

**NEW CAR ASSESSMENT PROGRAM
FORWARD COLLISION WARNING CONFIRMATION TEST
NCAP-DRI-FCW-21-02**

2021 Chevrolet Trailblazer FWD 4dr LT

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18 February 2021

Final Report

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National Highway Traffic Safety Administration
New Car Assessment Program
1200 New Jersey Avenue, SE
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16. Abstract These tests were conducted on the subject 2021 Chevrolet Trailblazer FWD 4dr LT 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 Principal 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

(Page 1 of 1)

2021 Chevrolet Trailblazer FWD 4dr LT

VIN: KL79MPSL5MB06xxxx

Test Date: 2/8/2021

Forward Collision Warning setting: Far

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)

2021 Chevrolet Trailblazer FWD 4dr LT

TEST VEHICLE INFORMATION

VIN: KL79MPSL5MB06xxxx

Body Style: MPV

Color: Dark Copper Metallic

Date Received: 2/1/2021

Odometer Reading: 281 mi

DATA FROM VEHICLE'S CERTIFICATON LABEL

Vehicle manufactured by: GM Korea Company

Date of manufacture: 09/20

Vehicle Type: MPV

DATA FROM TIRE PLACARD

Tires size as stated on Tire Placard: Front: 225/60R17 H

Rear: 225/60R17 H

Recommended cold tire pressure: Front: 240 kPa (35 psi)

Rear: 240 kPa (35 psi)

TIRES

Tire manufacturer and model: Continental Procontact TX

Front tire specification: 225/60R17 99H

Rear tire specification: 225/60R17 99H

Front tire DOT prefix: 16Y0F98YW

Rear tire DOT prefix: 16Y0F98YW

FORWARD COLLISION WARNING
DATA SHEET 3: TEST CONDITIONS

(Page 1 of 2)

2021 Chevrolet Trailblazer FWD 4dr LT

GENERAL INFORMATION

Test date: 2/8/2021

AMBIENT CONDITIONS

Air temperature: 12.8 C (55 F)

Wind speed: 0.0 m/s (0.0 mph)

X Wind speed \leq 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: 240 kPa (35 psi)

Rear: 240 kPa (35 psi)

FORWARD COLLISION WARNING
DATA SHEET 3: TEST CONDITIONS

(Page 2 of 2)

2021 Chevrolet Trailblazer FWD 4dr LT

WEIGHT

Weight of vehicle as tested including driver and instrumentation:

Left Front: 483.1 kg (1065 lb)

Right Front: 443.2 kg (977 lb)

Left Rear: 289.4 kg (638 lb)

Right Rear: 292.1 kg (644 lb)

Total: 1507.8 kg (3324 lb)

FORWARD COLLISION WARNING

DATA SHEET 4: FORWARD COLLISION WARNING SYSTEM OPERATION

(Page 1 of 2)

2021 Chevrolet Trailblazer FWD 4dr LT

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

Forward Collision Alert (FCA); included as standard equipment.

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

Front Camera Module – Mono Camera

Forward Collision Warning Setting used in test:

Gap setting of “Far” corresponds to “Early”.

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

When approaching a vehicle ahead too quickly, FCA provides a red flashing alert on the windshield and rapidly beeps. FCA also lights an amber visual alert if following another vehicle much too closely. See Appendix A, Figure 15.

The auditory alert is eight rapid high-pitched beeps that sounds from the front.

Is the vehicle equipped with a switch whose purpose is to render FCW inoperable? Yes
 No

FORWARD COLLISION WARNING

DATA SHEET 4: FORWARD COLLISION WARNING SYSTEM OPERATION

(Page 2 of 2)

2021 Chevrolet Trailblazer FWD 4dr LT

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

System menus are used to interact with the settings. The menu hierarchy is:

Settings

Vehicle

Collision/Detection Systems

Forward Collision System

Select from: Off, Alert, Alert and Brake

See Appendix A, Figures A12 and A13.

Is the vehicle equipped with a control whose purpose is to adjust the range setting or otherwise influence the operation of FCW? Yes
 No

If yes, please provide a full description.

The FCW range control is on the left side of the steering wheel. Press the button to set the FCA timing to Far, Medium, or Near. The first button press shows the current setting on the Driver Information Center. Additional button presses will change this setting. The chosen setting will remain until it is changed.

Refer to page 224 of the Owner's Manual shown in Appendix B, page B-10 and Appendix A, Figure A14

Are there other driving modes or conditions that render FCW inoperable or reduce its effectiveness? Yes
 No

If yes, please provide a full description.

System limitations are described on page 223 of the Owner's Manual, shown in Appendix B, page B-9.

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.

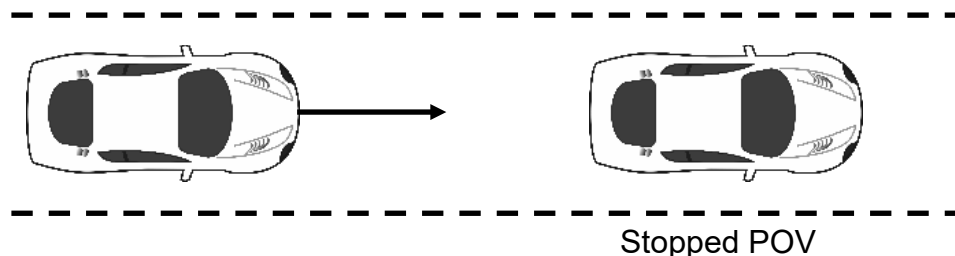


Figure 1. Depiction of Test 1

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.

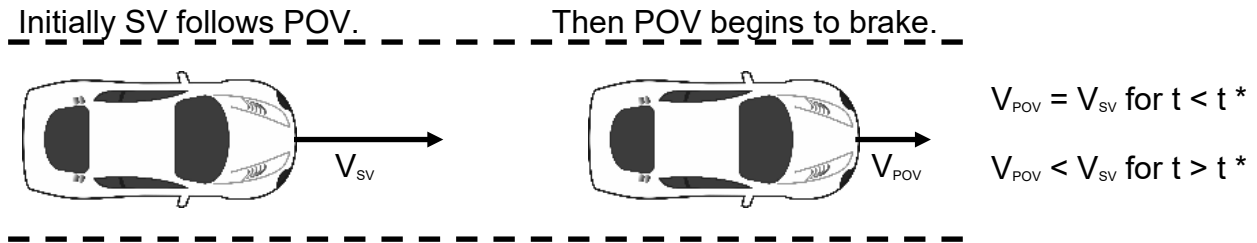


Figure 2. Depiction of Test 2

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 POV¹.

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.

¹To 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 ± 0.03 g, 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).

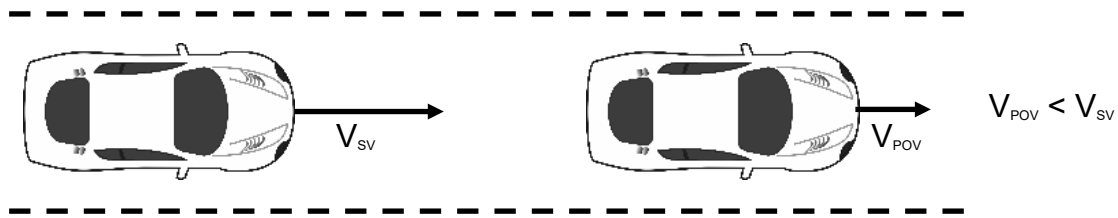


Figure 3. Depiction of Test 3

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 100 psi	Omega DPG8001	17042707002	By: DRI Date: 8/18/2020 Due: 8/18/2021
Platform Scales	Vehicle Total, Wheel, and Axle Load	2200 lb/platform	0.1% of reading	Intercomp SW wireless	0410MN20001	By: DRI Date: 4/20/2020 Due: 4/20/2021
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	N/A
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 Rate ±100 deg/s, Angle >45 deg, Velocity >200 km/h	Accels .01g, Angular Rate 0.05 deg/s, Angle 0.05 deg, Velocity 0.1 km/h			By: Oxford Technical Solutions
				SV: Oxford Inertial +	2258	Date: 5/3/2019 Due: 5/3/2021
				POV:	2182	Date: 9/16/2019 Due: 9/16/2021
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	N/A

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	N/A	N/A
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	N/A	N/A
Accelerometer	Acceleration (to measure time at haptic alert)	±5g	≤ 3% of full range	Silicon Designs, 2210-005	N/A	N/A
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: 1/6/2021 Due: 1/6/2022
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 \pm 5%
Tactile	5 th	3 dB	60 dB	Identified Center Frequency \pm 20%

APPENDIX A

Photographs

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Figure A1. Front View of Subject Vehicle



Figure A2. Rear View of Subject Vehicle

VIN: KL79MPSL5MB06



2021 Trailblazer FWD 4dr LT

CHEVROLET

VIN: KL79MPSL5MB06 MODEL: TRAILBLAZER ENGINE: ECOTEC 1.3L TURBO PORT OF ENTRY: EXTERIOR COLOR: DARK COPPER METALLIC INTERIOR/SEAT COLOR: JET BLACK TRANSPORT: TRUCK ACCESSORY WEIGHT: 16 lbs./ 7 kgs.		GOVERNMENT 5-STAR SAFETY RATINGS Overall Vehicle Score ★★★★★ Based on the combined rating of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight. <hr/> Frontal Driver ★★★★★ Passenger ★★★★★ Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight. <hr/> Side Front seat ★★★★★ Rear seat ★★★★★ Based on the risk of injury in a side impact. <hr/> Rollover ★★★★★ Based on the risk of rollover in a single-vehicle crash. <hr/> Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest. Source: National Highway Traffic Safety Administration (NHTSA). www.safercar.gov or 1-888-327-4236
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STANDARD FEATURES: ENTERTAINMENT - Audio system, Chevrolet Infotainment 3 system 7" diagonal color touchscreen, AM/FM stereo. Additional features for compatible phones include Bluetooth audio streaming for 2 active devices, voice command pass-through to phone, Apple CarPlay and Android Auto capable. (8" screen when (ZL3) Convenience Package and (ZL5) Driver Confidence Package are ordered.) - (Audio system feature, 6-speaker system, enhanced performance - Display, 7" diagonal color touchscreen - 4G LTE Wi-Fi hotspot capable (Terms and limitations apply. See onstar.com or dealer for details.) - Wireless Apple CarPlay/Wireless Android Auto INTERIOR - Seats, front bucket - Seat trim, Cloth - Seats, heated driver and front passenger - Seat adjuster, driver 8-way power - Seat adjuster, driver 2-way power lumbar - Seat adjuster, front passenger 4-way manual - Seatback, front passenger flat-folding - Seat, rear 40/60 split-bench, folding (60 percent on passenger side) - Head restraints, front, 2-way adjustable - Head restraints, rear outboard, 4-way adjustable SAFETY - Automatic Emergency Braking - Front Pedestrian Braking - Daytime Running Lamps, signature LED - Airbags, driver and front passenger frontal and knee, seat-mounted side-impact and roof rail-mounted head-curtain for all outboard seating positions and Passenger Sensing System for front passenger (Always use seat belts and child restraints. Children are safer when properly secured in a rear seat in the appropriate child restraint. See the Owner's Manual for more information.) - OnStar and Chevrolet connected services capable (Terms and limitations apply. See onstar.com or dealer for details.) - Rear Vision Camera - Lane Keep Assist with Lane Departure Warning - Following Distance Indicator - Forward Collision Alert - Seat belts, 3-point, driver and front passenger, height-adjustable includes pretensioners and front passenger load limiter EXTERIOR - Wheels, 17" (43.2 cm) High Gloss Black machined aluminum - Tires, 225/60R17 all-season, blackwall - Wheel, spare, 16" (40.6 cm) steel - Tire, compact spare 16" (40.3 cm) - Side rails, roof-mounted (Silver-painted.)	Manufacturer's Suggested Retail Price: \$23,700.00 ADDED FEATURES: PREMIUM SEATING PACKAGE \$845.00 includes (HVL/HVM) Leatherette interior, (N34) leather-wrapped steering wheel, (VY7) leather-wrapped shift knob and (DA5) rear center armrest LPO, ALL-WEATHER FLOOR MATS \$150.00 LICENSE PLATE BRACKET, FRONT \$40.00 LPO, CARGO SHADE, SOFT \$205.00 PERFORMANCE PACKAGE \$395.00 includes (L3T) ECOTEC 1.3L Turbo engine, (C2Y) 4255 lbs. GVWR, Sport mode and Snow mode CONVENIENCE PACKAGE \$620.00 includes (C68) automatic climate control air conditioning, (U2K) SiriusXM Radio, (UJ) 8" diagonal color touchscreen display, (US5) one type-A and one type-C charging only USB ports, (K16) 120-volt power outlet, (DD8) inside rearview auto-dimming mirror and (DMS) driver and front passenger illuminated vanity mirrors, covered, sliding visors DRIVER CONFIDENCE PACKAGE \$345.00 includes (UKC) Lane Change Alert with Side Blind Zone Alert, (UFG) Rear Cross Traffic Alert and (UD7) Rear Park Assist
Total Price : \$26,300.00	

EPA DOT	Fuel Economy and Environment	Gasoline Fuel
Fuel Economy 30 MPG combined city/hwy 29 city 33 highway Large Cars range from 14 to 40 MPG. The best vehicle rates 119 MPG.		You save \$1,450 more in fuel costs over 5 years compared to the average new vehicle.
Annual fuel cost \$1,110		Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 25 MPG and costs \$8,000 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$3.00 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.
Calculate personalized estimates and compare vehicles fueleconomy.gov		Smartphone QR Code =

Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service. Gasoline license and title fees state and local taxes and dealer installed options and accessories are not included in the manufacturer's suggested retail price. This label has been affixed to this vehicle by Hyundai Motor America, pursuant to the requirements of 15 U.S.C. 1231 et seq, which prohibits its removal or alteration prior to delivery to the ultimate purchaser.

293 A

Figure A3. Window Sticker (Monroney Label)

GM MFD BY GM KOREA COMPANY 09 / 20

GVWR 4255 LB GAWR FRT 2336 LB GAWR RR 2336 LB

THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S. FEDERAL MOTOR VEHICLE SAFETY AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

KL79MPSL5MB06 TYPE: MPV

MODEL : 1TU56

	TIRE SIZE	SPEED RTG	RIM	COLD TIRE PRESSURE
FRT	225/60R17	H	17x7.5J	240KPA, 35 PSI
RR	225/60R17	H	17x7.5J	240KPA, 35 PSI
SPA	T125/70R16	M	16x4.0BT	420KPA, 60 PSI

SEE OWNER'S MANUAL  FOR MORE INFORMATION.

Figure A4. Vehicle Certification Label



TIRE AND LOADING INFORMATION

SEATING CAPACITY | TOTAL 5 | FRONT 2 | REAR 3

The combined weight of occupants and cargo should never exceed 428 kg or 943 lbs.

