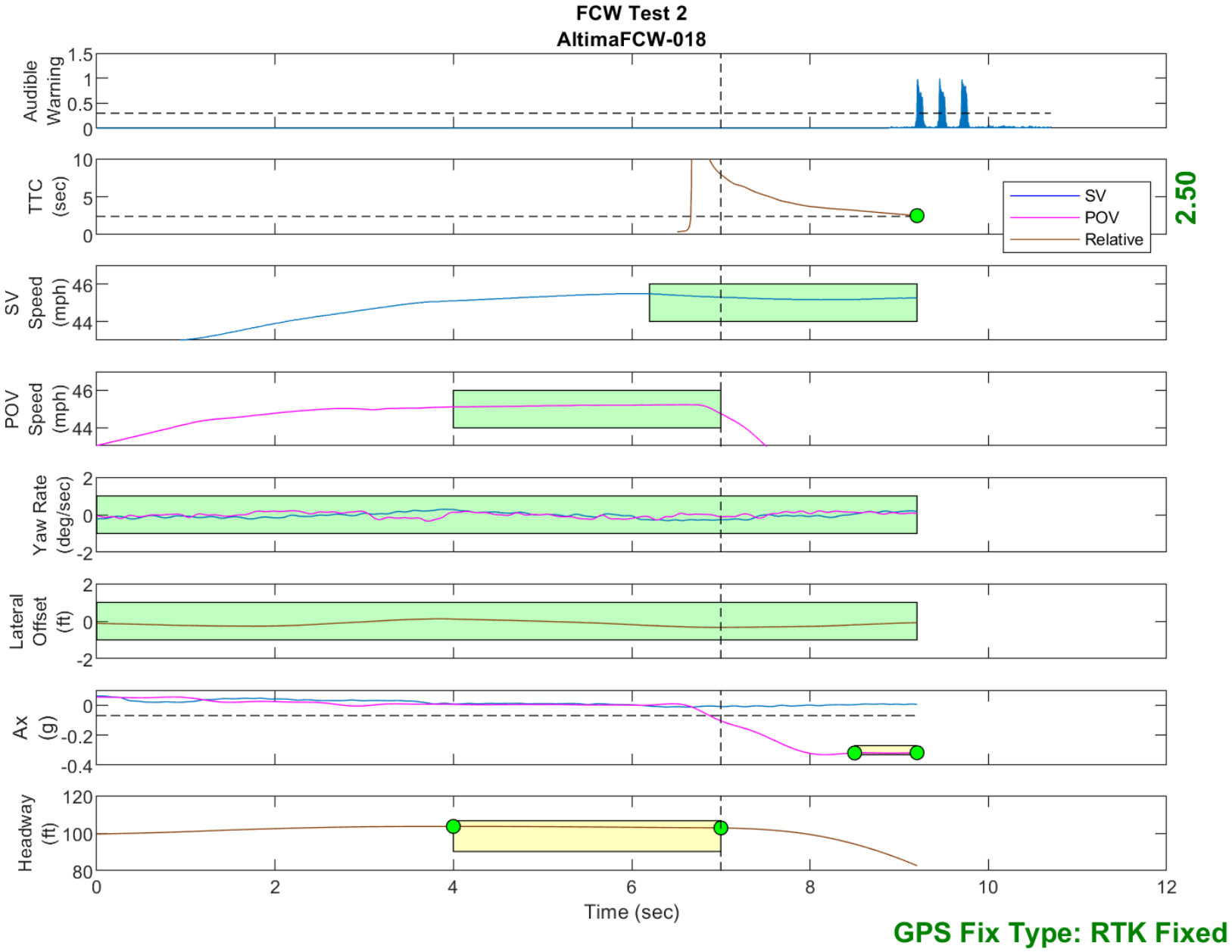


Figure D27. Time History for Run 18, FCW Test 2, Audible Warning

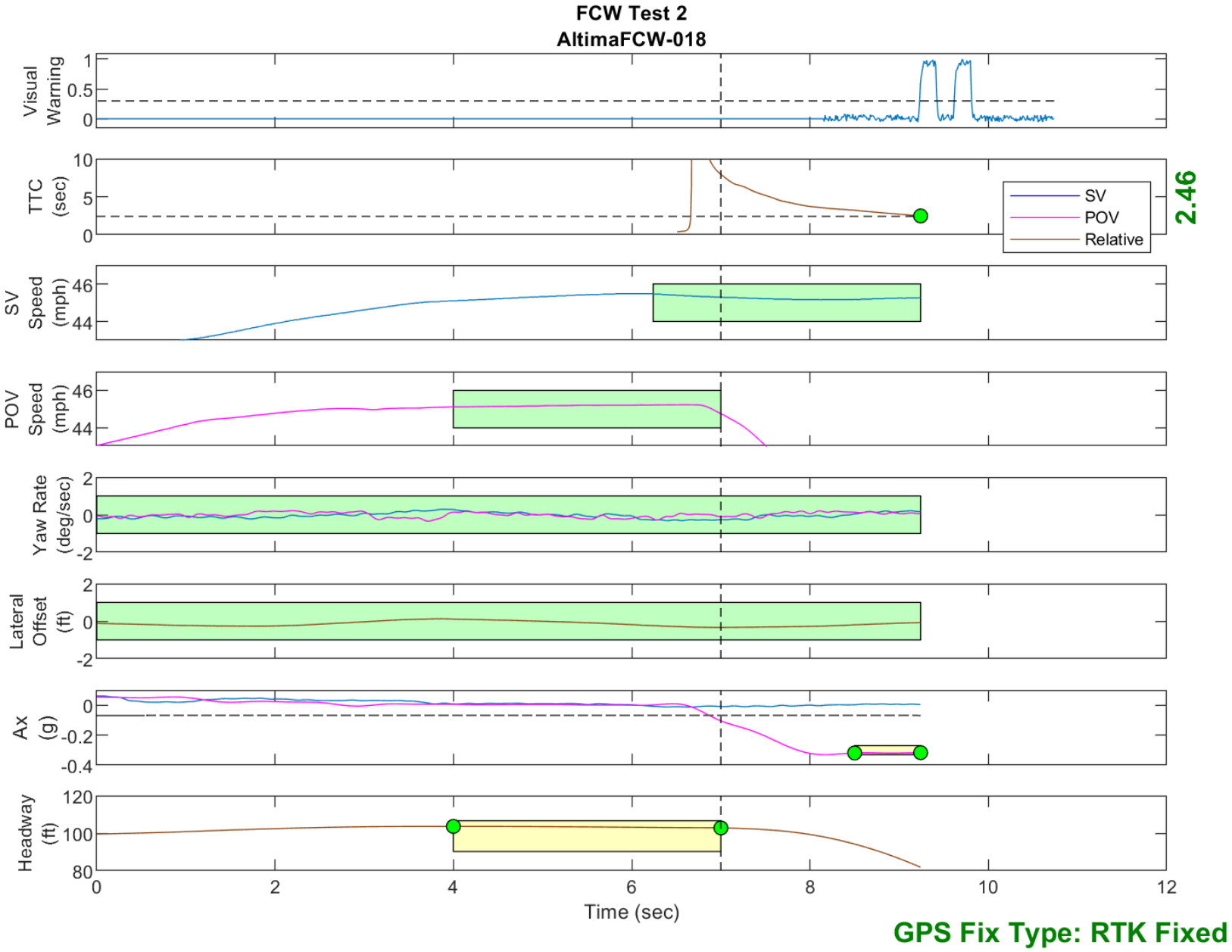


Figure D28. Time History for Run 18, FCW Test 2, Visual Warning

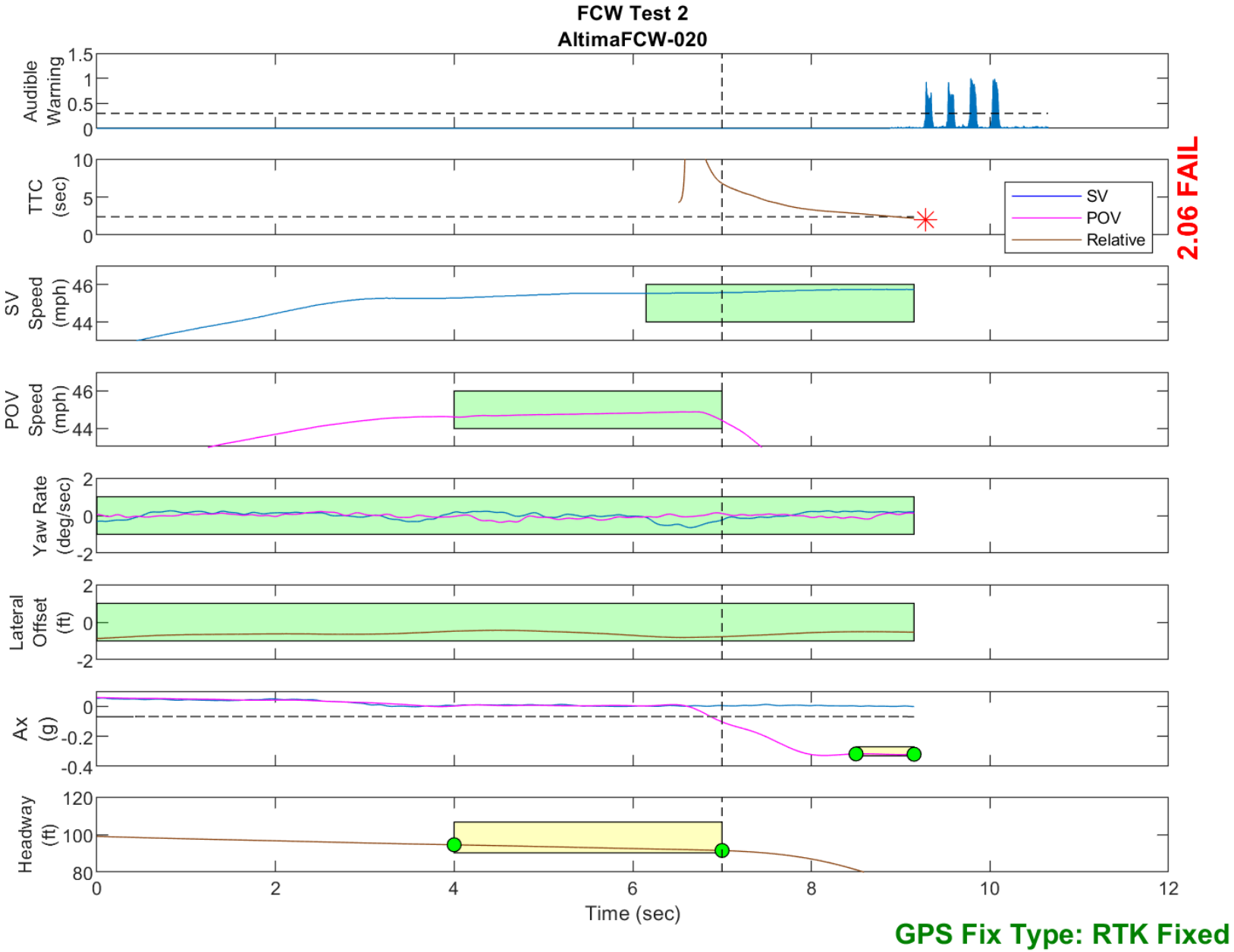


Figure D29. Time History for Run 20, FCW Test 2, Audible Warning