TIRE	ORIGINAL SIZE	COLD TIRE PRESSURE
FRONT	225/60R17 H	240 kpa, 35 psi
REAR	225/60R17 H	240 kpa, 35 psi
SPARE	T125/70R16 M	420 kpa, 60 psi

SEE OWNER'S
MANUAL FOR
ADDITIONAL
INFORMATION

A1X8

42726766

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. Sensors for Detecting Auditory and Visual Alerts



Figure A10. Computer Installed in Subject Vehicle



Figure A11. Brake Actuation System Installed in Principal Other Vehicle

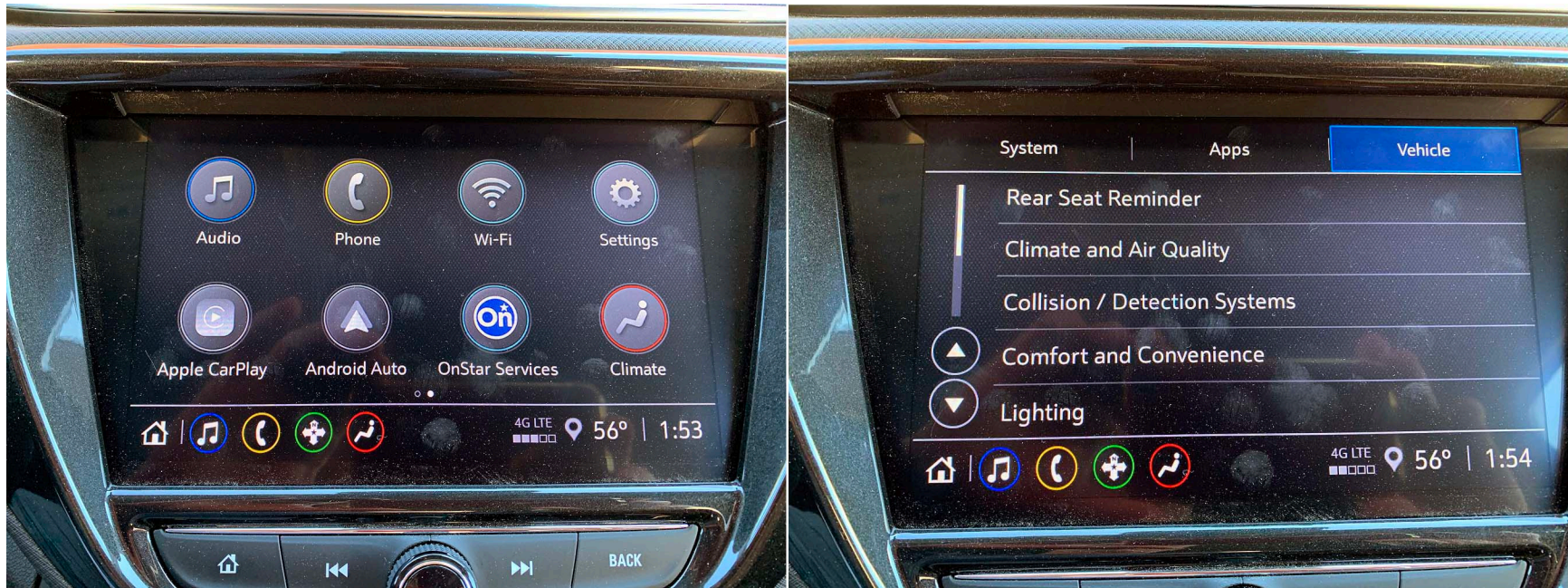


Figure A12. System Setup Menus (1 of 2)



Figure A13. System Setup Menus (2 of 2)



Figure A14. FCW System Range Setting Button



Figure A15. FCW Visual Alert

APPENDIX B

Excerpts from Owner's Manual

2 Introduction

Using this Manual

To quickly locate information about the vehicle, use the Index in the back of the manual. It is an alphabetical list of what is in the manual and the page number where it can be found.

About Driving the Vehicle

As with other vehicles of this type, failure to operate this vehicle correctly may result in loss of control or a crash. Be sure to read the driving guidelines in this manual in the section called "Driving and Operating" and specifically *Driver Behavior* ⇨ 181, *Driving Environment* ⇨ 181, and *Vehicle Design* ⇨ 181.

Danger, Warning, and Caution

Warning messages found on vehicle labels and in this manual describe hazards and what to do to avoid or reduce them.

Danger

Danger indicates a hazard with a high level of risk which will result in serious injury or death.

Warning

Warning indicates a hazard that could result in injury or death.

Caution


Caution indicates a hazard that could result in property or vehicle damage.




A circle with a slash through it is a safety symbol which means "Do not," "Do not do this," or "Do not let this happen."

Symbols

The vehicle has components and labels that use symbols instead of text. Symbols are shown along with the text describing the operation or information relating to a specific component, control, message, gauge, or indicator.

 : Shown when the owner's manual has additional instructions or information.

 : Shown when the service manual has additional instructions or information.

⇨ : Shown when there is more information on another page — "see page."


Vehicle Symbol Chart

Here are some additional symbols that may be found on the vehicle and what they mean. See the features in this manual for information.

 : Air Conditioning System

 : Air Conditioning Refrigerant Oil


 : Airbag Readiness Light

 : Antilock Brake System (ABS)

 : Brake System Warning Light

 : Dispose of Used Components Properly

 : Do Not Apply High Pressure Water

 : Engine Coolant Temperature

 : Flame/Fire Prohibited

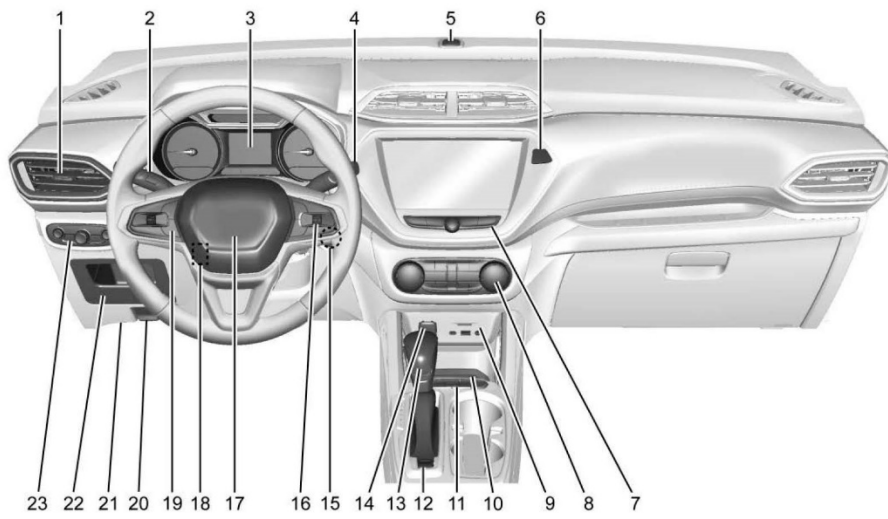
 : Flammable

 : Forward Collision Alert

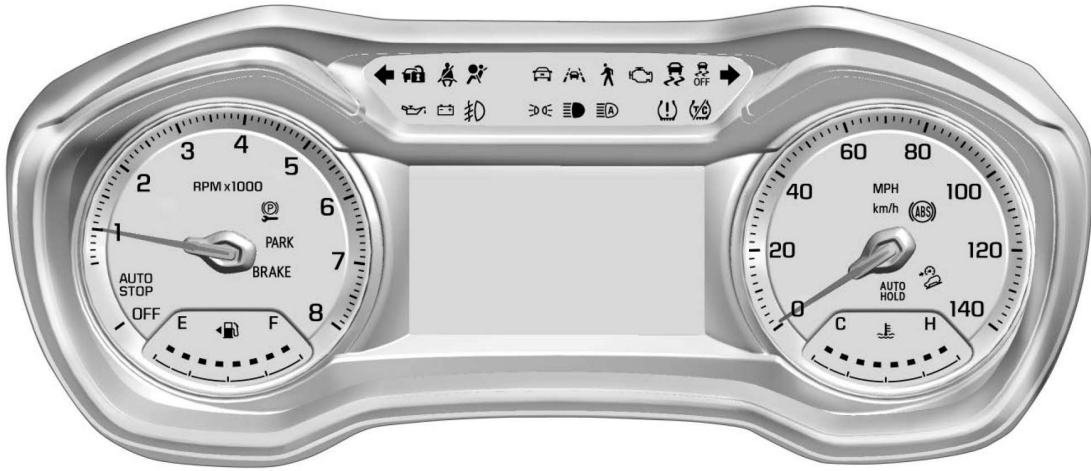
 : Fuse Block Cover Lock Location

4 Introduction

Instrument Panel Overview



- | | | |
|--|---|---|
| <ol style="list-style-type: none"> 1. <i>Air Vents</i> ⇨ 178. 2. <i>Turn Signal Lever</i>. See <i>Turn and Lane-Change Signals</i> ⇨ 117.
<i>IntelliBeam System Button</i> (If Equipped). See <i>Exterior Lamp Controls</i> ⇨ 114. 3. <i>Instrument Cluster</i> ⇨ 89.
<i>Driver Information Center (DIC) Display</i>. See <i>Driver Information Center (DIC) (Base Level)</i> ⇨ 104 or <i>Driver Information Center (DIC) (Uplevel)</i> ⇨ 107. 4. <i>Windshield Wiper/Washer</i> ⇨ 83.
<i>Rear Window Wiper/Washer</i> ⇨ 84. 5. <i>Light Sensor</i>. See <i>Automatic Headlamp System</i> ⇨ 116. 6. <i>Hazard Warning Flashers</i> ⇨ 117. 7. <i>Infotainment</i>. See <i>Overview</i> ⇨ 122. 8. <i>Climate Control Systems</i> ⇨ 174.
<i>Automatic Climate Control System</i> ⇨ 176.
<i>Heated Front Seats</i> ⇨ 40. (If Equipped). 9. <i>USB Port</i> ⇨ 130.
<i>Auxiliary Jack</i> ⇨ 132. 10. <i>Wireless Charging</i> ⇨ 86 (If Equipped). 11. <i>Stop/Start Disable Button</i>. See <i>Stop/Start System</i> ⇨ 195 (If Equipped). | <ol style="list-style-type: none"> <i>Lane Keep Assist (LKA)</i> ⇨ 229 (If Equipped). <i>Traction Control/Electronic Stability Control</i> ⇨ 206. <i>Sport Mode</i> (If Equipped). See <i>Driver Mode Control</i> ⇨ 208 <i>All-Wheel Drive</i> ⇨ 203 (If Equipped). 12. <i>Electric Parking Brake</i> ⇨ 205. 13. <i>Shift Lever</i>. See <i>Automatic Transmission</i> ⇨ 201. 14. <i>Power Outlets</i> ⇨ 85. 15. <i>Engine START/STOP Button</i>. See <i>Ignition Positions (Key Access)</i> ⇨ 191 or <i>Ignition Positions (Keyless Access)</i> ⇨ 192 (If Equipped). 16. <i>Steering Wheel Controls</i> ⇨ 83. 17. <i>Horn</i> ⇨ 83. 18. <i>Steering Wheel Adjustment</i> ⇨ 83 (Out of View). 19. <i>Cruise Control</i> ⇨ 209.
<i>Adaptive Cruise Control (Camera)</i> ⇨ 211 (If Equipped).
<i>Forward Collision Alert (FCA) System</i> ⇨ 223 (If Equipped). 20. <i>Hood Release</i>. See <i>Hood</i> ⇨ 245. | <ol style="list-style-type: none"> 21. <i>Data Link Connector (DLC) (Out of View)</i>. See <i>Malfunction Indicator Lamp (Check Engine Light)</i> ⇨ 96. 22. <i>Instrument Panel Storage</i> ⇨ 78.
<i>Instrument Panel Fuse Block</i> ⇨ 277. 23. <i>Exterior Lamp Controls</i> ⇨ 114. |
|--|---|---|



Uplevel English Metric Similar

Sport Mode Light



This light comes on when Sport Mode is selected. See *Driver Mode Control* ⇨ 208.

Lane Keep Assist (LKA) Light



After the vehicle is started, this light turns off and stays off if LKA has not been turned on or is unavailable.

If equipped, this light is white if LKA is turned on, but not ready to assist.

This light is green if LKA is turned on and is ready to assist.

LKA may assist by gently turning the steering wheel if the vehicle approaches a detected lane marking. The LKA light is amber when assisting.

This light flashes amber as a Lane Departure Warning (LDW) alert, to indicate that the lane marking has been crossed.

LKA will not assist or alert if the turn signal is active in the direction of lane departure, or if LKA detects that you are accelerating, braking or actively steering.

See *Lane Keep Assist (LKA)* ⇨ 229.

Vehicle Ahead Indicator



If equipped, this indicator will display green when a vehicle is detected ahead and amber when you are following a vehicle ahead much too closely.

See *Forward Collision Alert (FCA) System* ⇨ 223.

Pedestrian Ahead Indicator



If equipped, this indicator will display when a nearby pedestrian is detected directly in front of the vehicle.

See *Front Pedestrian Braking (FPB) System* ⇨ 226.

Traction Off Light



This light comes on briefly while starting the engine. If it does not, have the vehicle serviced by your dealer. If the system is working normally, the indicator light then turns off.

Auto Rear Defog

When on, this feature turns on the rear defogger at vehicle start when the interior temperature is cold and fog is likely. See "Rear Window Defogger" under *Automatic Climate Control System* ⇨ 176.

Touch Off or On.

Collision / Detection Systems

Touch and the following may display:

- Forward Collision System
- Front Pedestrian Detection
- Adaptive Cruise Go Notifier
- Lane Change Alert
- Rear Camera Park Assist Symbols
- Rear Cross Traffic Alert
- Rear Park Assist

Forward Collision System

This setting controls the vehicle response when detecting a vehicle ahead of you. The Off setting disables all FCA and AEB functions. With the Alert and Brake setting, both FCA and AEB are available. The Alert setting disables AEB. See *Automatic Emergency Braking (AEB)* ⇨ 224.

Touch Off, Alert, or Alert and Brake.

Front Pedestrian Detection

This feature may help avoid or reduce the harm caused by front-end crashes with nearby pedestrians. See *Front Pedestrian Braking (FPB) System* ⇨ 226.

Touch Off, Alert, or Alert and Brake.

Adaptive Cruise Go Notifier

This setting determines if an alert will appear when Adaptive Cruise Control brings the vehicle to a complete stop and the vehicle ahead of you starts moving again. See *Adaptive Cruise Control (Camera)* ⇨ 211.

Touch Off or On.

Lane Change Alert

This allows the feature to be turned on or off. See *Lane Change Alert (LCA)* ⇨ 228.

When Lane Change Alert is disabled, Side Blind Zone Alert is also disabled.

Touch Off or On.

Rear Camera Park Assist Symbols

This setting enables the Rear Camera Park Assist Symbols. See *Assistance Systems for Parking or Backing* ⇨ 221.

Touch Off or On.

Rear Cross Traffic Alert

This setting specifies if you see alerts when the vehicle detects approaching rear cross traffic when in R (Reverse). See *Assistance Systems for Parking or Backing* ⇨ 221.

Touch Off or On.

Rear Park Assist

This setting specifies if you have alerts when an object is detected at parking or backing when in R (Reverse). See *Assistance Systems for Parking or Backing* ⇨ 221.

Touch Off or On.

Comfort and Convenience

Touch and the following may display:

- Chime Volume
- Handsfree Liftgate/Trunk Control
- Auto Wipe in Reverse Gear
- Extended Hill Start Assist

Chime Volume

This allows the selection of the chime volume level.

Touch + or - to adjust the volume

Warning

ACC has limited braking ability and may not have time to slow the vehicle down enough to avoid a collision with another vehicle you are following. This can occur when vehicles suddenly slow or stop ahead, or enter your lane. Also see “Alerting the Driver” later in this section. Complete attention is always required while driving and you should be ready to take action and apply the brakes. See *Defensive Driving* ⇨ 182

Warning

ACC will not detect or brake for children, pedestrians, animals, or other objects.

Do not use ACC when:

- On winding and hilly roads or when the camera sensor is blocked by snow, ice, or dirt. The system may not detect a vehicle ahead. Keep the windshield and headlamps clean.
- When visibility is poor due to rain, snow, fog, dirt, insect residue, or dust; when other foreign objects obscure

(Continued)

Warning (Continued)

the camera’s view; or when the vehicle in front or oncoming traffic causes additional environmental obstructions, such as road spray. ACC performance is limited under these conditions.

- On slippery roads where fast changes in tire traction can cause excessive wheel slip.
- With extremely heavy cargo loaded in the cargo area or rear seat.
- When towing a trailer.



OFF : Press to turn the system on or off. The indicator turns white on the instrument cluster when ACC is turned on.

RES+ : Press briefly to resume the previous set speed or to increase vehicle speed if ACC is already activated. To increase speed by about 1 km/h (1 mph), press RES+ briefly. To increase speed to the next 5 km/h (5 mph) mark on the speedometer, hold RES+.

SET- : Press briefly to set the speed and activate ACC or to decrease vehicle speed if ACC is already activated. To decrease speed by about 1 km/h (1 mph), press SET- briefly. To decrease speed to the next 5 km/h (5 mph) mark on the speedometer, hold SET-.

DIS : Press to disengage ACC without erasing the selected set speed.

GA : Press to select a following gap setting for ACC of Far, Medium, or Near.

The speedometer reading can be displayed in either English or metric units. See *Instrument Cluster* ⇨ 89. The increment value used depends on the units displayed.

Forward Collision Alert (FCA) System

If equipped, the FCA system may help to avoid or reduce the harm caused by front-end crashes. When approaching a vehicle ahead too quickly, FCA provides a red flashing alert on the windshield and rapidly beeps. FCA also lights an amber visual alert if following another vehicle much too closely.

FCA detects vehicles within a distance of approximately 60 m (197 ft) and operates at speeds above 8 km/h (5 mph).

Warning

FCA is a warning system and does not apply the brakes. When approaching a slower-moving or stopped vehicle ahead too rapidly, or when following a vehicle too closely, FCA may not provide a warning with enough time to help avoid a crash. It also may not provide any warning at all. FCA does not warn of pedestrians, animals, signs, guardrails, bridges, construction barrels, or other

(Continued)

Warning (Continued)

objects. Be ready to take action and apply the brakes. See *Defensive Driving* ⇨ 182.

FCA can be disabled through vehicle personalization. See "Collision/Detection Systems" under *Vehicle Personalization* ⇨ 110.

Detecting the Vehicle Ahead



FCA warnings will not occur unless the FCA system detects a vehicle ahead. When a vehicle is detected, the vehicle ahead indicator will display green. Vehicles may not be detected on curves, highway exit ramps, or hills, due to poor visibility; or if a vehicle ahead is partially blocked by pedestrians or other objects. FCA will not detect another vehicle ahead until it is completely in the driving lane.

Warning

FCA does not provide a warning to help avoid a crash, unless it detects a vehicle. FCA may not detect a vehicle ahead if the FCA sensor is blocked by dirt, snow, or ice, or if the windshield is damaged. It may also not detect a vehicle on winding or hilly roads, or in conditions that can limit visibility such as fog, rain, or snow, or if the headlamps or windshield are not cleaned or in proper condition. Keep the windshield, headlamps, and FCA sensors clean and in good repair.

Collision Alert

When your vehicle approaches another detected vehicle too rapidly, the red FCA display will flash on the windshield.


Also, eight rapid high-pitched beeps will sound from the front. When this Collision Alert occurs, the brake system may prepare for driver braking to occur more rapidly which can cause a brief, mild deceleration. Continue to apply the brake pedal as needed. Cruise control may be disengaged when the Collision Alert occurs.

Tailgating Alert



The vehicle ahead indicator will display amber when you are following a vehicle ahead too closely.

Selecting the Alert Timing

The Collision Alert control is on the steering wheel. Press  to set the FCA timing to Far, Medium, or Near. The first button press shows the current setting on the DIC. Additional button presses will change this setting. The chosen setting will remain until it is changed and will affect the timing of both the Collision Alert and the Tailgating Alert features. The timing of both alerts will

vary based on vehicle speed. The faster the vehicle speed, the farther away the alert will occur. Consider traffic and weather conditions when selecting the alert timing. The range of selectable alert timings may not be appropriate for all drivers and driving conditions.

If your vehicle is equipped with Adaptive Cruise Control (ACC), changing the FCA timing setting automatically changes the following gap setting (Far, Medium, or Near).

Following Distance Indicator

The following distance to a moving vehicle ahead in your path is indicated in following time in seconds on the Driver Information Center (DIC). See *Driver Information Center (DIC) (Base Level)* ⇨ 104 or *Driver Information Center (DIC) (Uplevel)* ⇨ 107. The minimum following time is 0.5 seconds away. If there is no vehicle detected ahead, or the vehicle ahead is out of sensor range, dashes will be displayed.

Unnecessary Alerts

FCA may provide unnecessary alerts for turning vehicles, vehicles in other lanes, objects that are not vehicles, or shadows. These alerts are normal operation and the vehicle does not need service.

Cleaning the System

If the FCA system does not seem to operate properly, this may correct the issue:

- Clean the outside of the windshield in front of the rearview mirror.
- Clean the entire front of the vehicle.
- Clean the headlamps.

Automatic Emergency Braking (AEB)

If the vehicle has Forward Collision Alert (FCA), it also has AEB, which includes Intelligent Brake Assist (IBA). When the system detects a vehicle ahead in your path that is traveling in the same direction that you may be about to crash into, it can provide a boost to braking or automatically brake the vehicle. This can help avoid or lessen the severity of crashes when driving in a forward gear. Depending on the situation, the vehicle may automatically

APPENDIX C

Run Log

Subject Vehicle: **2021 Chevrolet Trailblazer FWD 4dr LT**

Test Date: **2/8/2021**

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	3.17	3.08	1.07	Pass	
2		Y	2.99	2.90	0.89	Pass	
3		Y	3.32	3.21	1.22	Pass	
4		Y	3.16	3.07	1.06	Pass	
5		Y	3.22	3.15	1.12	Pass	
6		Y	3.27	3.20	1.17	Pass	
7		Y	3.41	3.31	1.31	Pass	
17	Decelerating POV	Y	2.68	2.62	0.28	Pass	
18		Y	3.16	3.09	0.76	Pass	
19		Y	3.13	3.04	0.73	Pass	
20		N					SV speed
21		Y	3.10	3.00	0.70	Pass	
22		Y	2.87	2.76	0.47	Pass	
23		Y	2.89	2.80	0.49	Pass	
24	Y	2.80	2.71	0.40	Pass		

Run	Test Type	Valid Run?	TTCW Sound (sec)	TTCW Light (sec)	TTCW Margin (sec)	Pass/Fail	Notes
8	Slower POV	Y	3.26	3.18	1.26	Pass	
9		Y	3.28	3.18	1.28	Pass	
10		N					Post error
11		N					Lateral error
12		Y	3.25	3.16	1.25	Pass	
13		Y	3.39	3.30	1.39	Pass	
14		Y	3.11	3.03	1.11	Pass	
15		Y	3.17	3.04	1.17	Pass	
16		Y	3.30	3.20	1.30	Pass	

APPENDIX D

Time History Plots

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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)

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 \pm 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.

Notes

When vehicles provide more than one type of alert, and when it is possible to measure the timing of these alerts, plots will be shown of each alert for each run. Because alert timing nearly always differs between alert types, a plot may indicate a valid run for one of the alerts and invalid for another. Test run validity is based on the validity window of the earliest alert, but validity determination for each individual alert is based on the timing of that alert alone. As an example, a vehicle has both visual and audible alerts. For a particular run, the audible alert occurs first followed by the visual alert. The validity period for the run ends when the audible alert occurs, at which time the driver steers and/or brakes to avoid the POV. Since the visual alert occurs after the audible alert, the run is essentially already over by the time the visual alert occurs. Depending on the relative timing gap between alerts, it may be expected that the validity criteria (yaw rate, speed, etc.) based on the timing of the visual alert could indicate an invalid run.

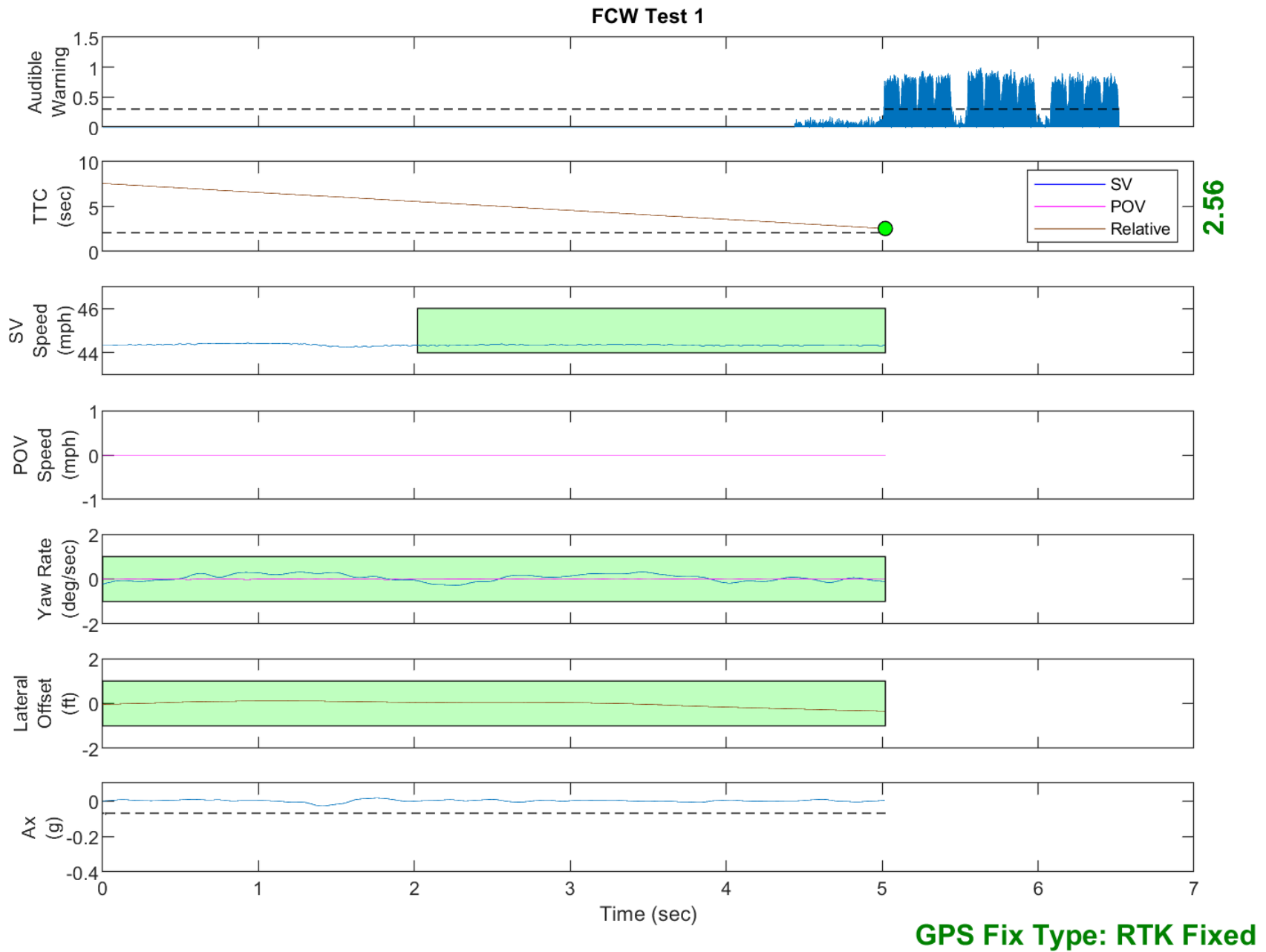
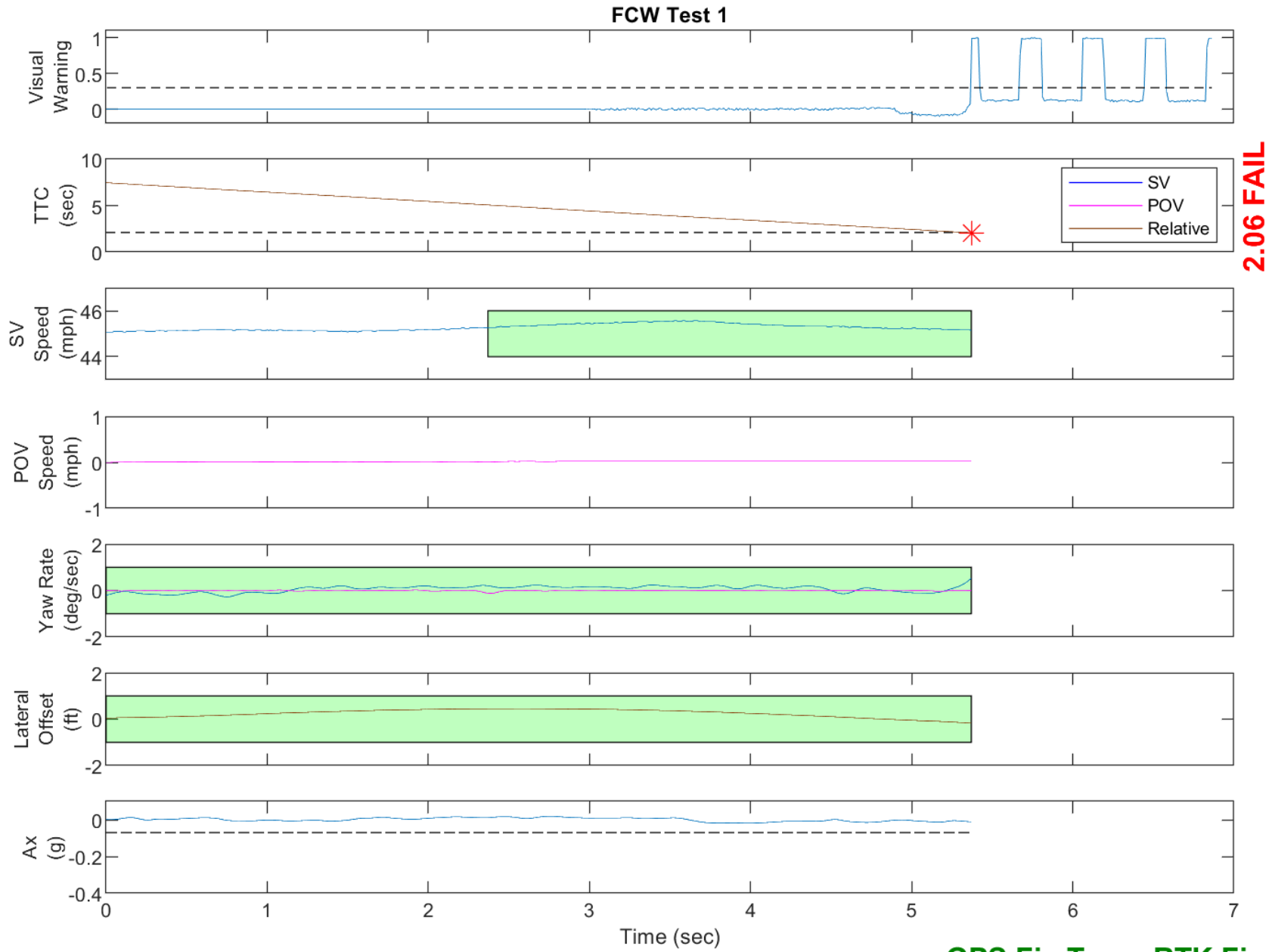


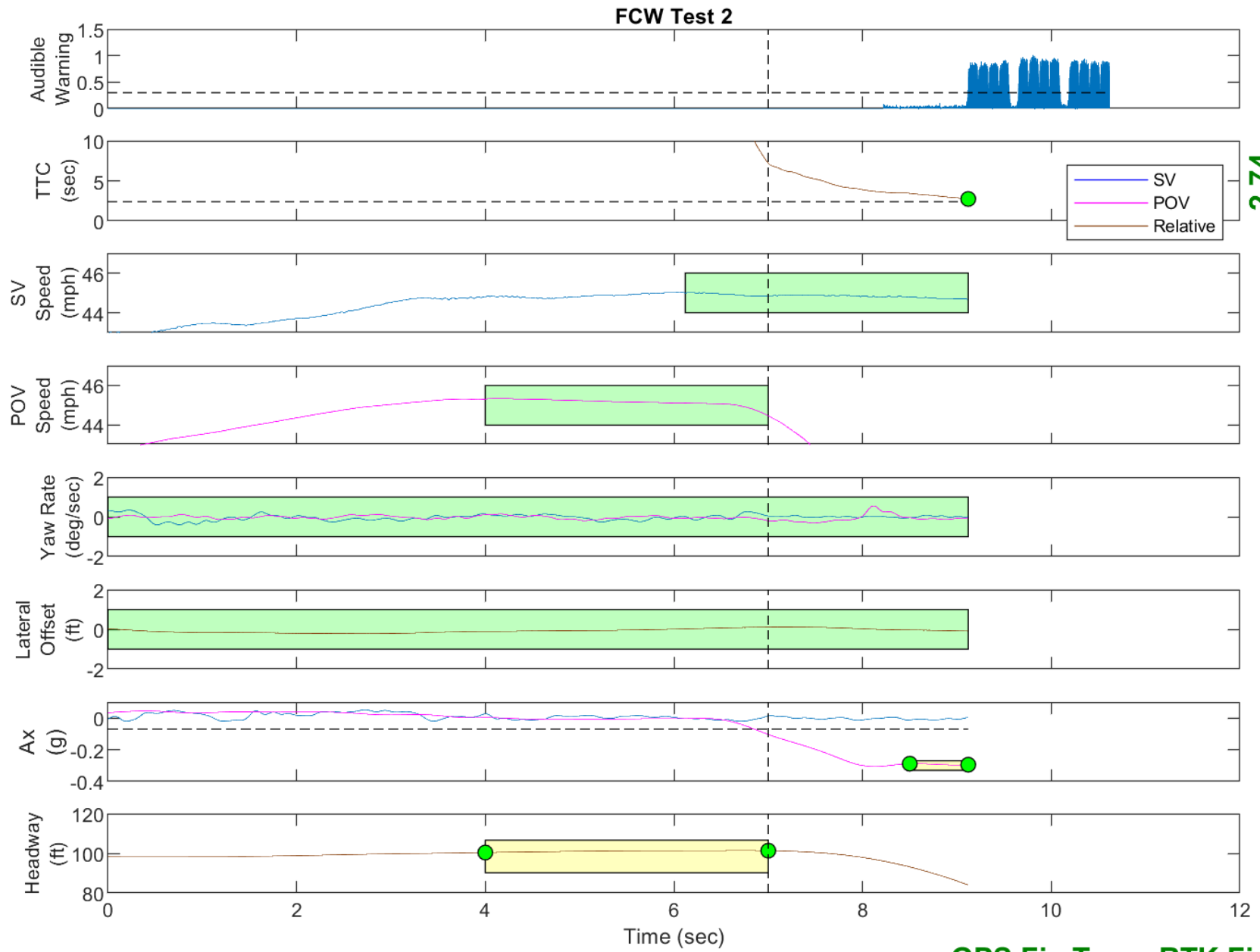
Figure D1. Example Time History for Test Type 1, Passing