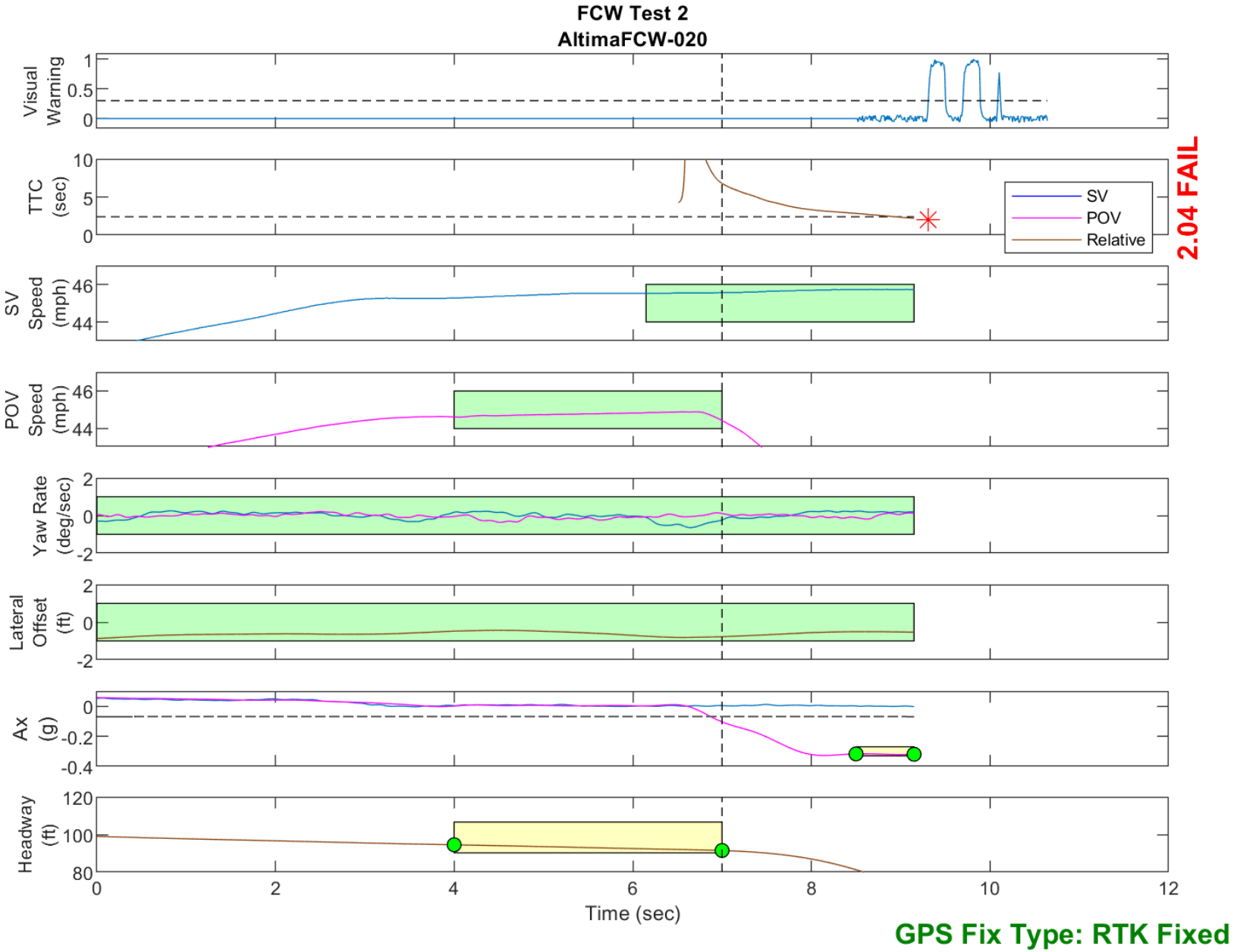


Figure D30. Time History for Run 20, FCW Test 2, Visual Warning

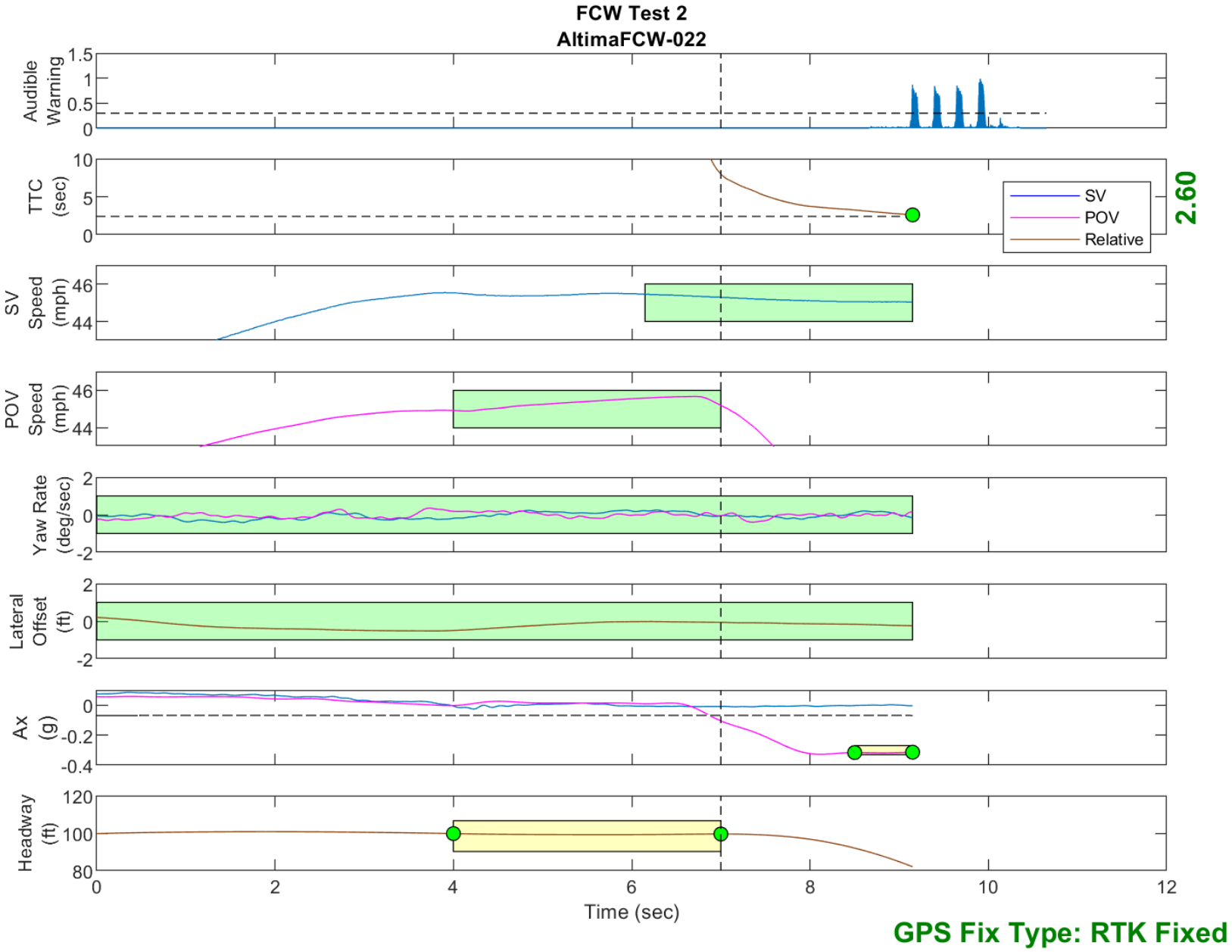


Figure D31. Time History for Run 22, FCW Test 2, Audible Warning

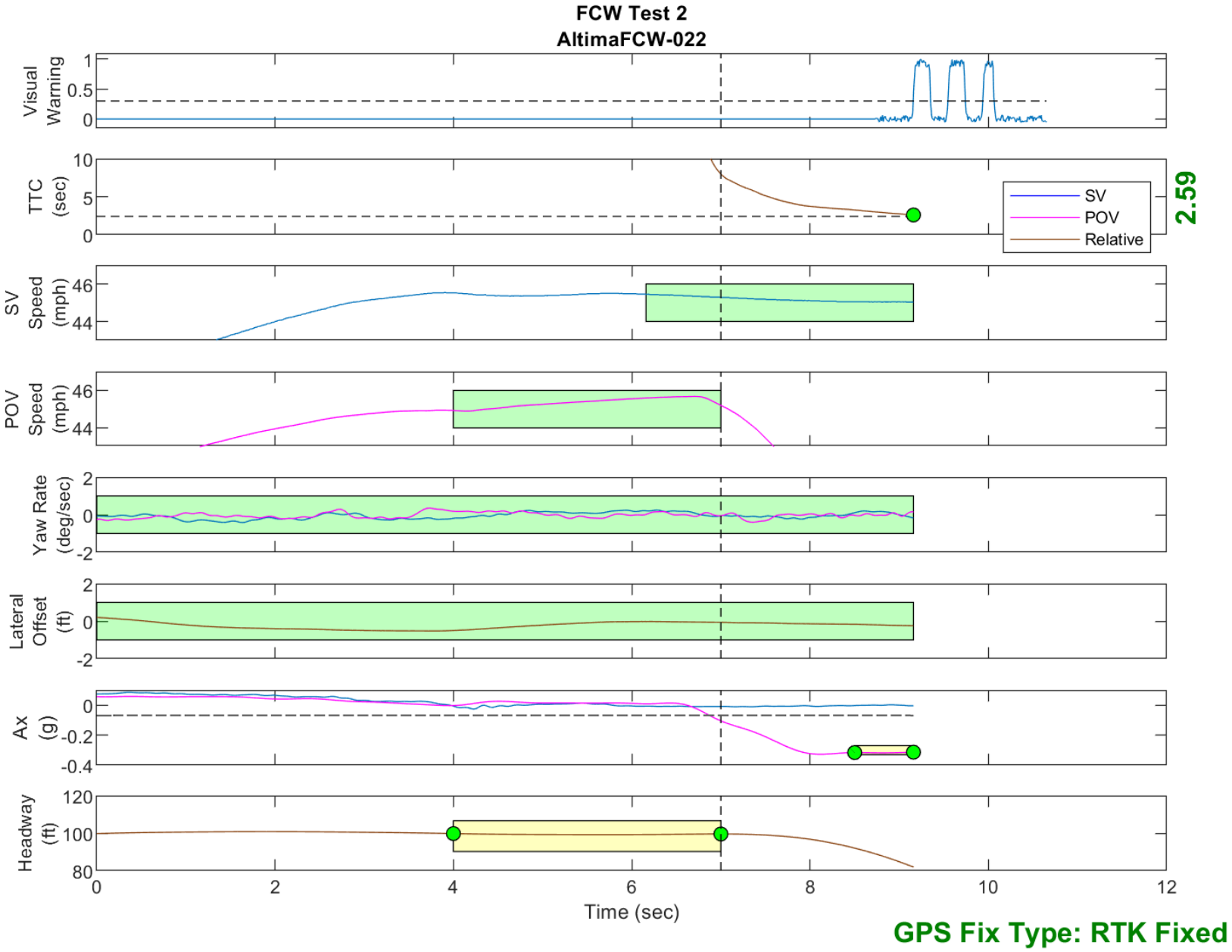