2.06 FAIL

GPS Fix Type: RTK Fixed

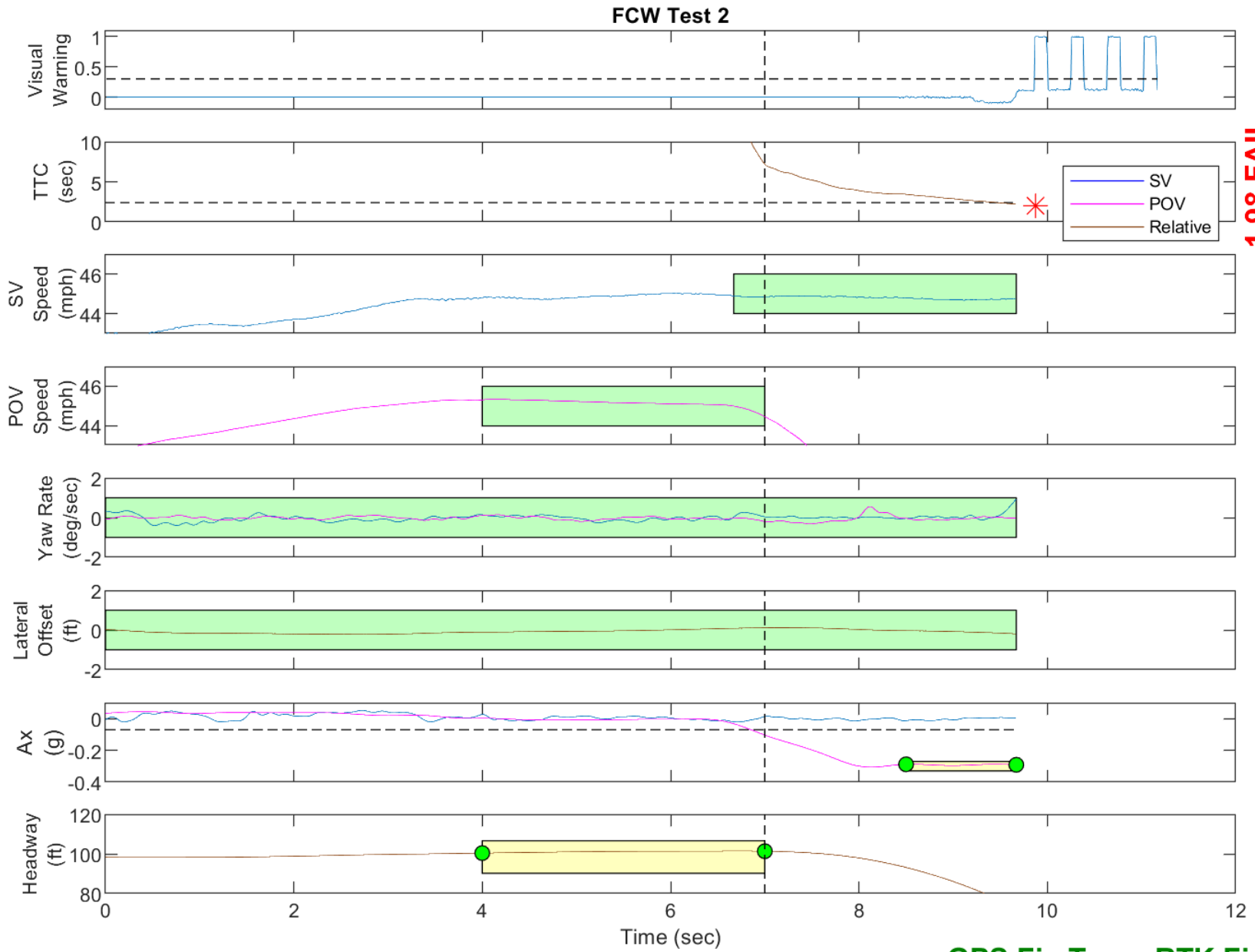
Figure D2. Example Time History for Test Type 1, Failing



2.74

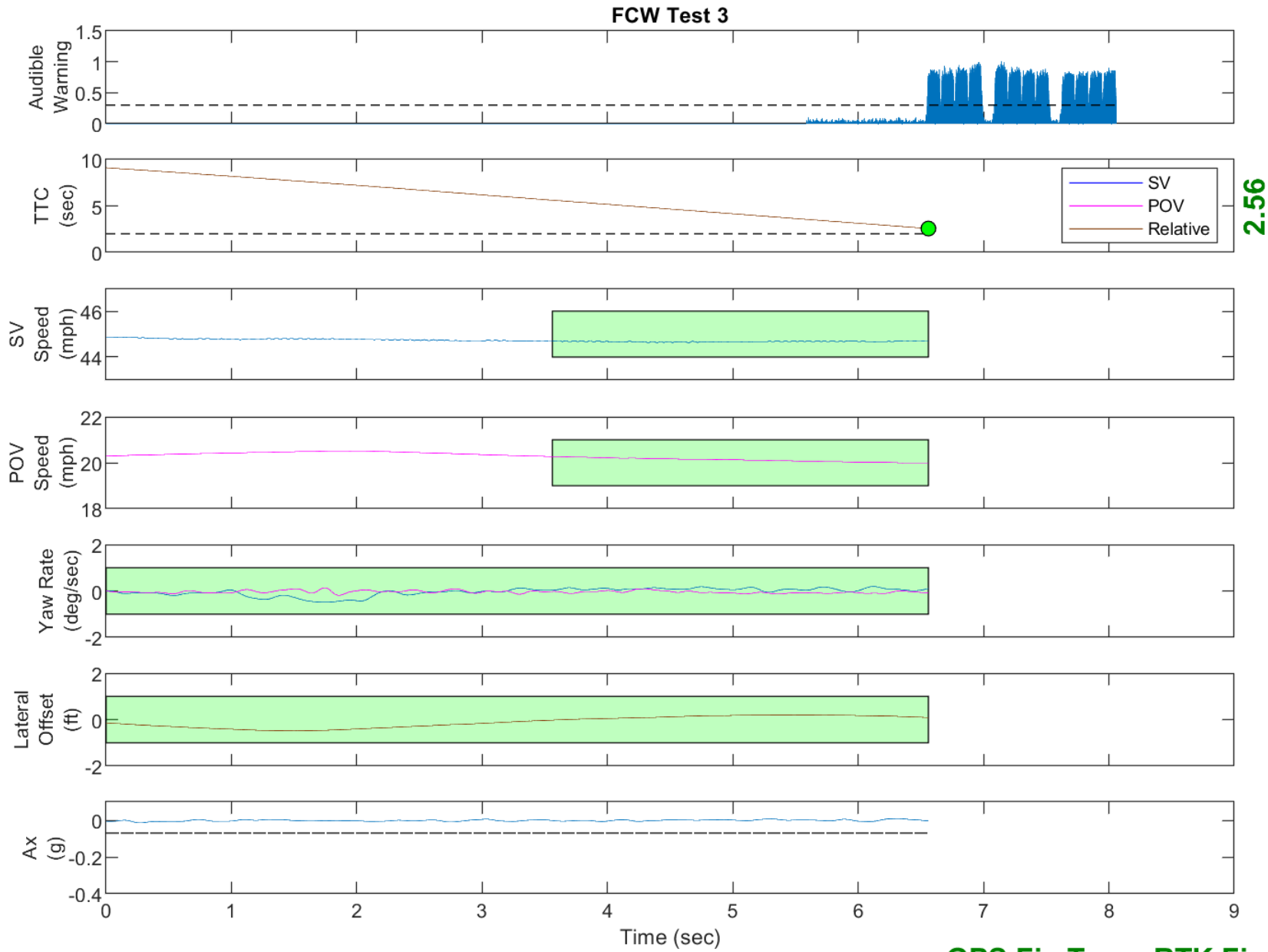
GPS Fix Type: RTK Fixed

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



GPS Fix Type: RTK Fixed

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



GPS Fix Type: RTK Fixed

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

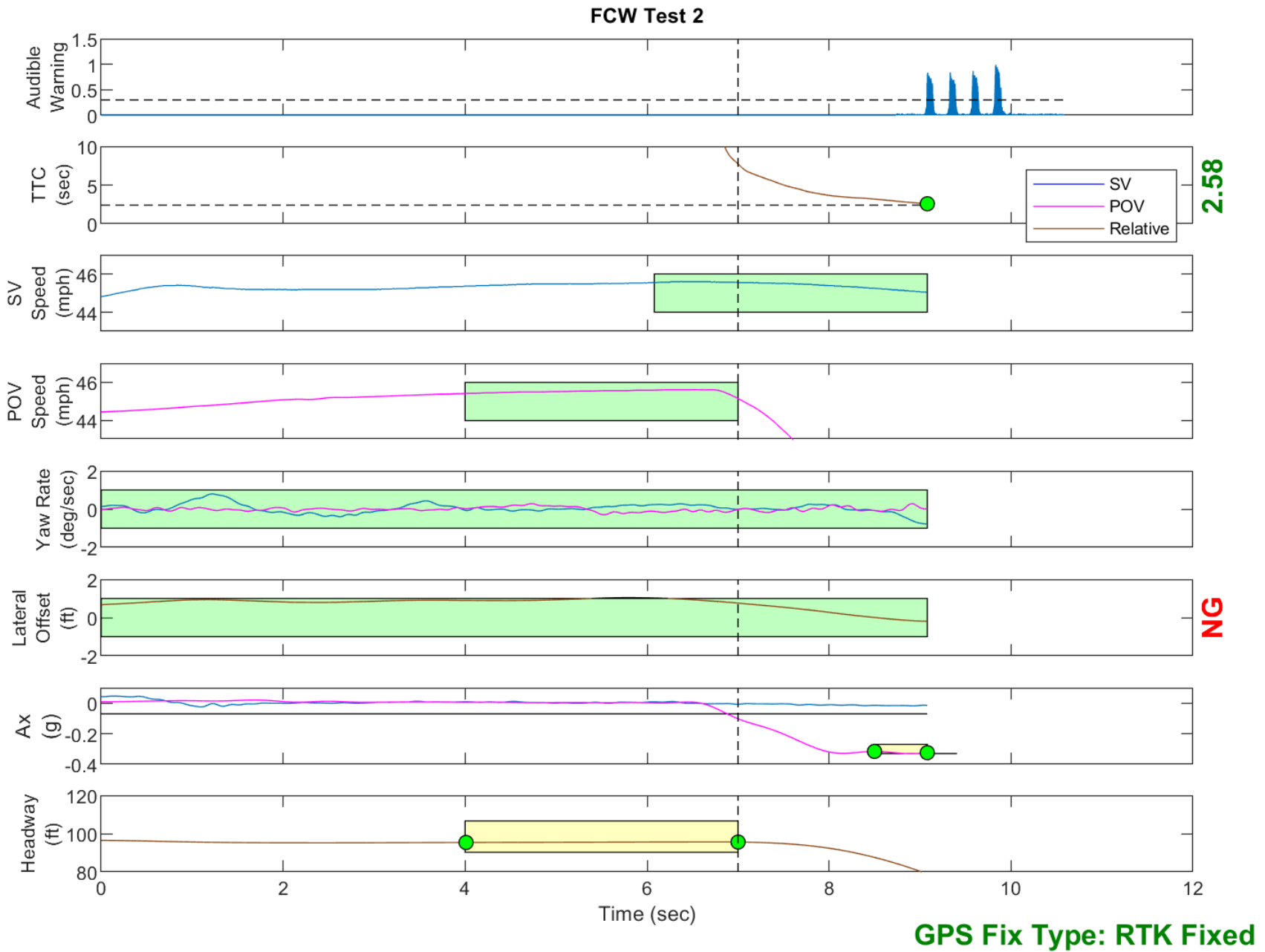


Figure D6. Example Time History Showing Invalid Lateral Offset Criteria

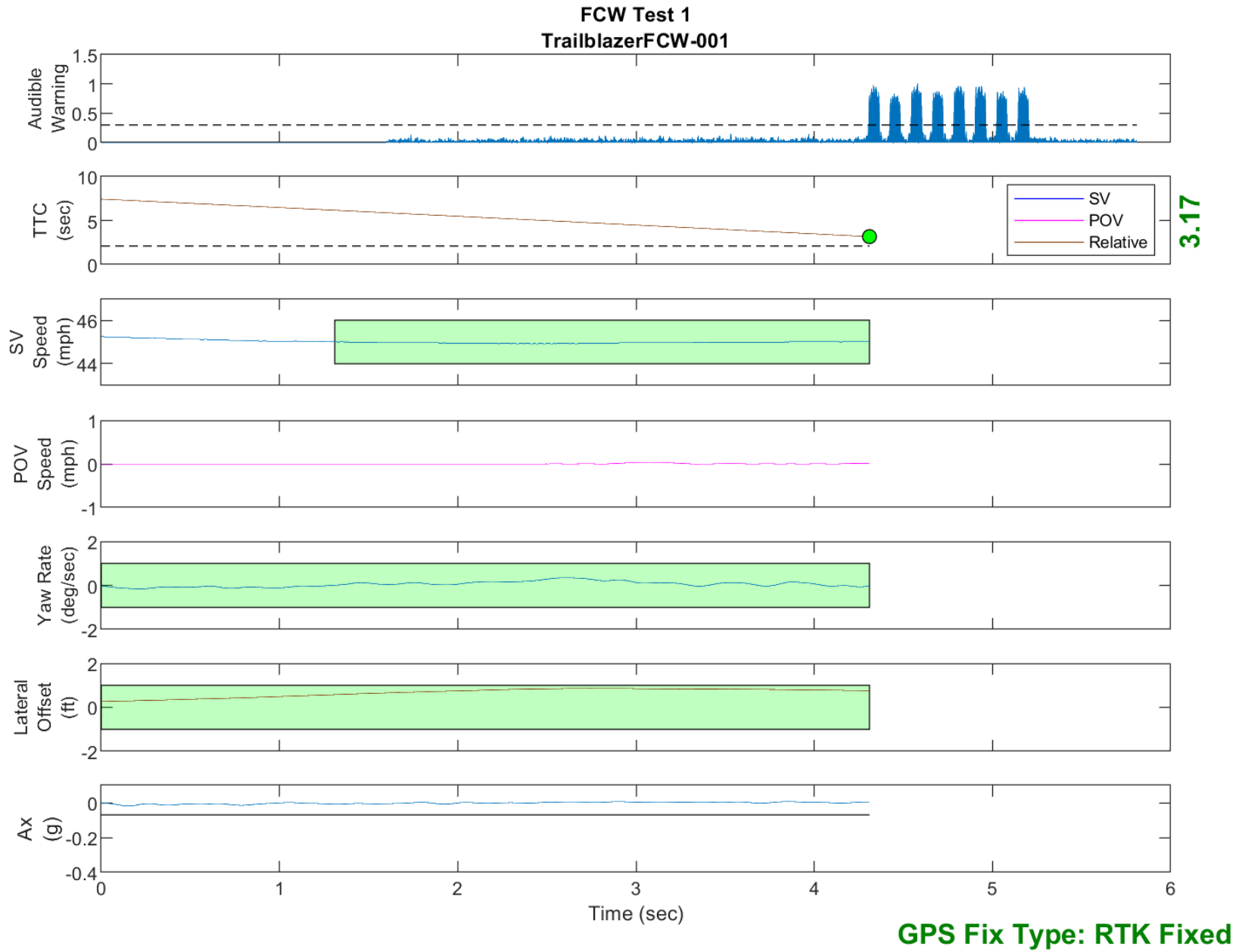


Figure D7. Time History for Run 1, FCW Test 1, Audible Warning

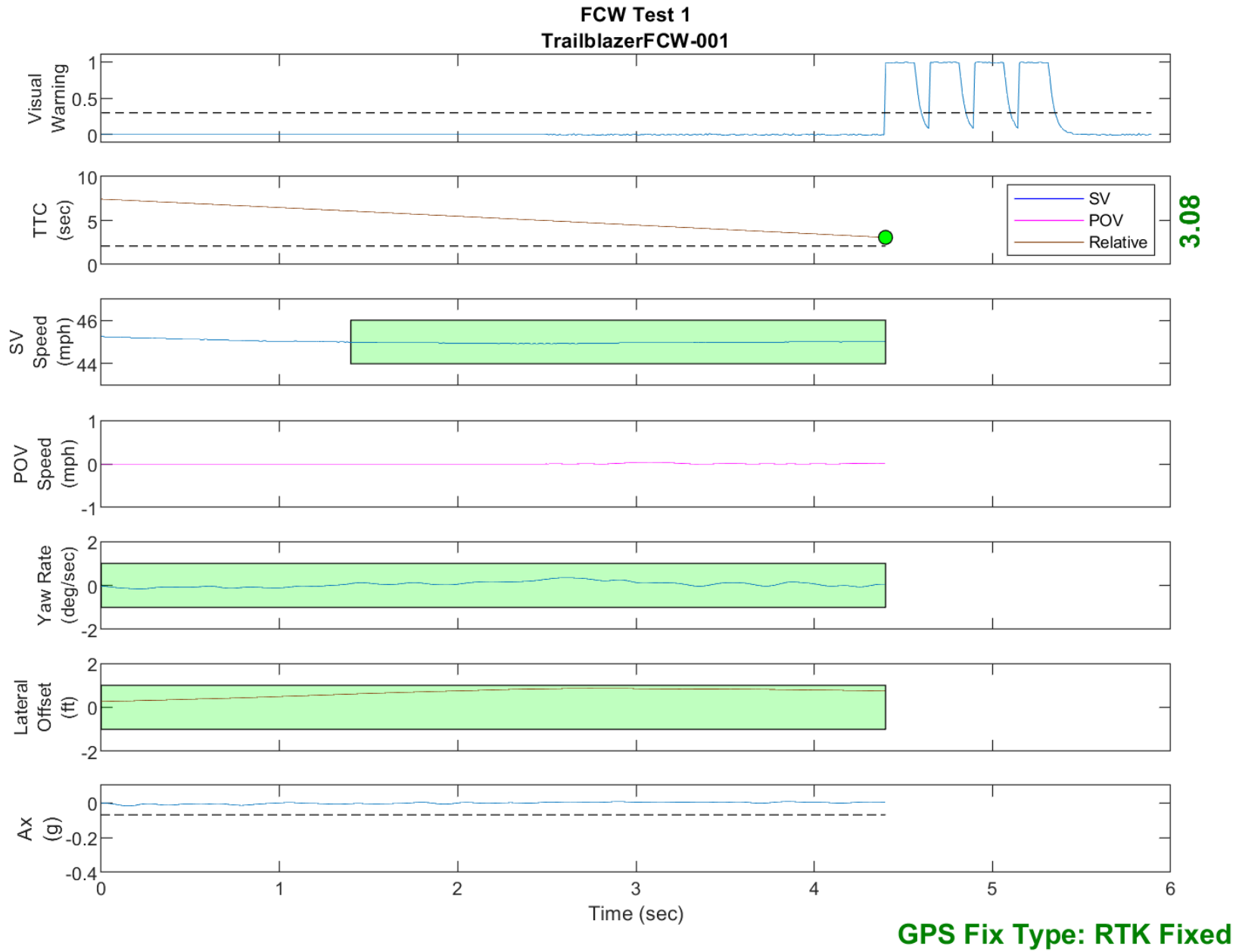