Figure D32. Time History for Run 22, FCW Test 2, Visual Warning

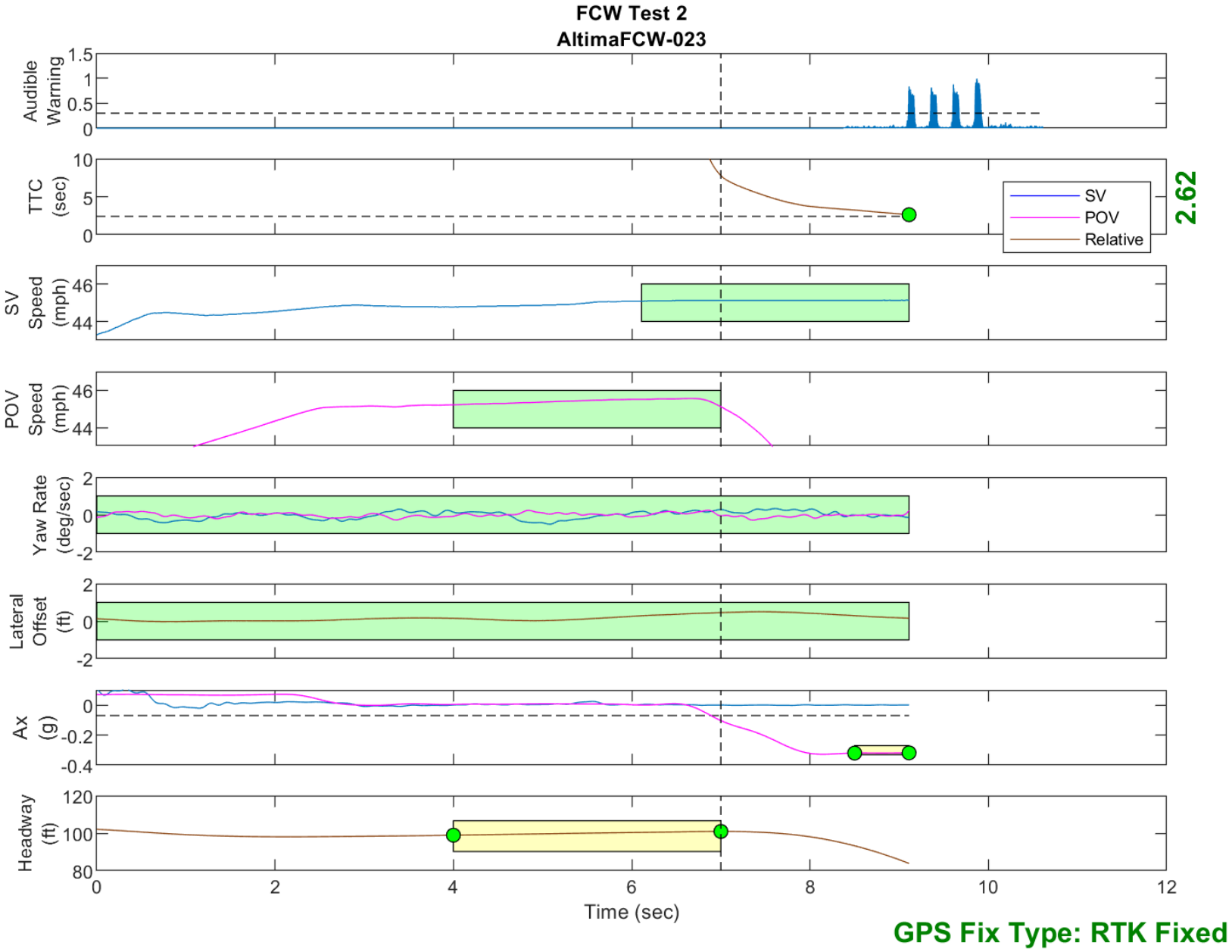


Figure D33. Time History for Run 23, FCW Test 2, Audible Warning

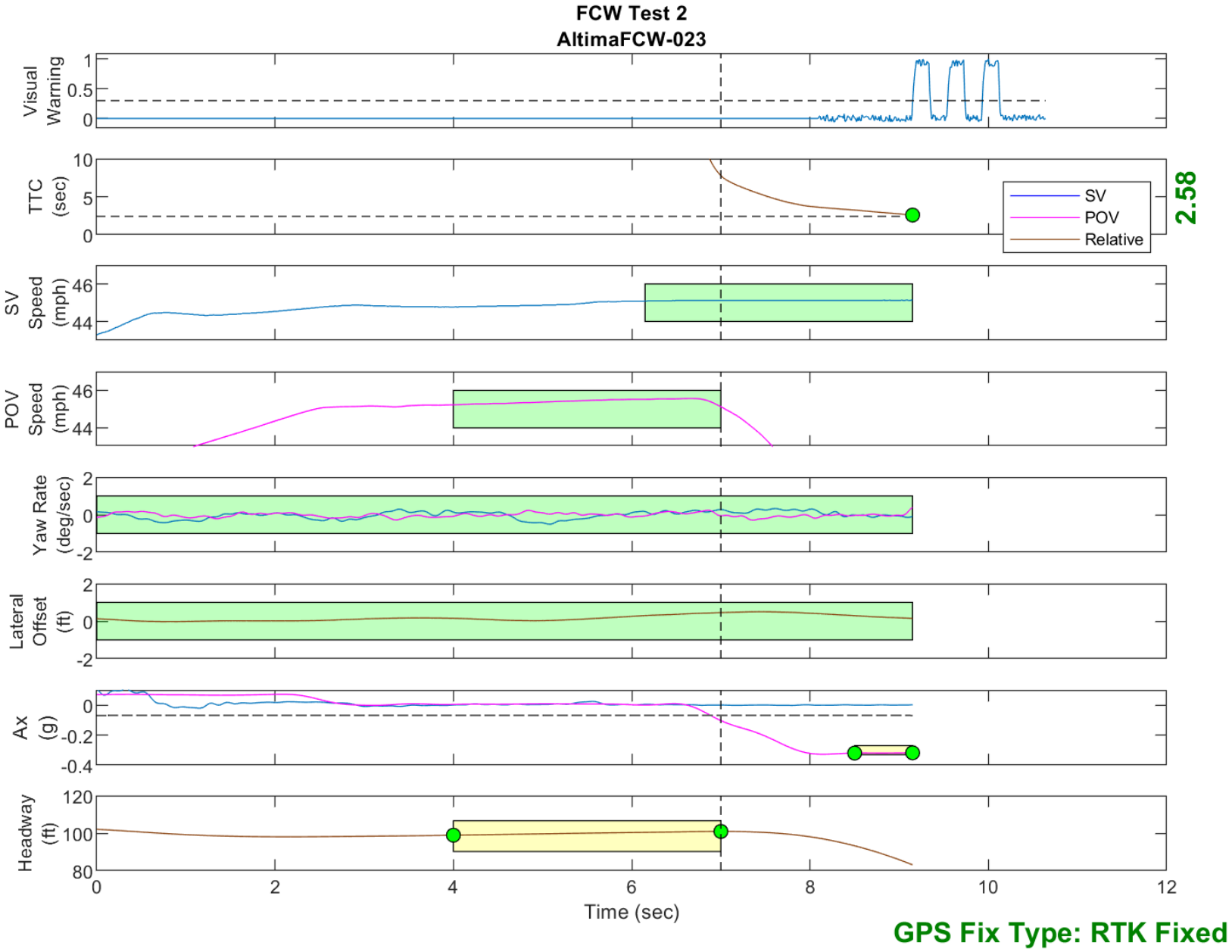


Figure D34. Time History for Run 23, FCW Test 2, Visual Warning

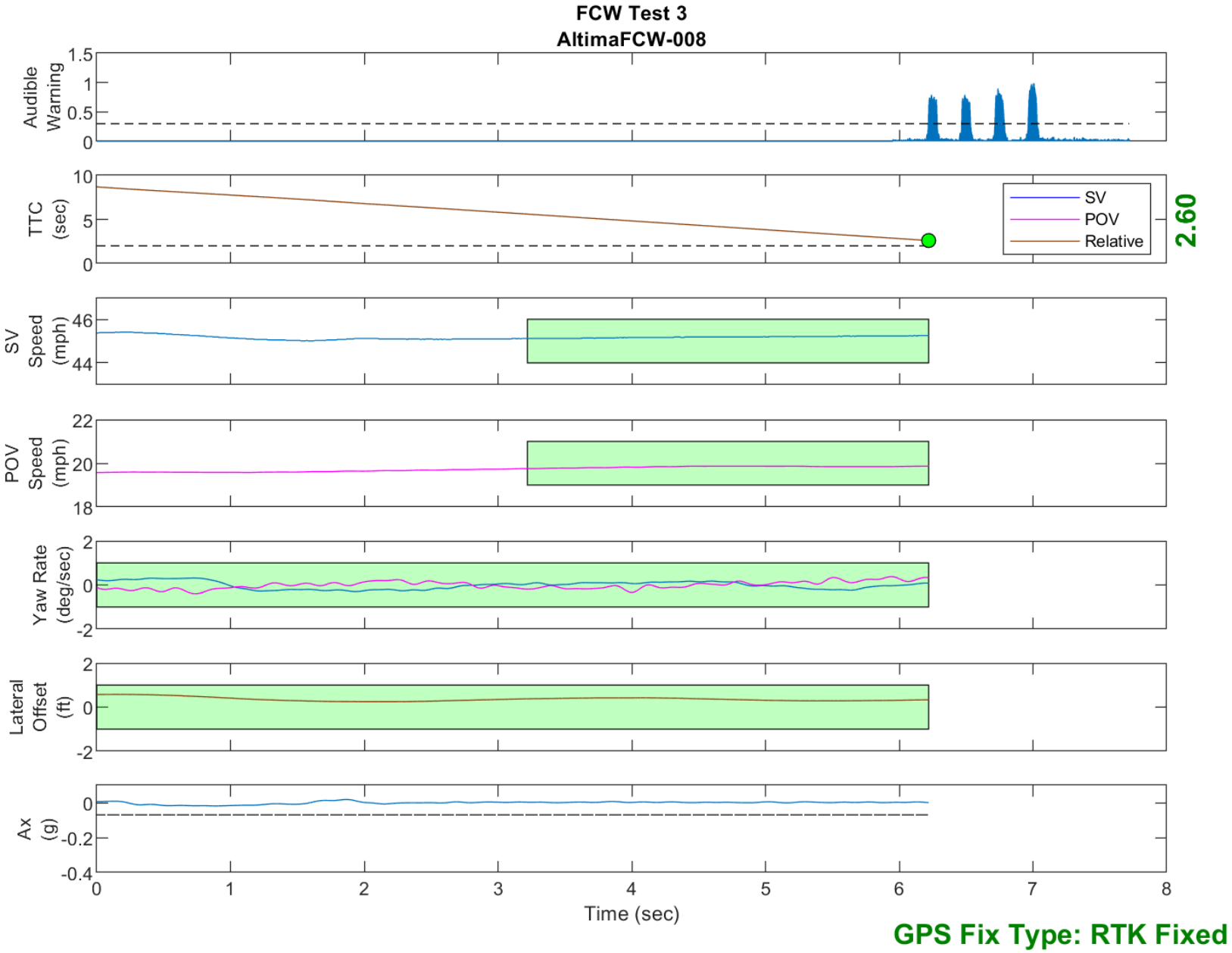