Figure D8. Time History for Run 1, FCW Test 1, Visual Warning

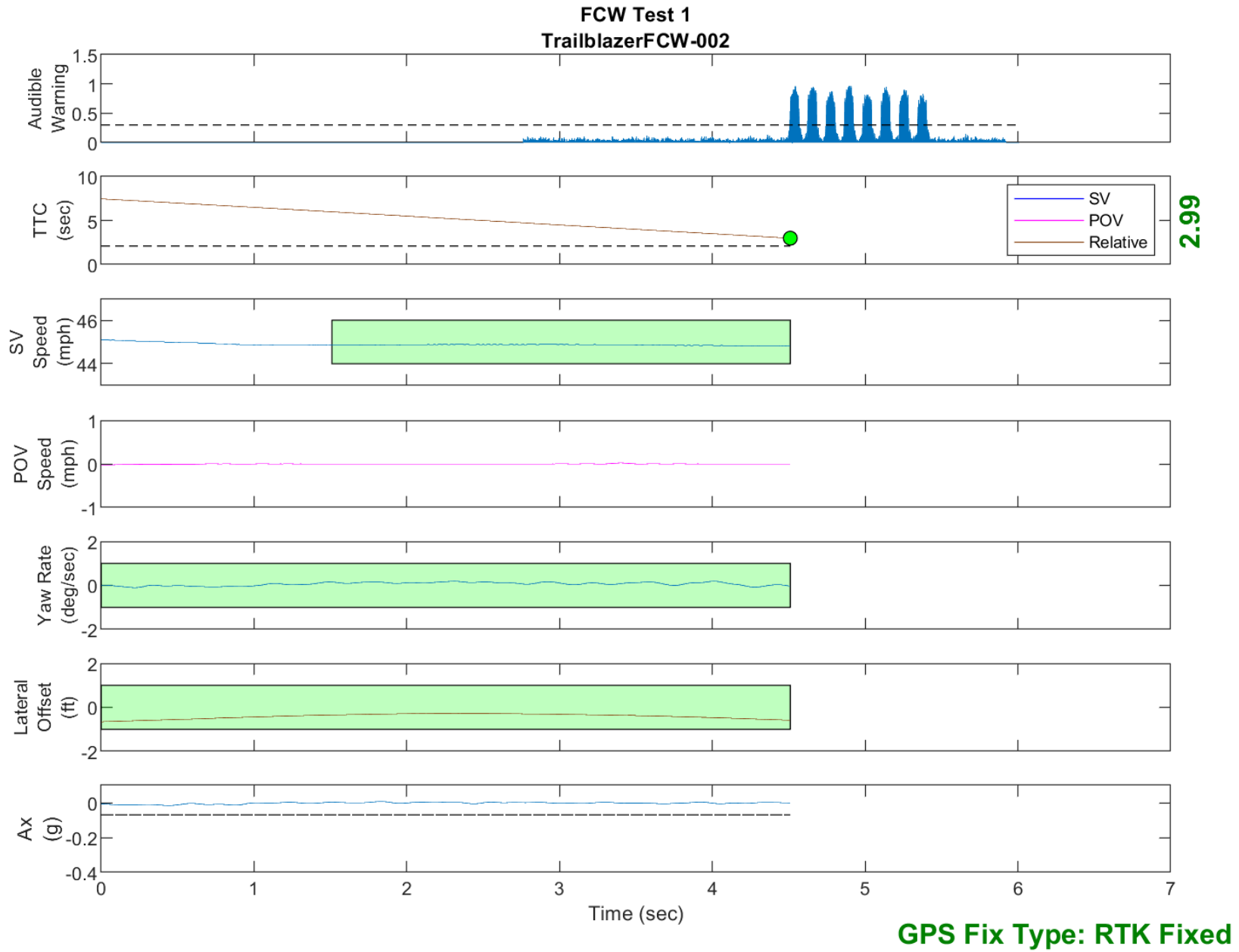


Figure D9. Time History for Run 2, FCW Test 1, Audible Warning

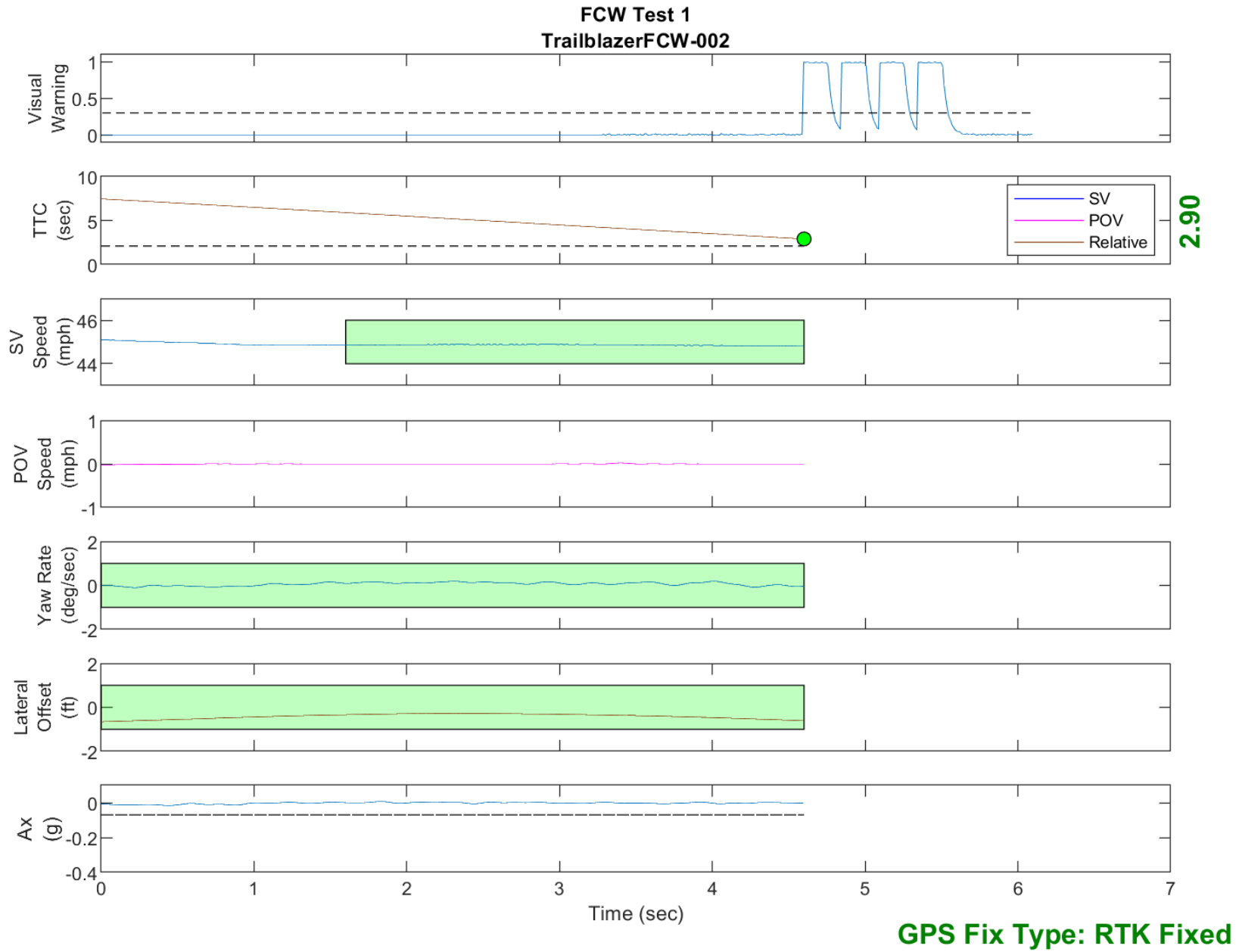


Figure D10. Time History for Run 2, FCW Test 1, Visual Warning

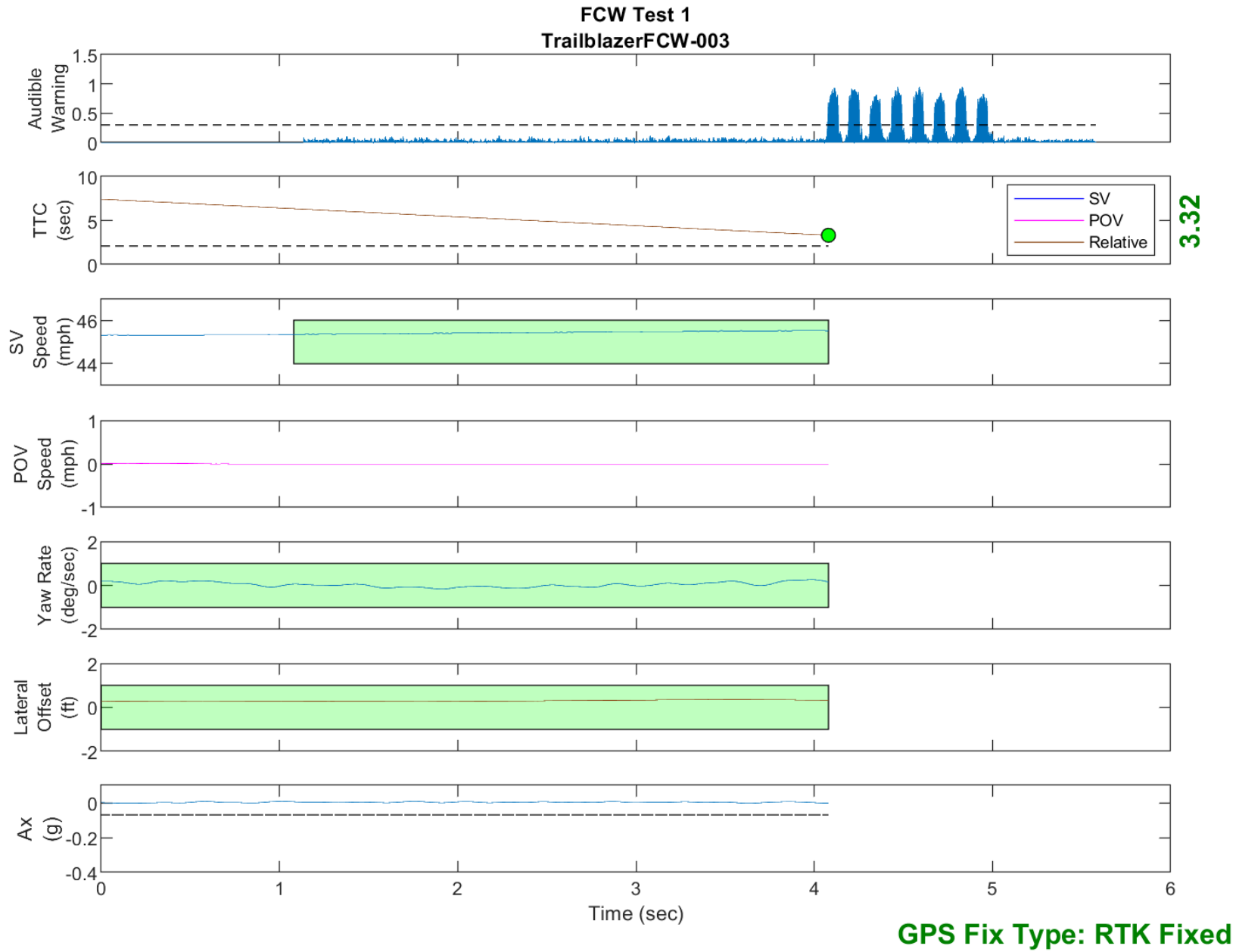


Figure D11. Time History for Run 3, FCW Test 1, Audible Warning

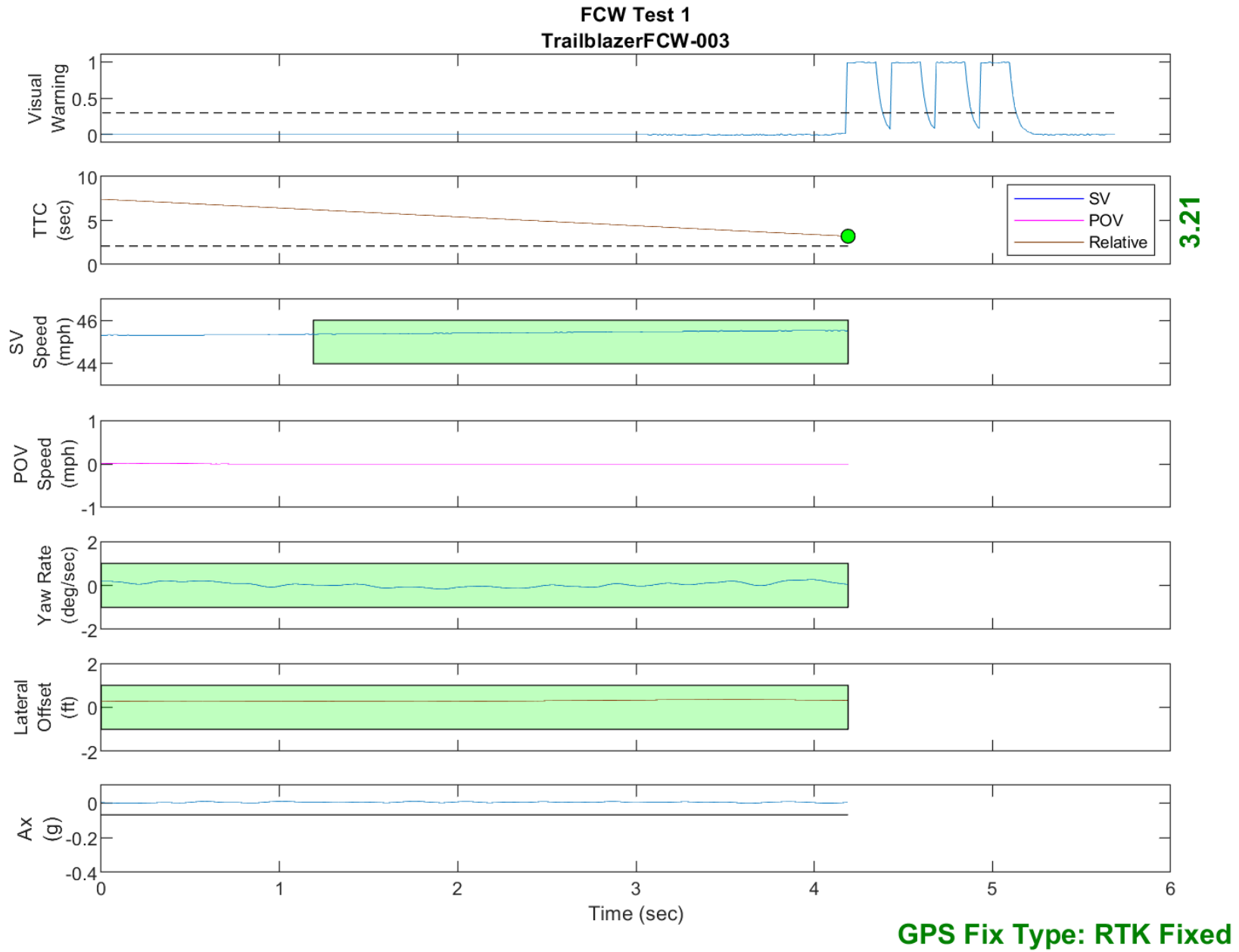


Figure D12. Time History for Run 3, FCW Test 1, Visual Warning

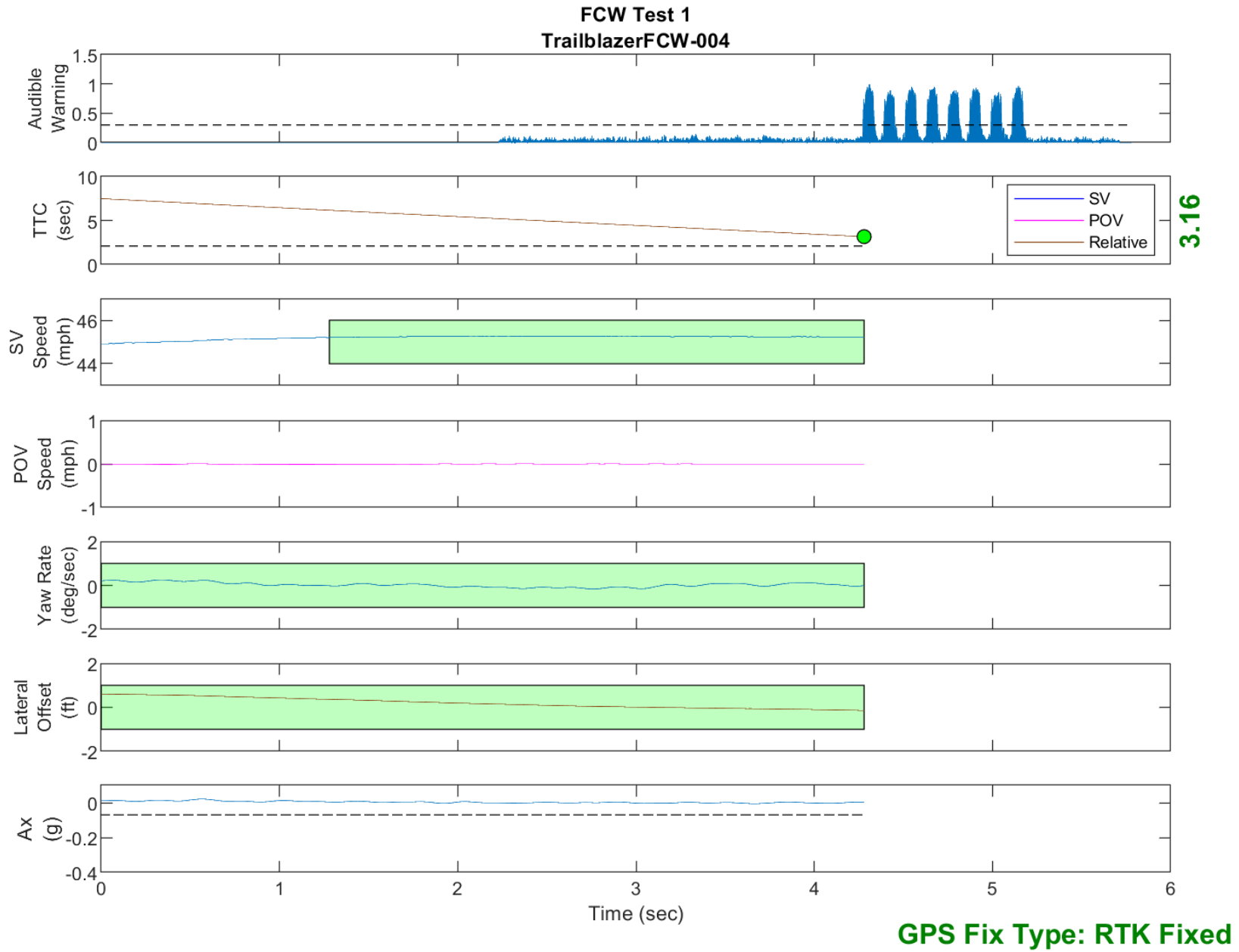


Figure D13. Time History for Run 4, FCW Test 1, Audible Warning

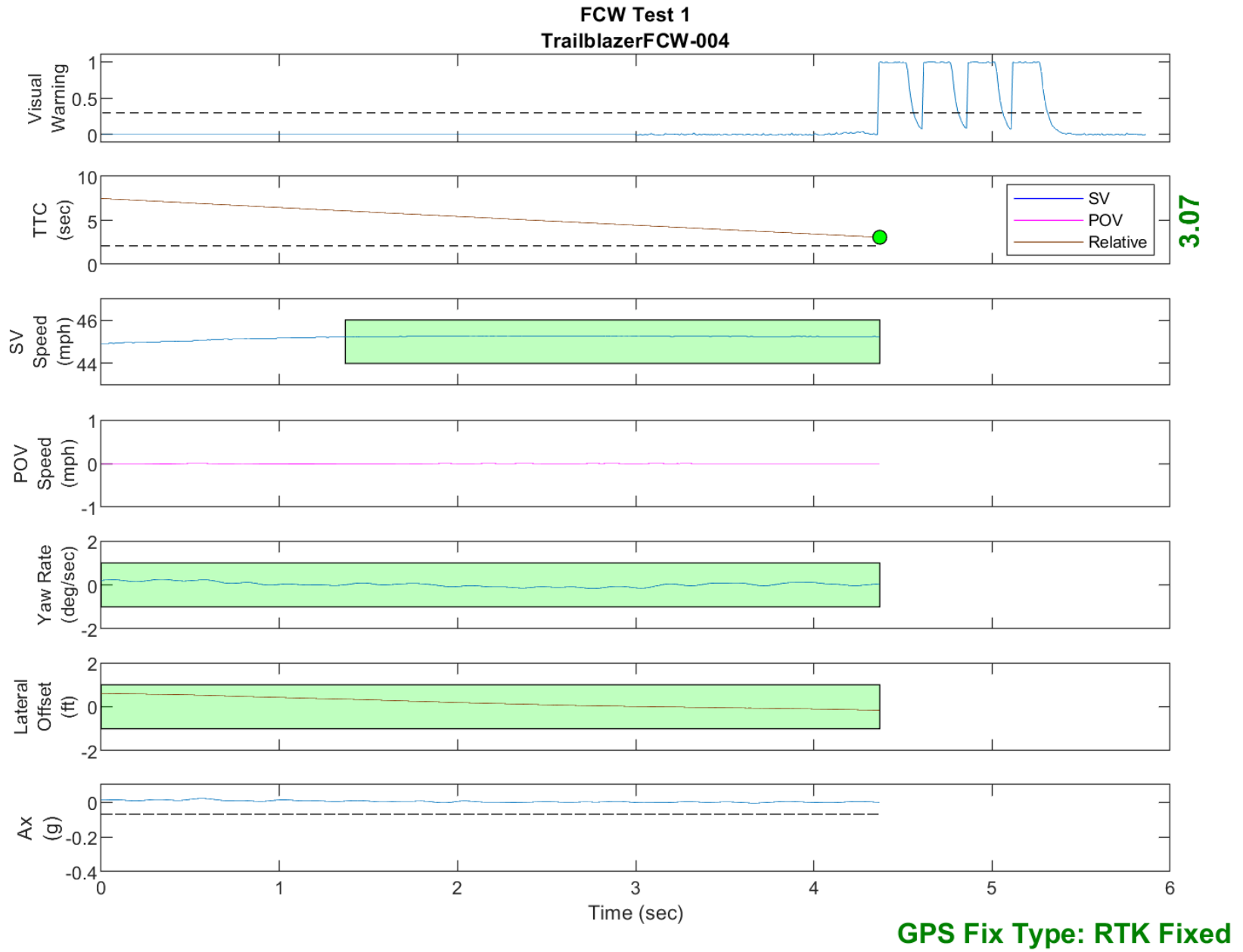


Figure D14. Time History for Run 4, FCW Test 1, Visual Warning

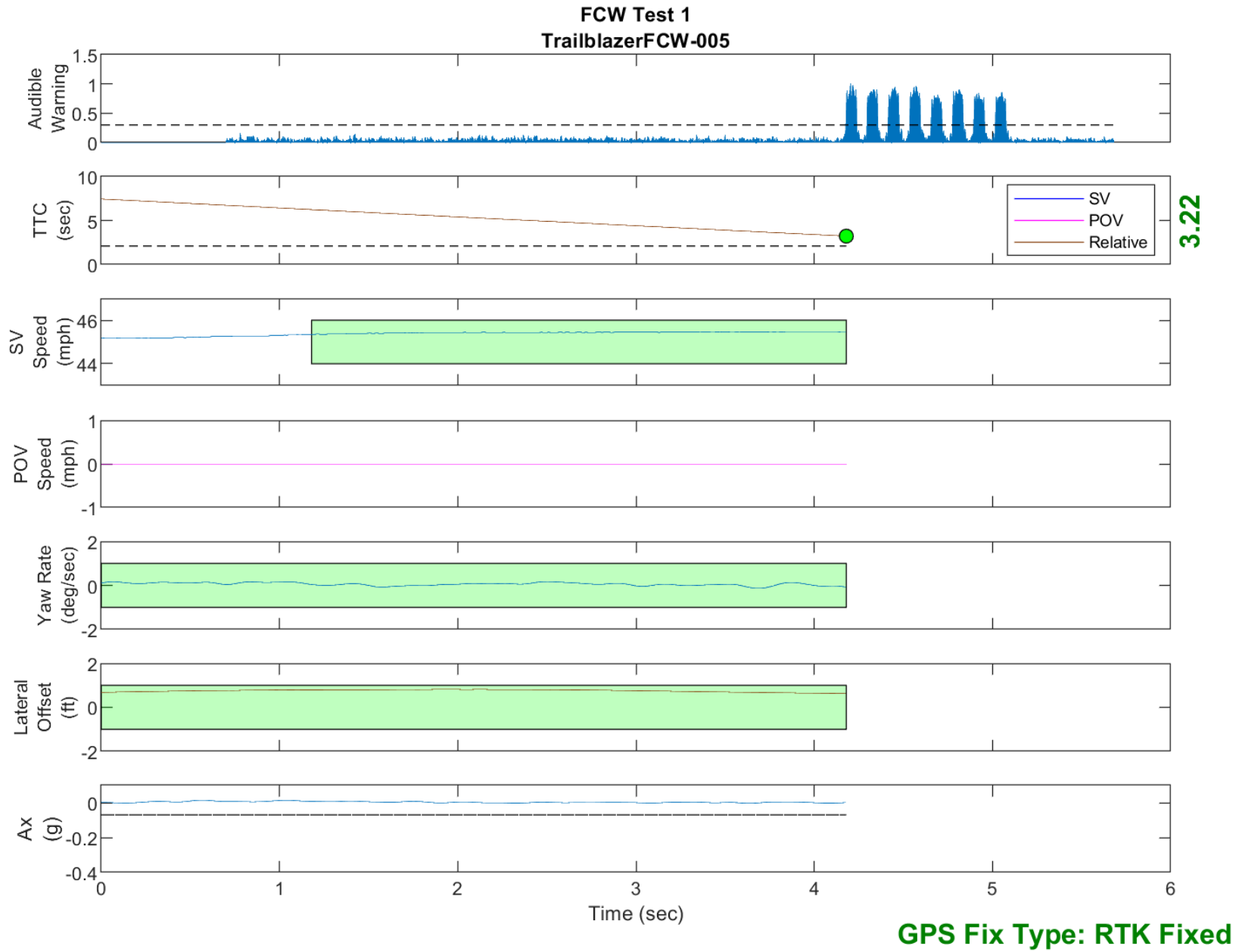


Figure D15. Time History for Run 5, FCW Test 1, Audible Warning

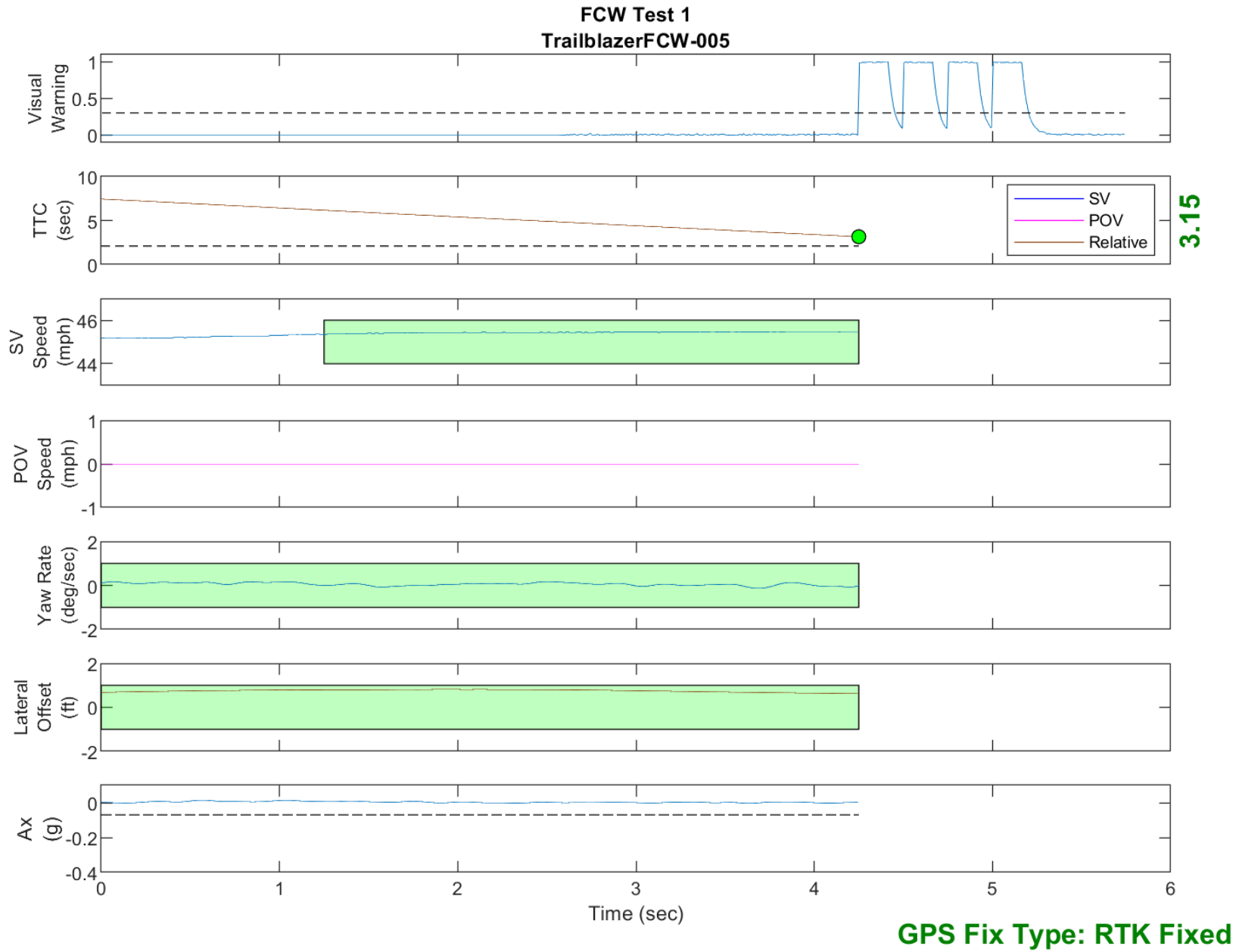


Figure D16. Time History for Run 5, FCW Test 1, Visual Warning

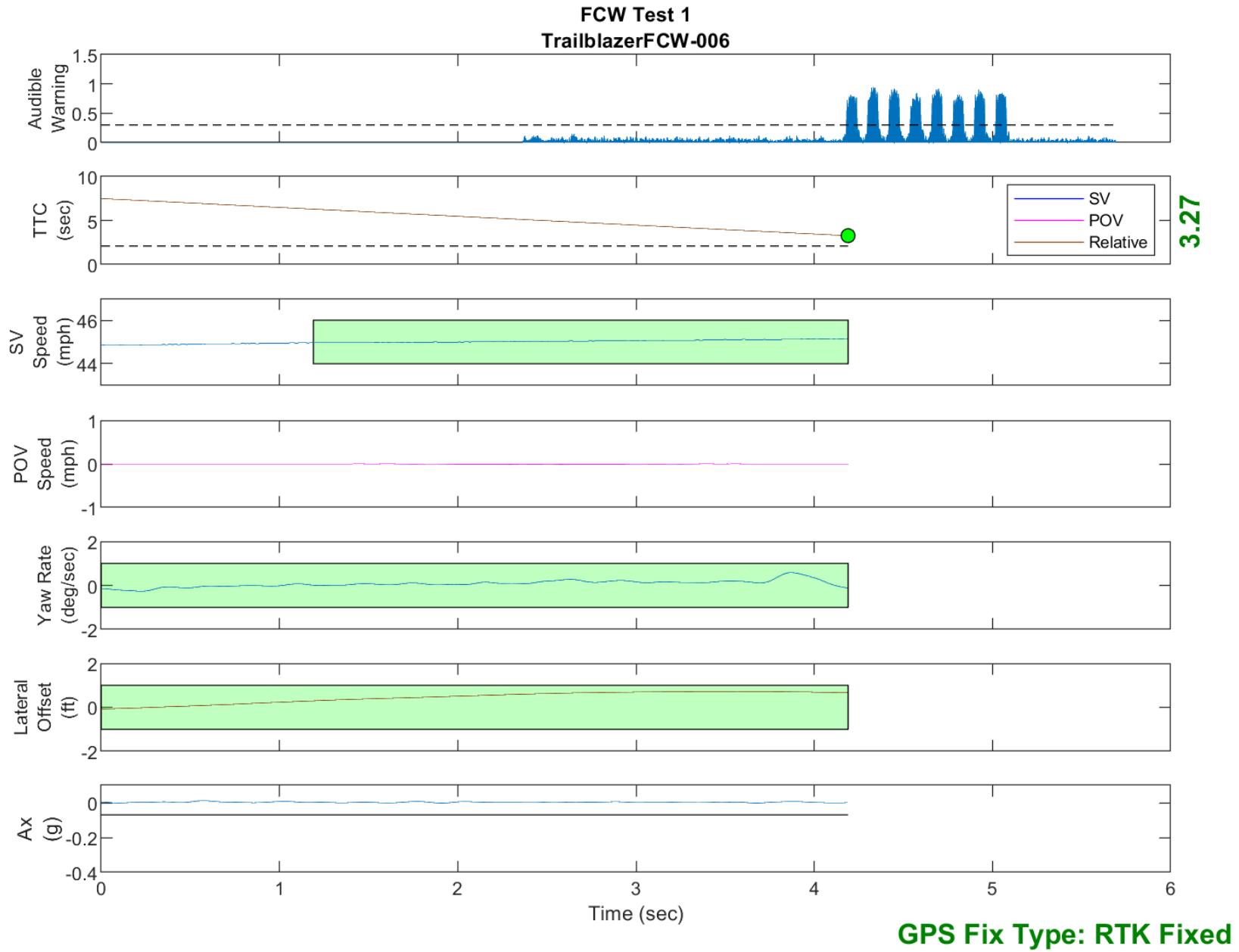


Figure D17. Time History for Run 6, FCW Test 1, Audible Warning

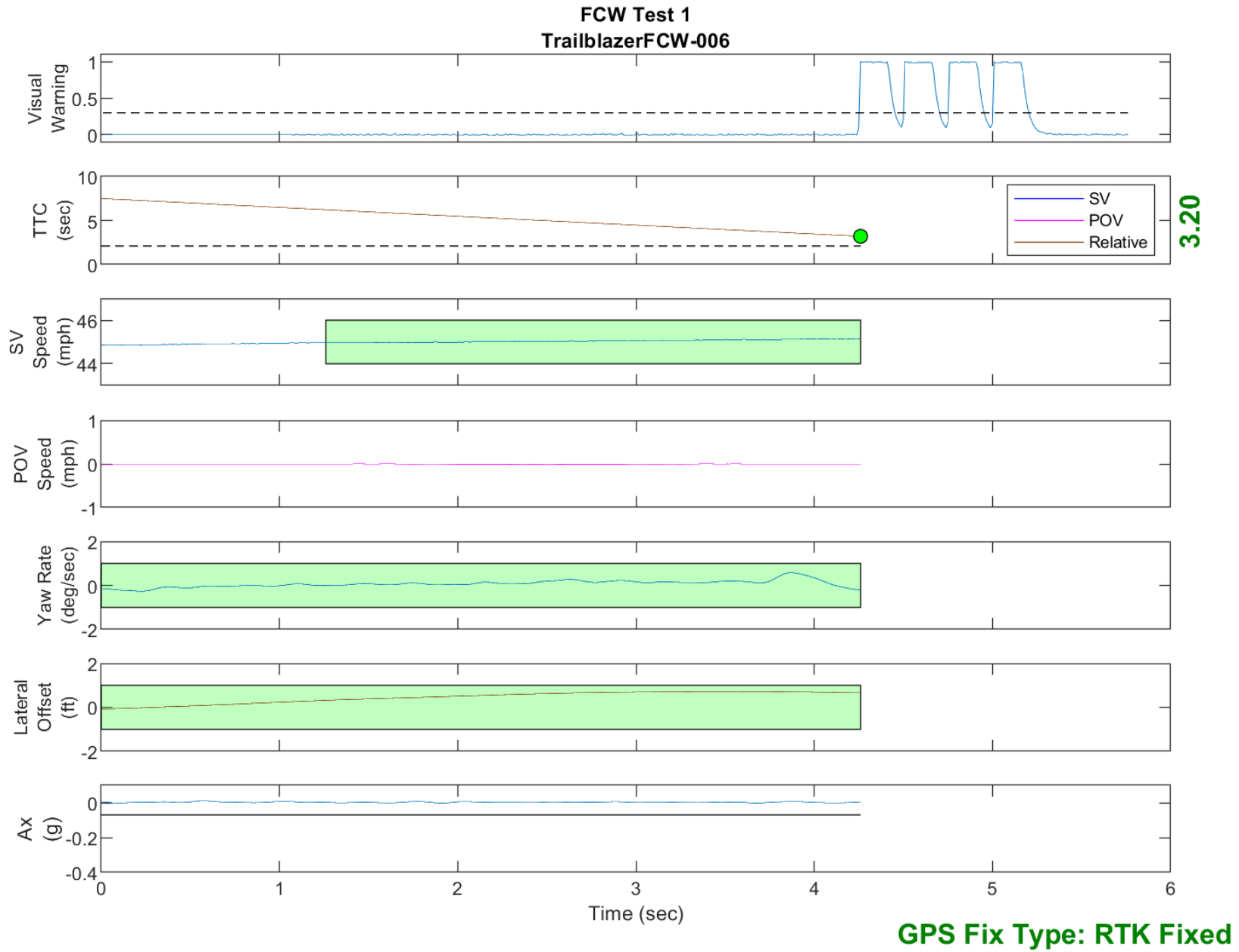


Figure D18. Time History for Run 6, FCW Test 1, Visual Warning

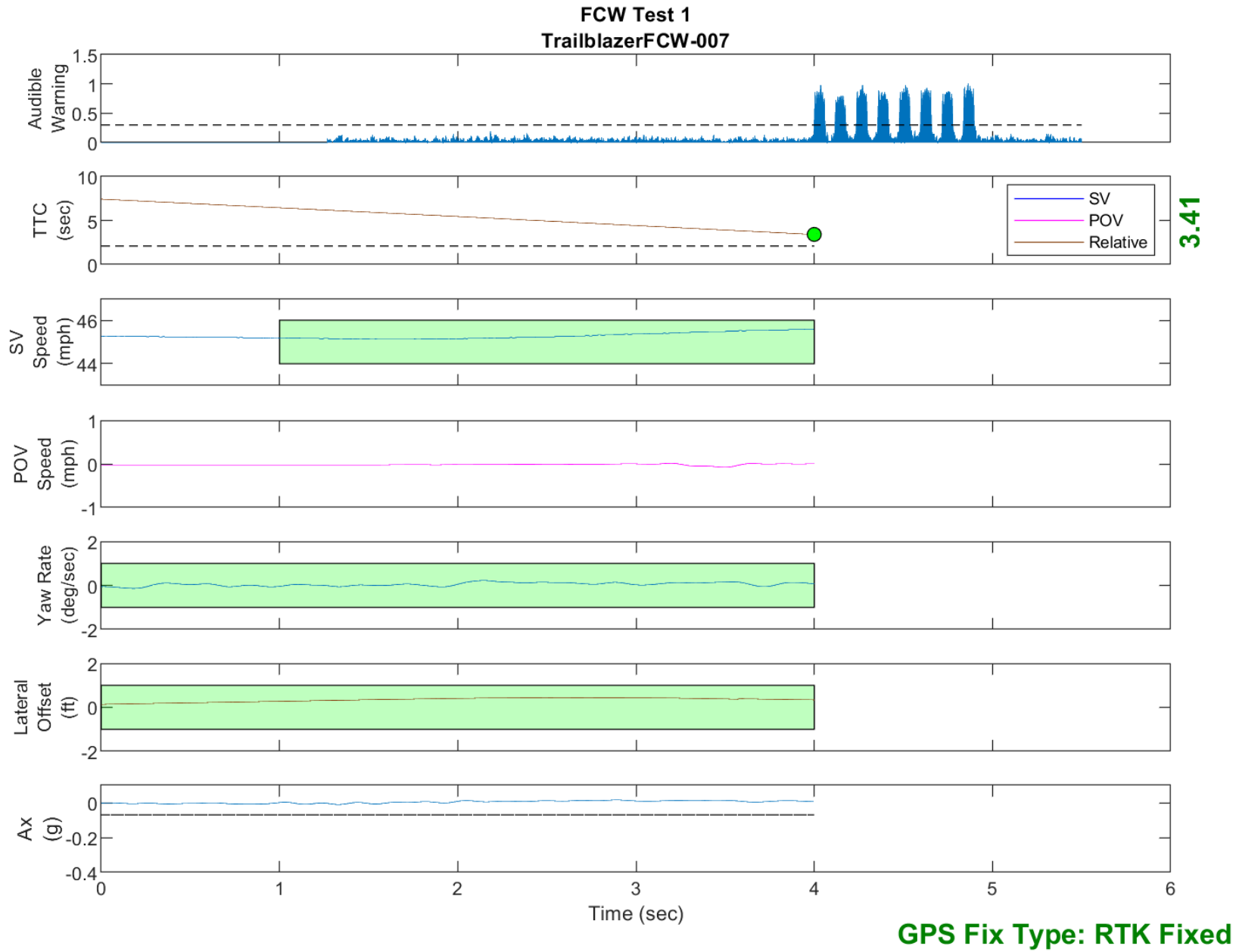