Figure D35. Time History for Run 8, FCW Test 3, Audible Warning

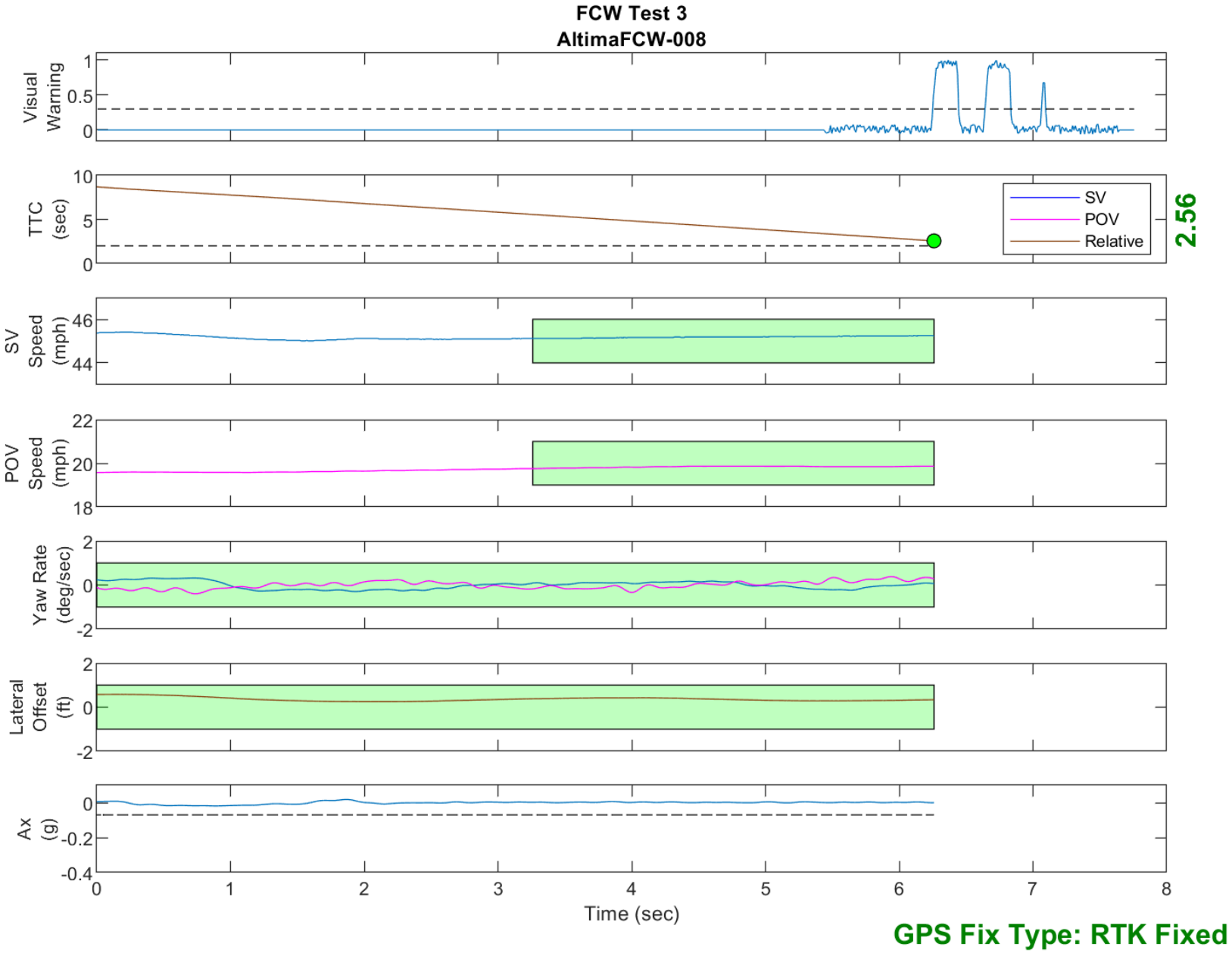


Figure D36. Time History for Run 8, FCW Test 3, Visual Warning

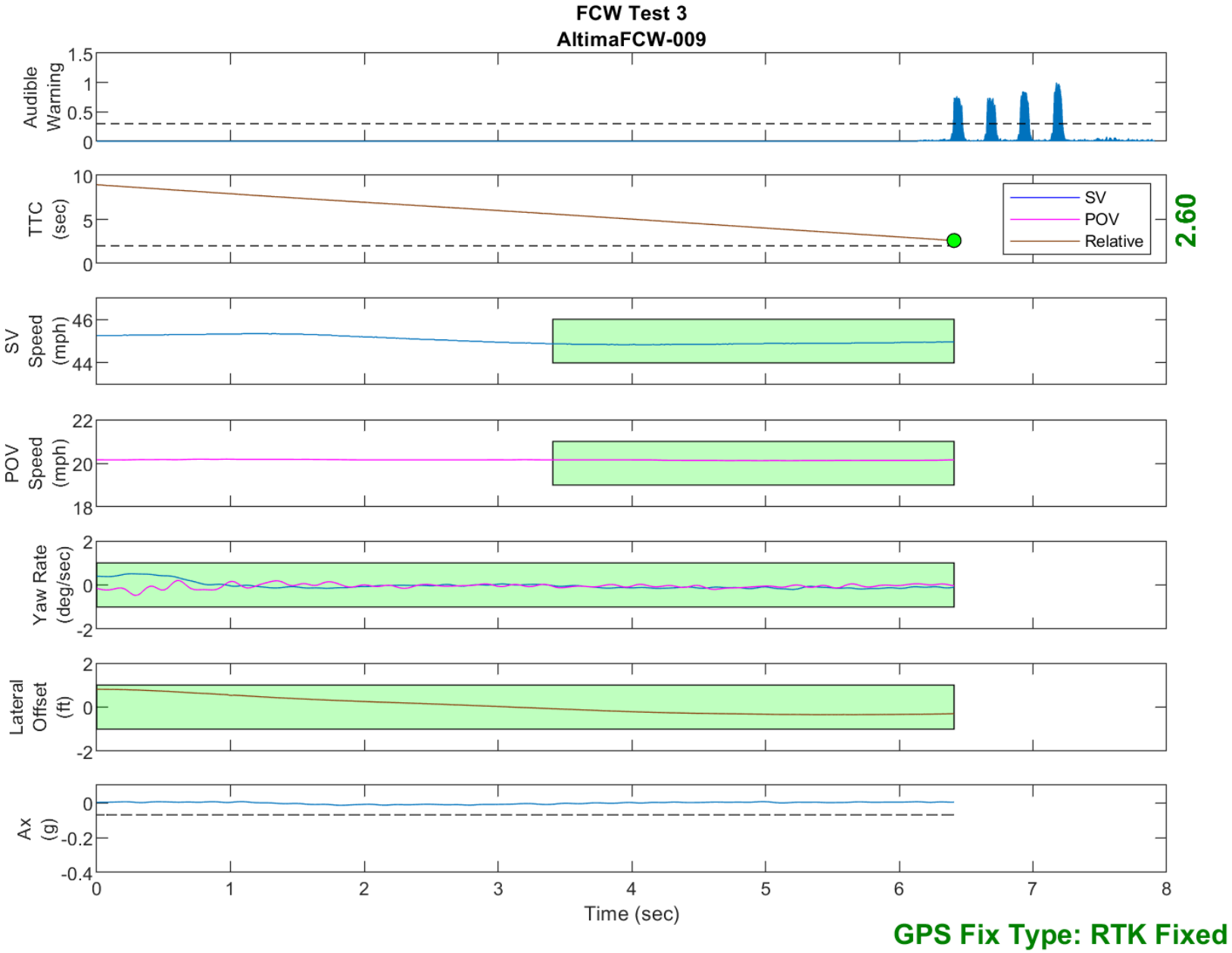


Figure D37. Time History for Run 9, FCW Test 3, Audible Warning

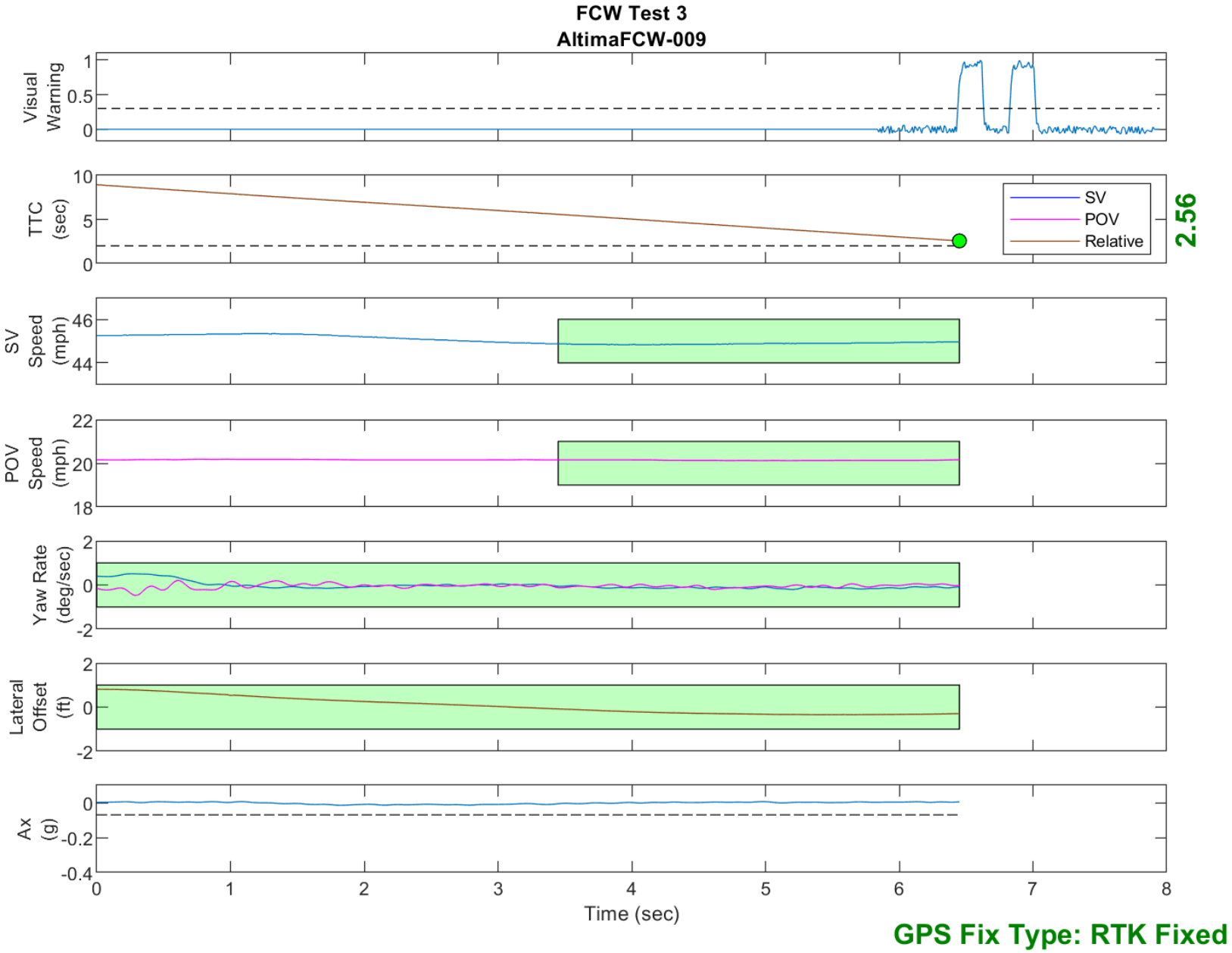


Figure D38. Time History for Run 9, FCW Test 3, Visual Warning

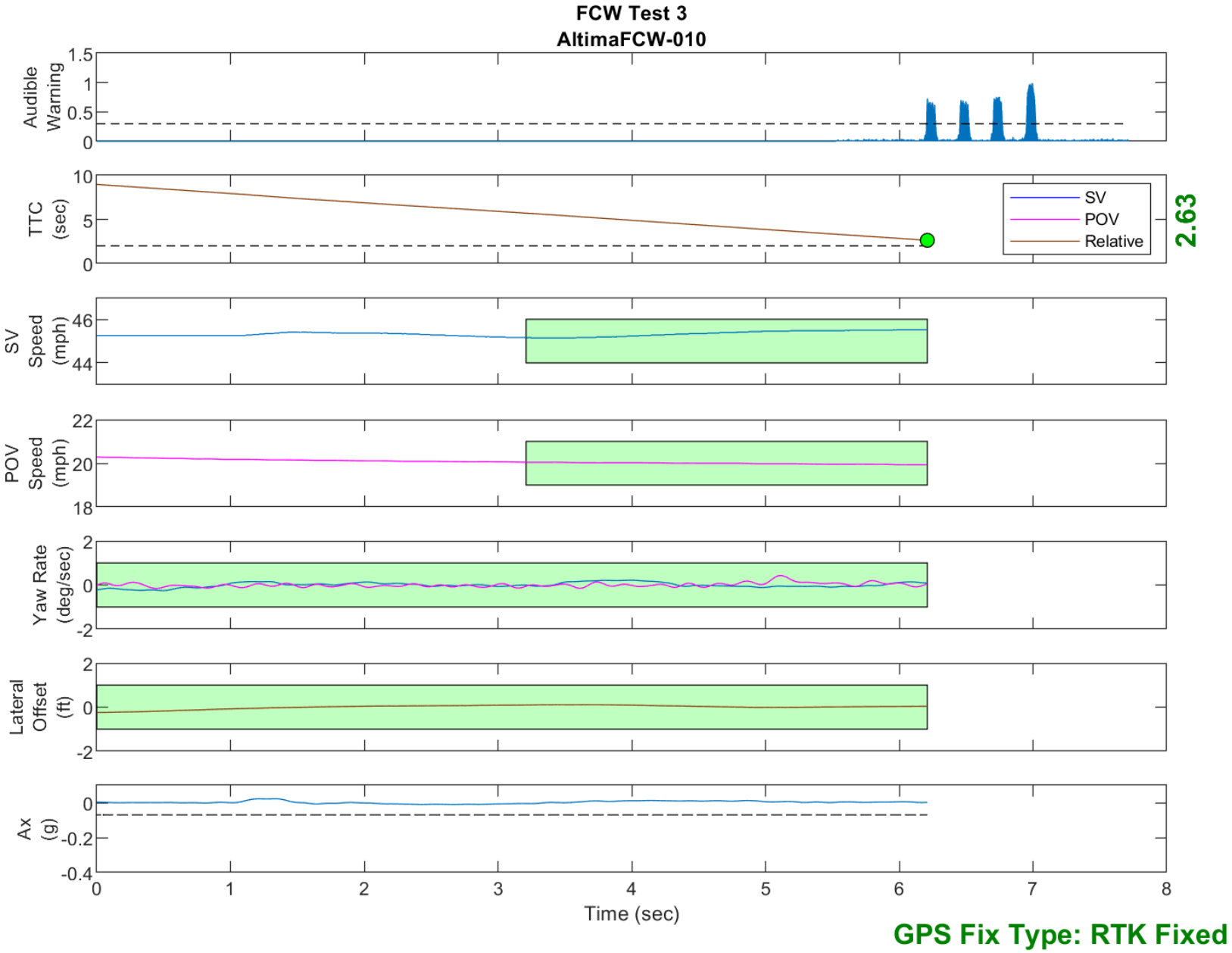


Figure D39. Time History for Run 10, FCW Test 3, Audible Warning

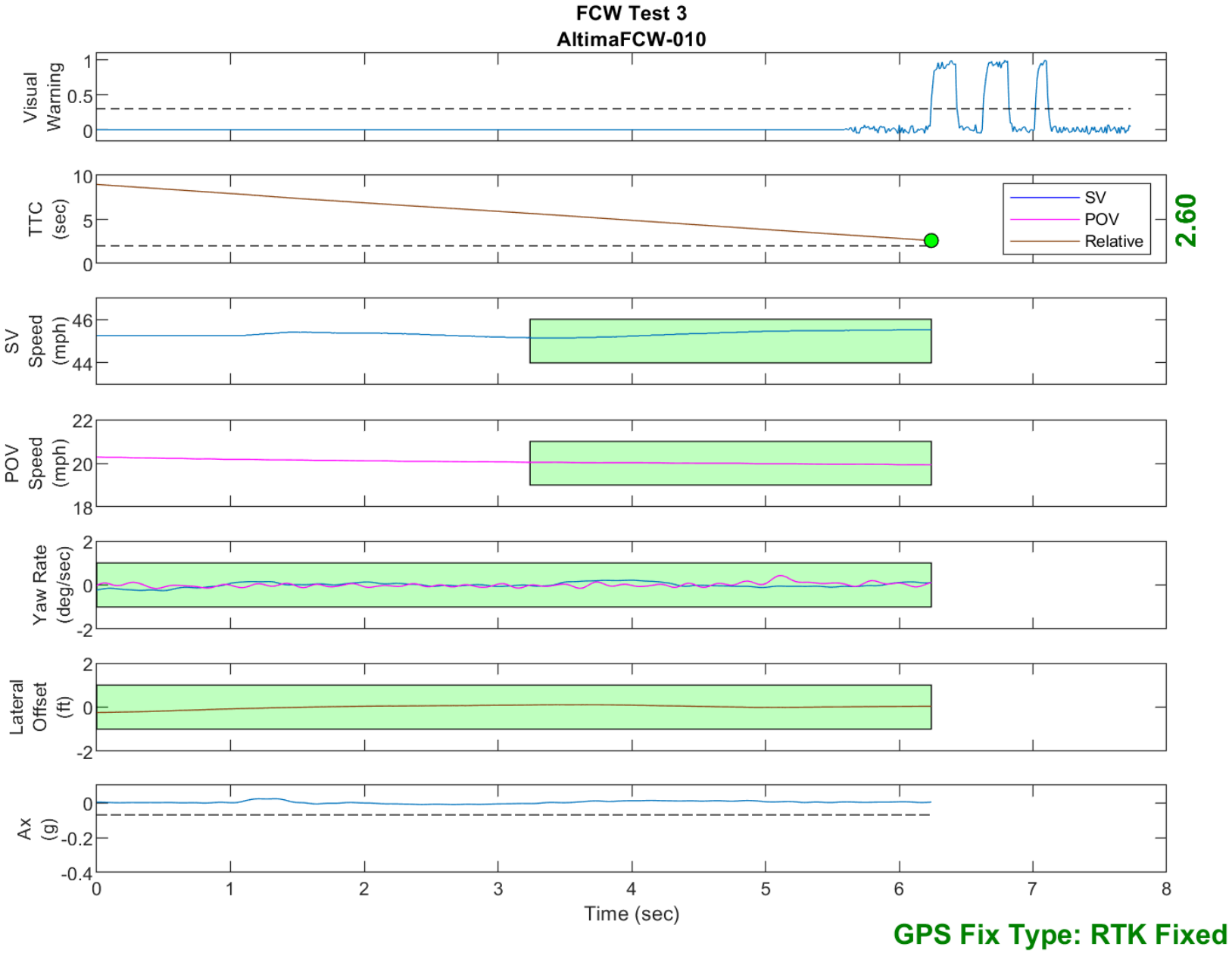


Figure D40. Time History for Run 10, FCW Test 3, Visual Warning

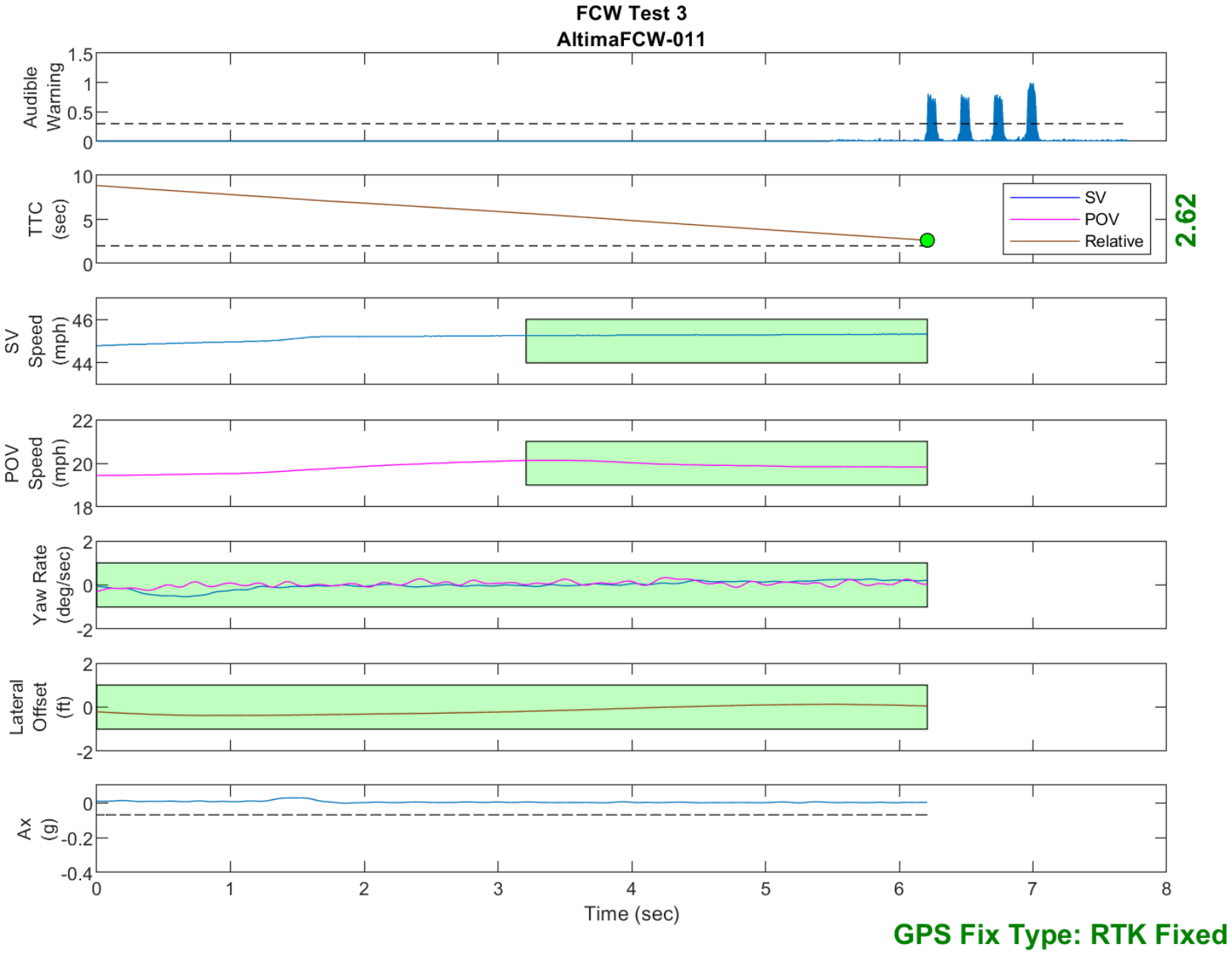


Figure D41. Time History for Run 11, FCW Test 3, Audible Warning

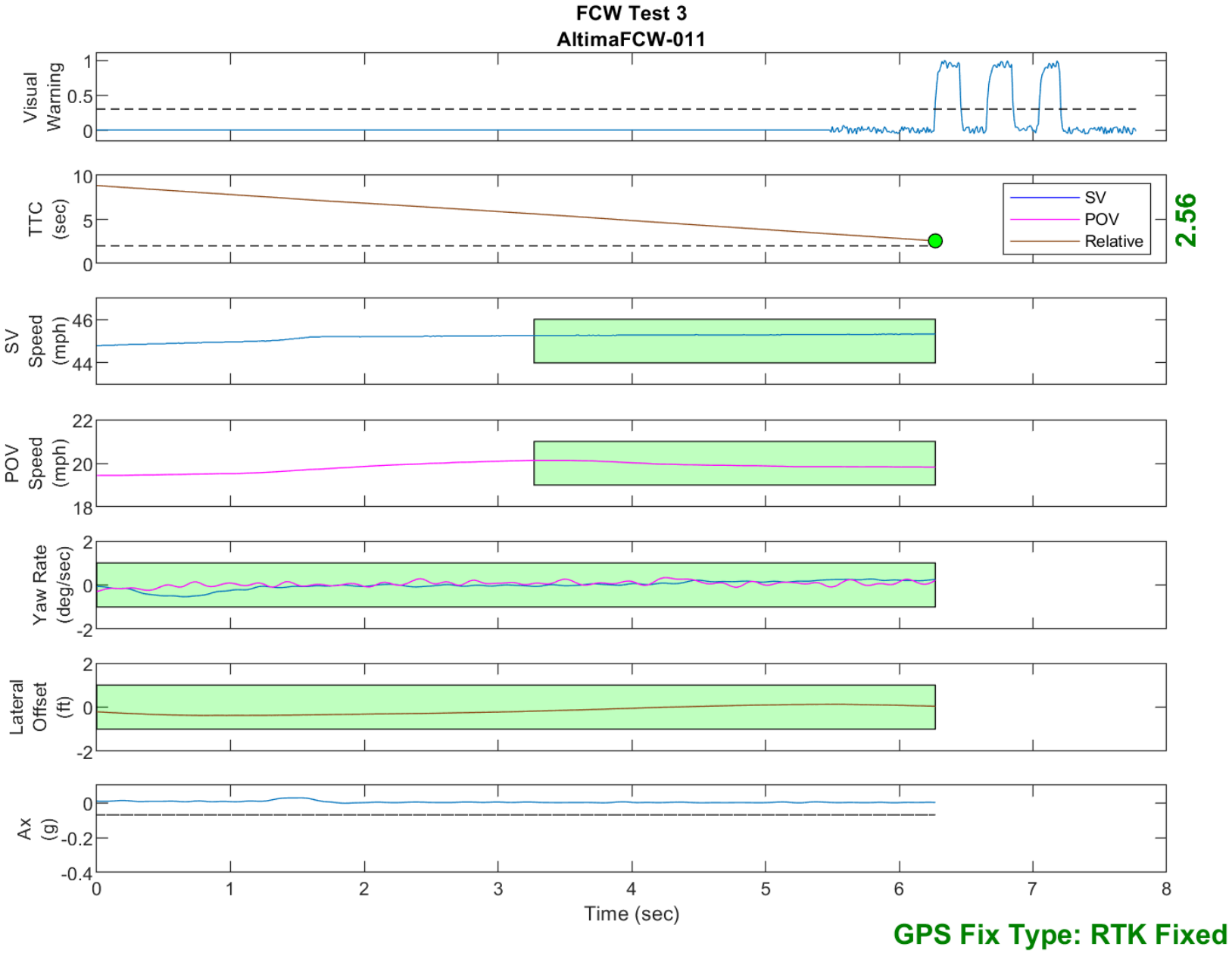


Figure D42. Time History for Run 11, FCW Test 3, Visual Warning

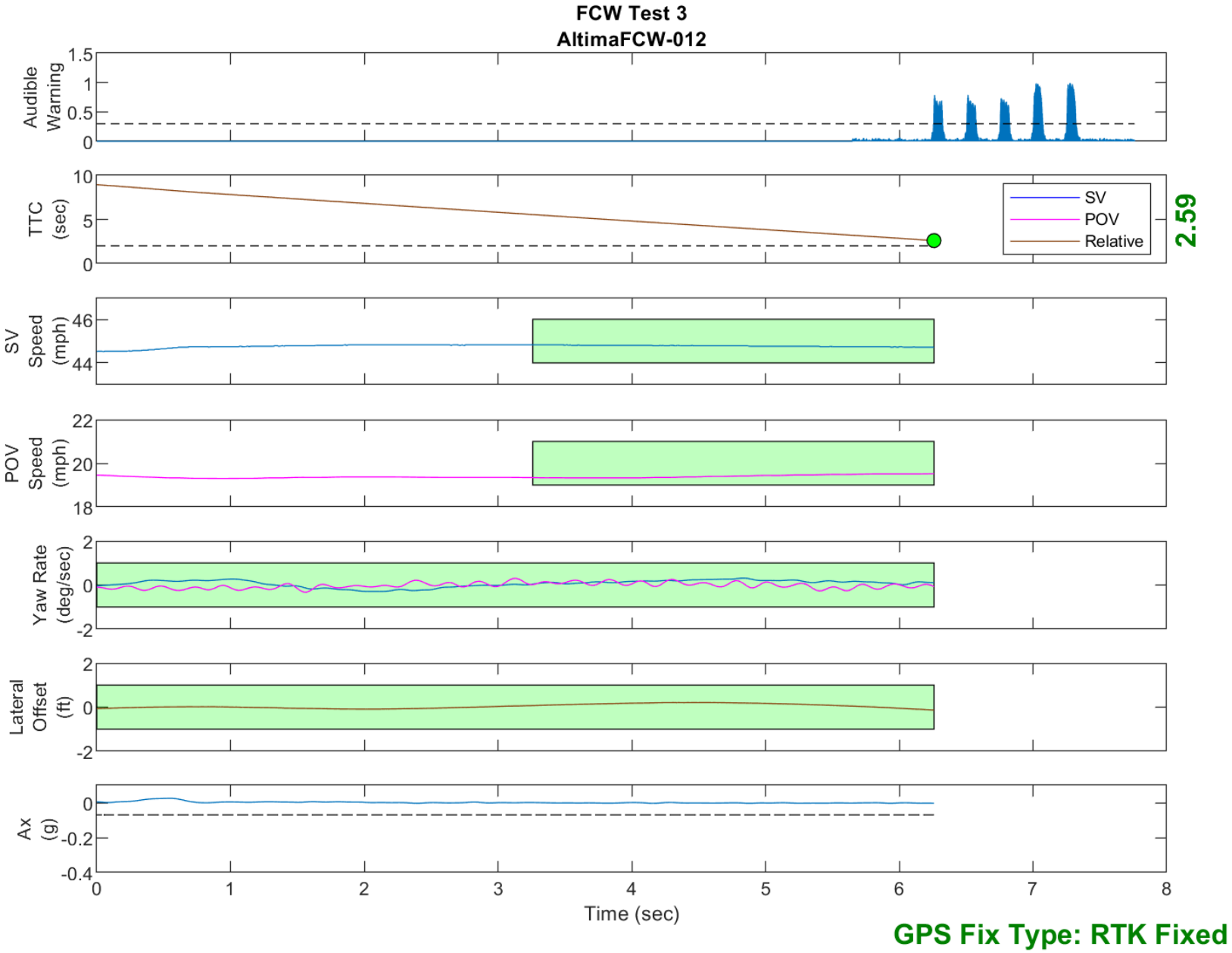


Figure D43. Time History for Run 12, FCW Test 3, Audible Warning

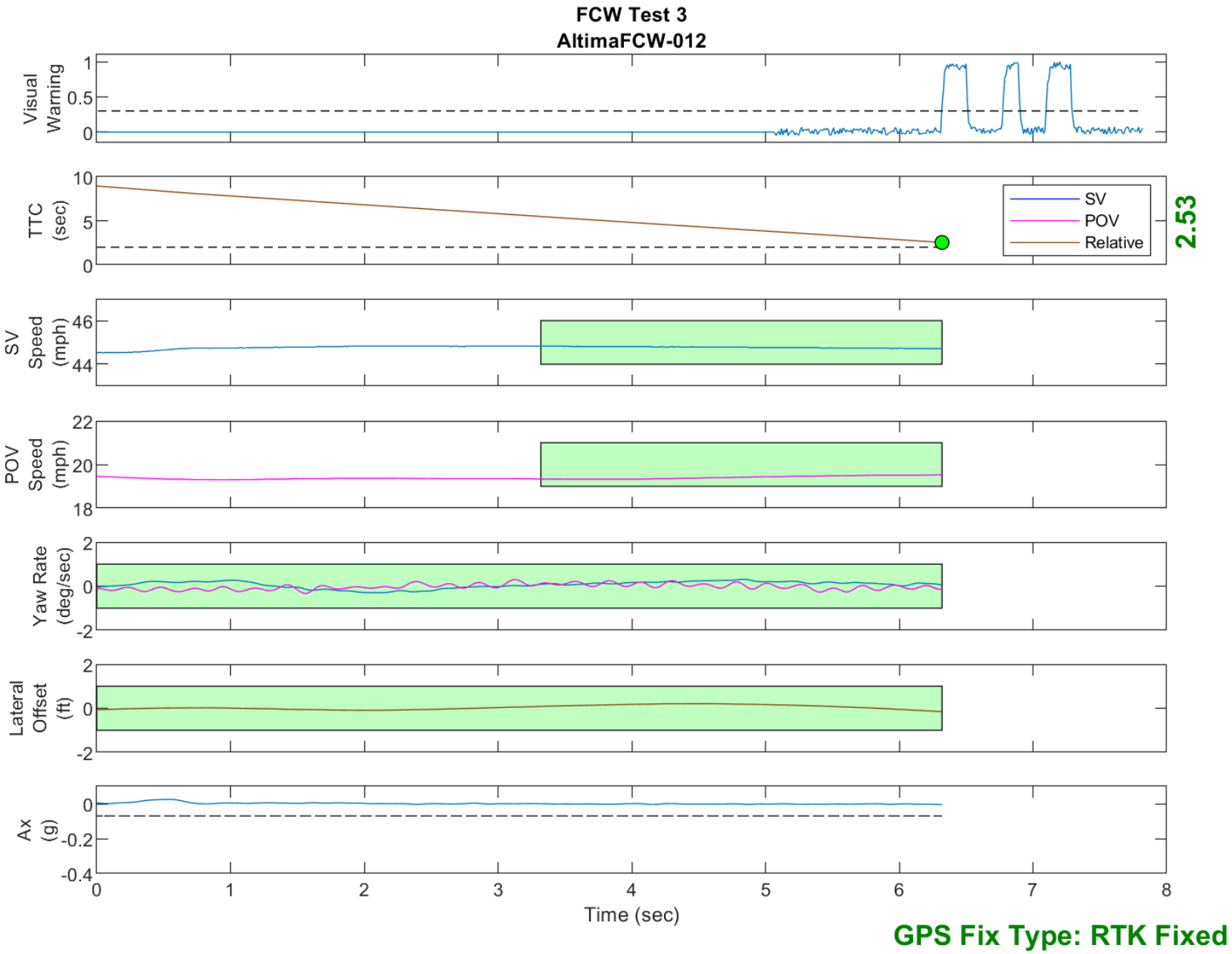


Figure D44. Time History for Run 12, FCW Test 3, Visual Warning

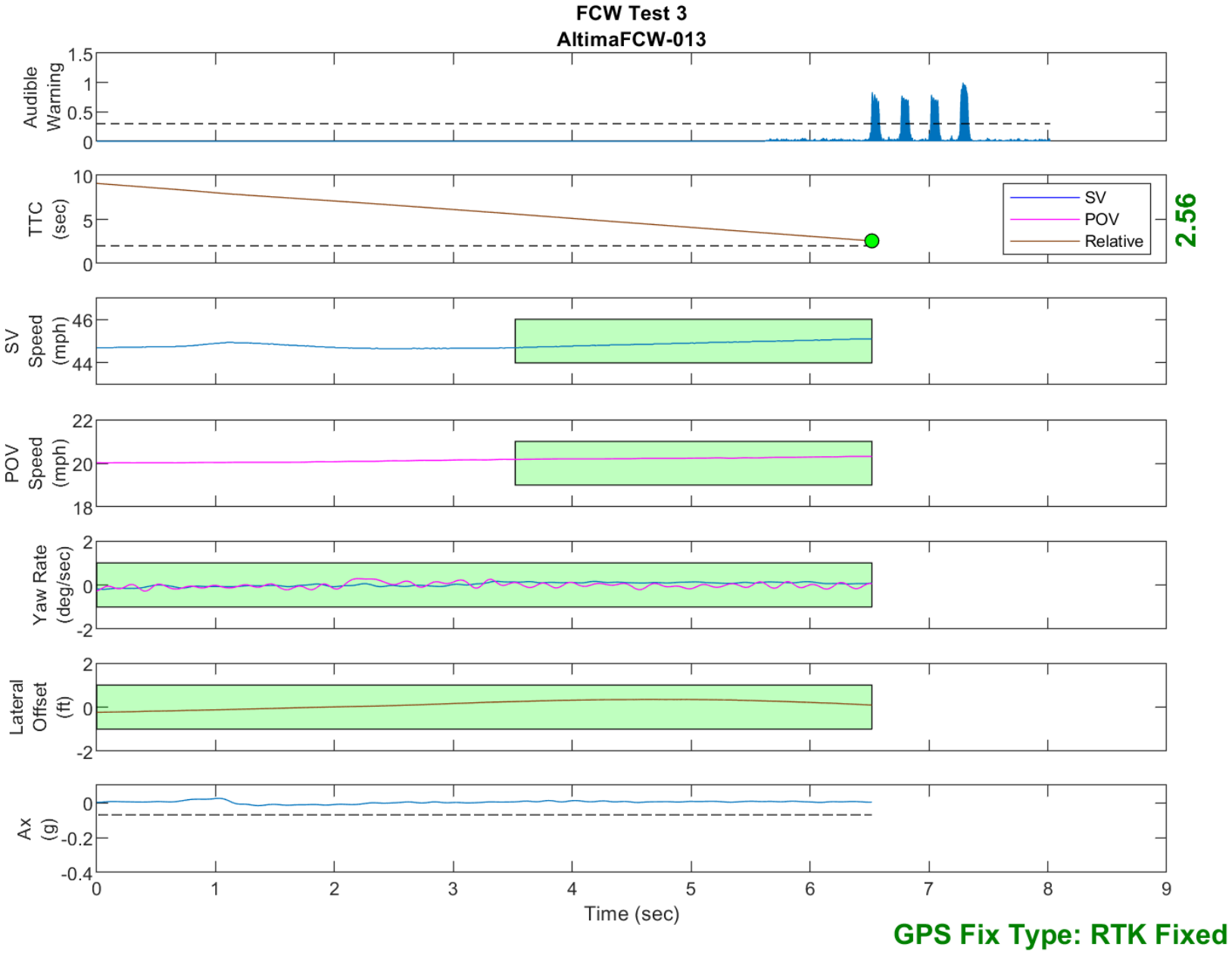


Figure D45. Time History for Run 13, FCW Test 3, Audible Warning

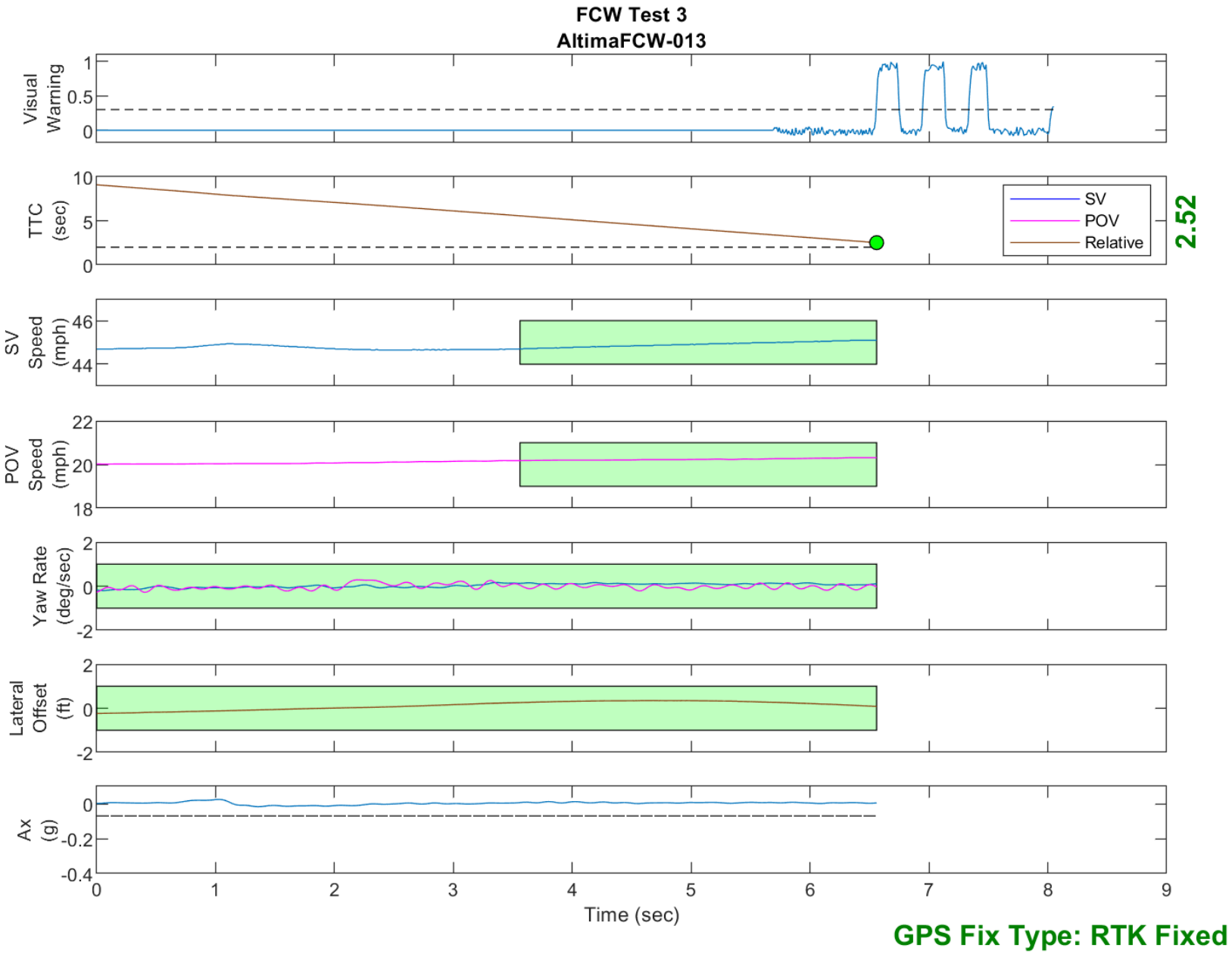


Figure D46. Time History for Run 13, FCW Test 3, Visual Warning

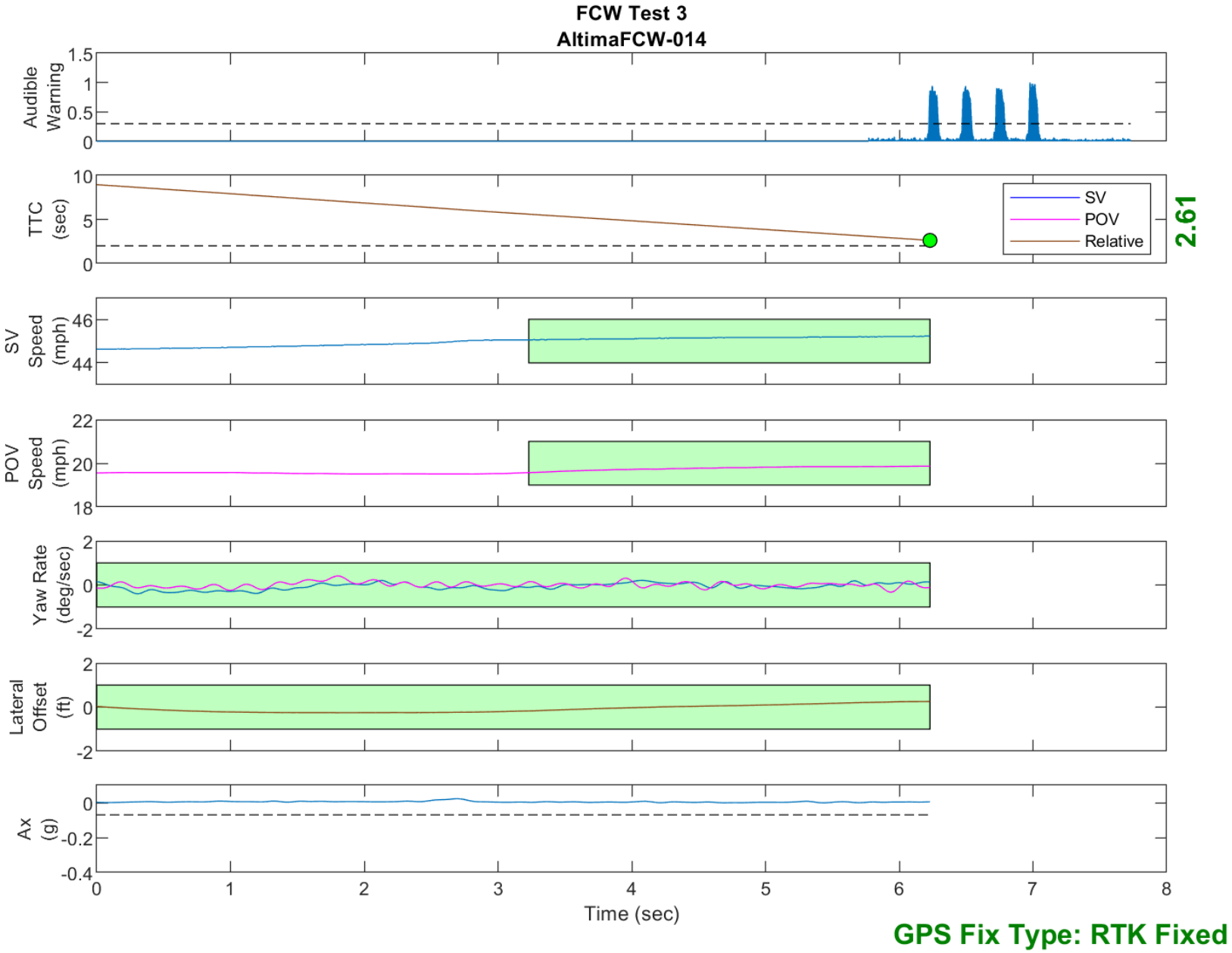


Figure D47. Time History for Run 14, FCW Test 3, Audible Warning

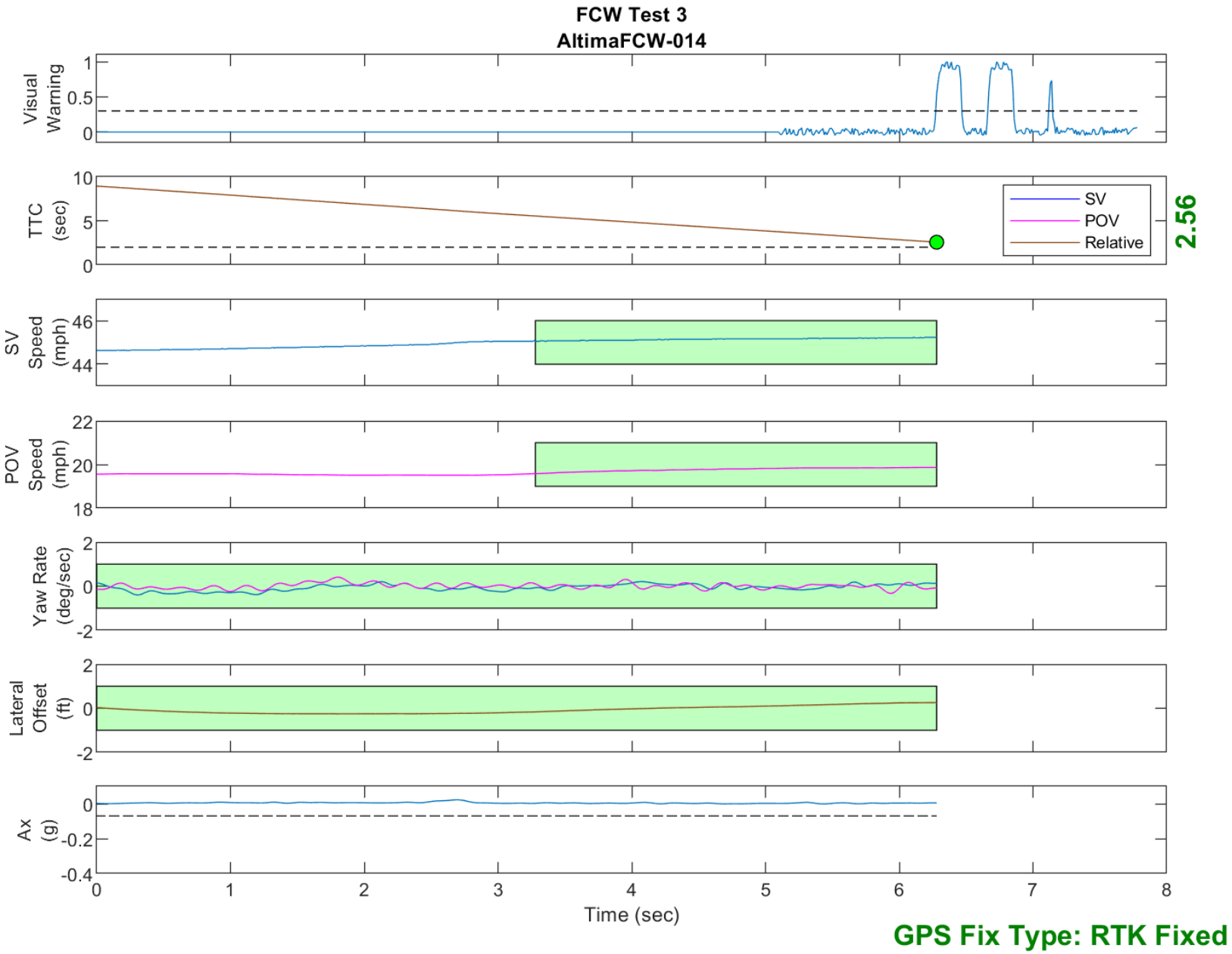


Figure D48. Time History for Run 14, FCW Test 3, Visual Warning