Figure D19. Time History for Run 7, FCW Test 1, Audible Warning

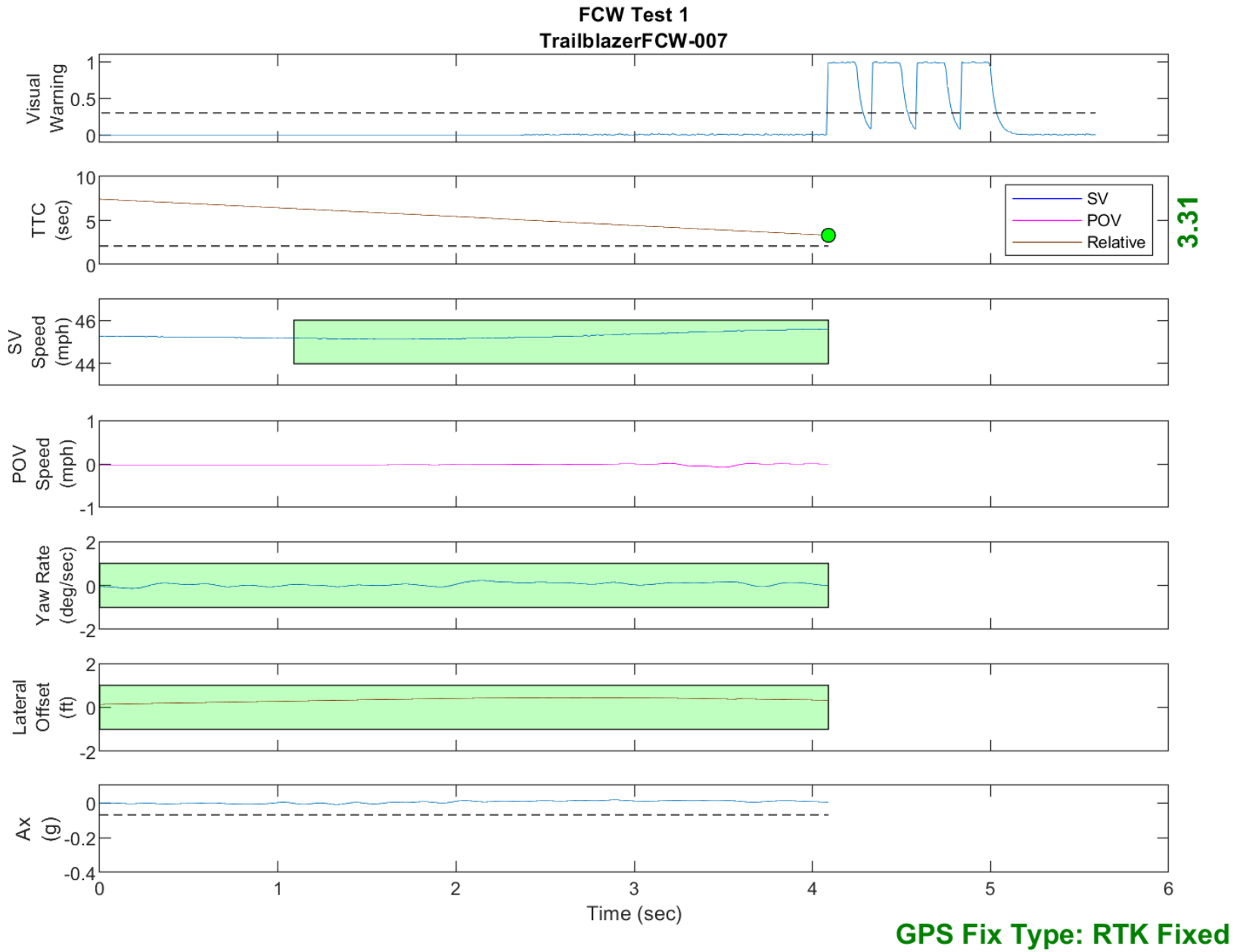


Figure D20. Time History for Run 7, FCW Test 1, Visual Warning

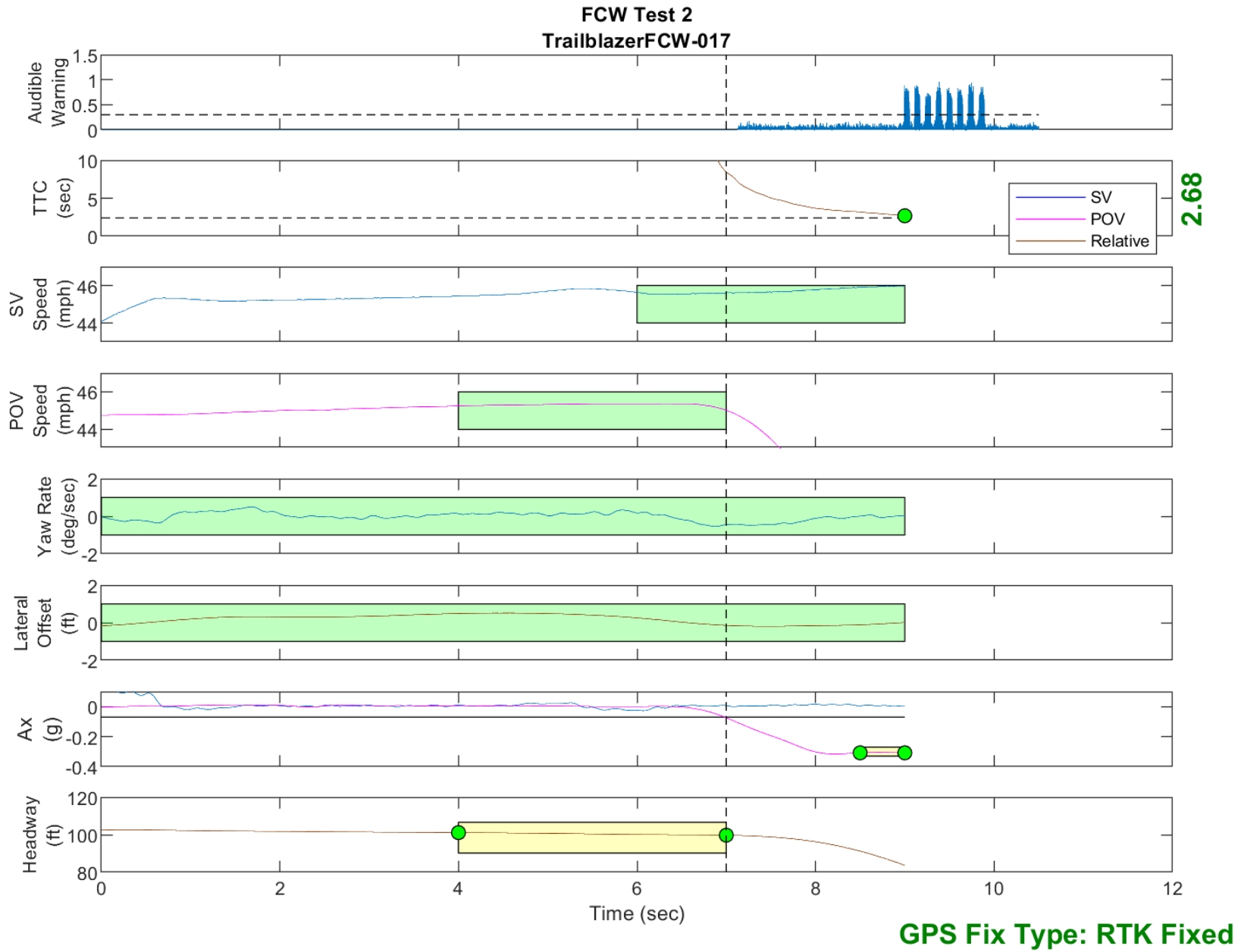


Figure D21. Time History for Run 17, FCW Test 2, Audible Warning

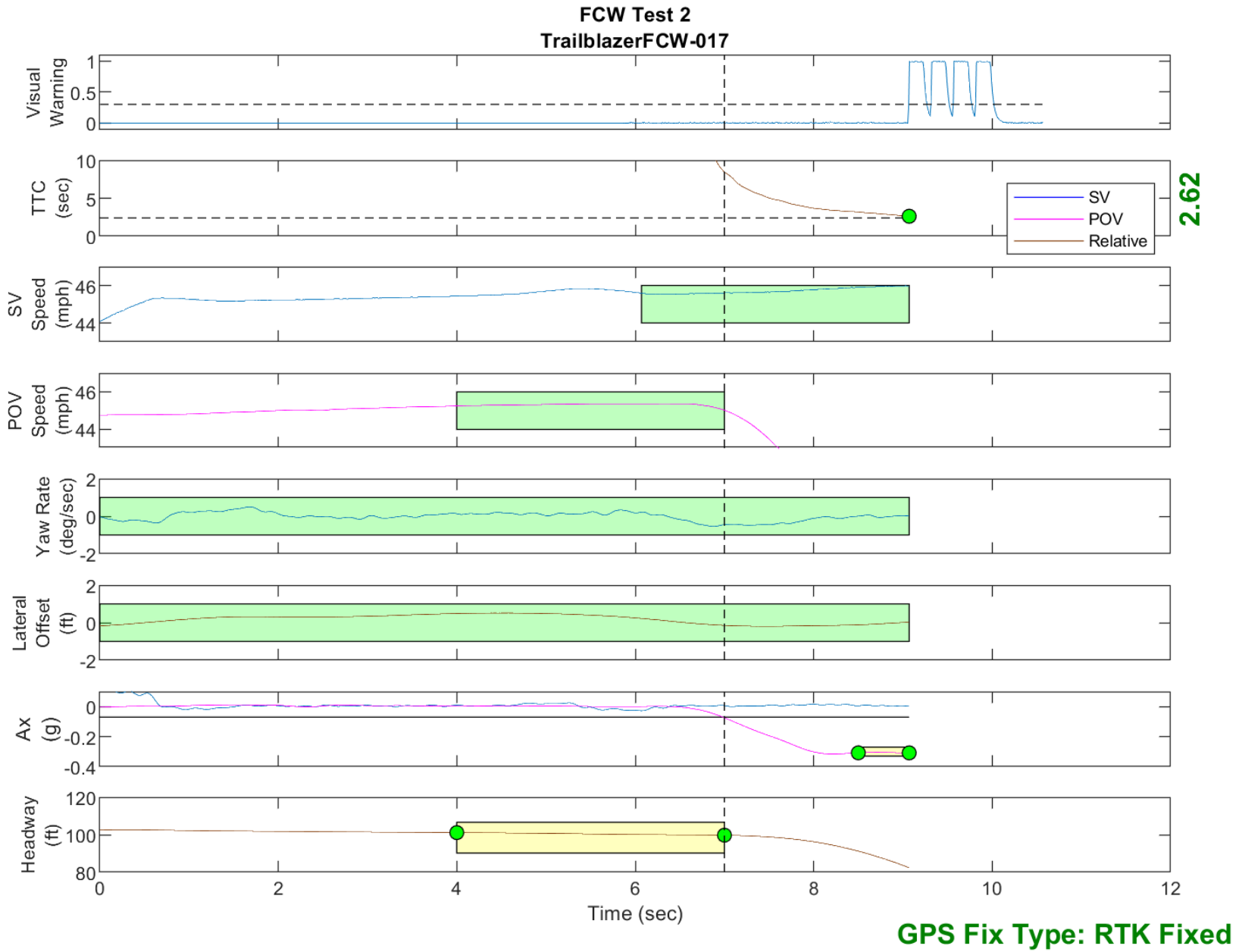


Figure D22. Time History for Run 17, FCW Test 2, Visual Warning

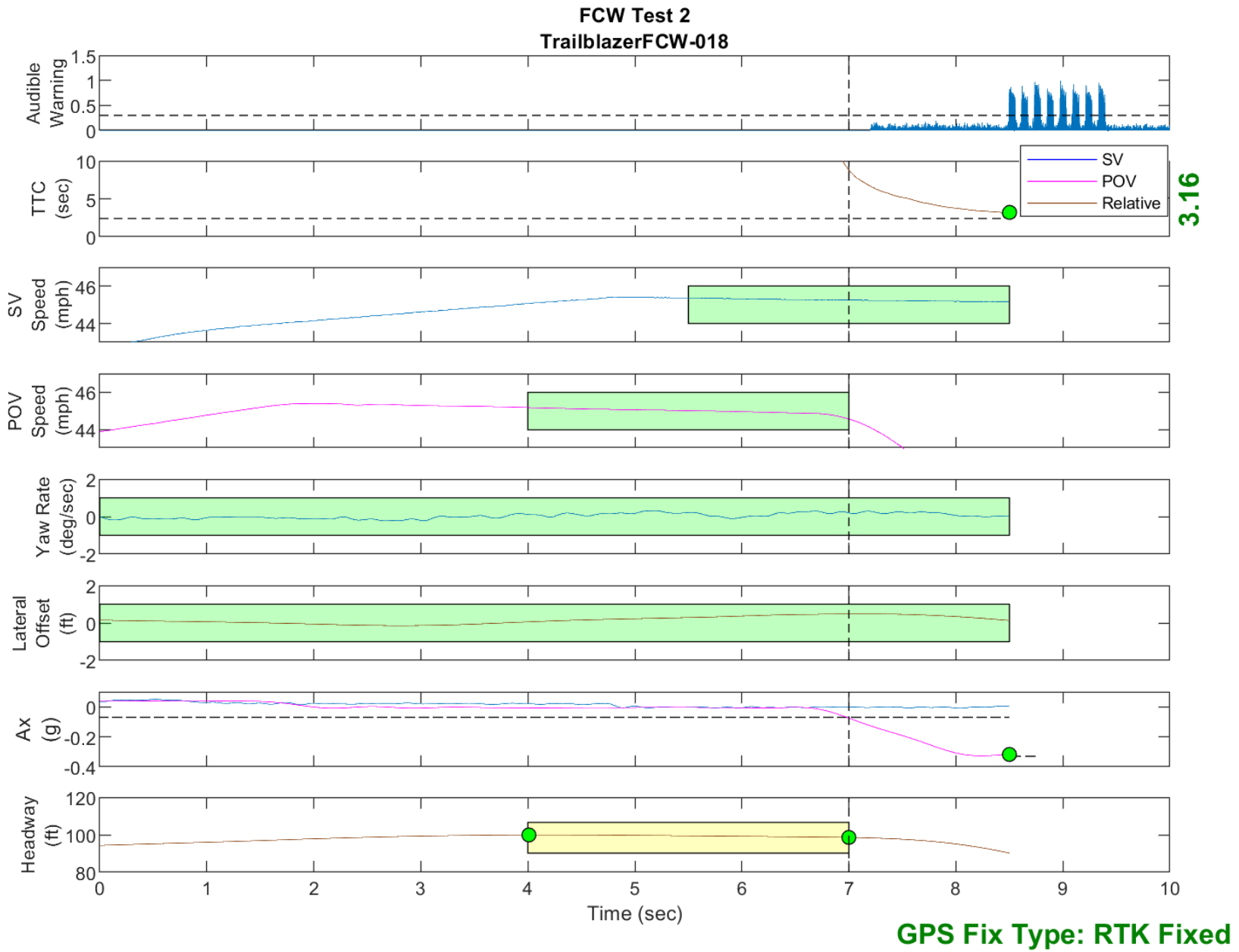


Figure D23. Time History for Run 18, FCW Test 2, Audible Warning

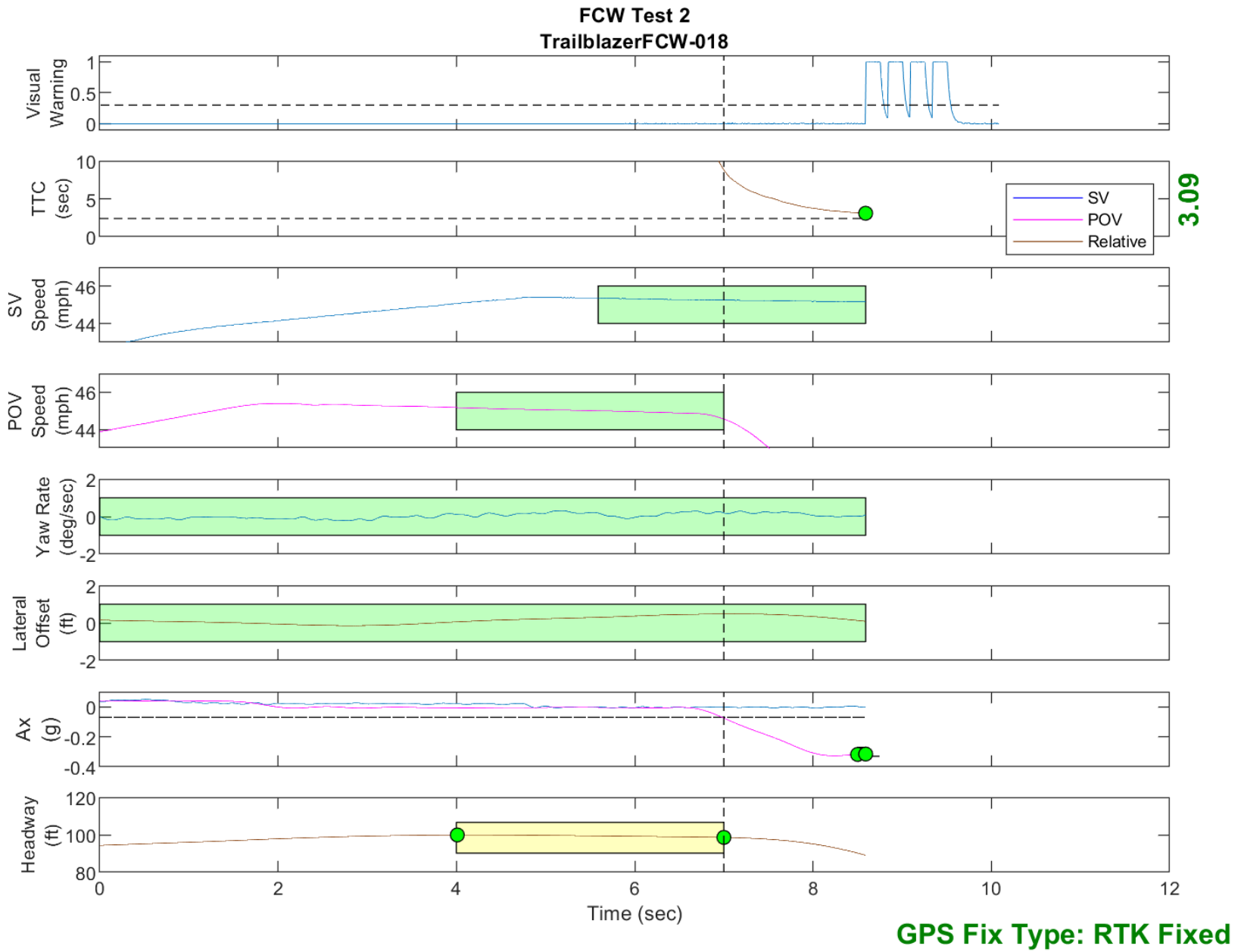


Figure D24. Time History for Run 18, FCW Test 2, Visual Warning

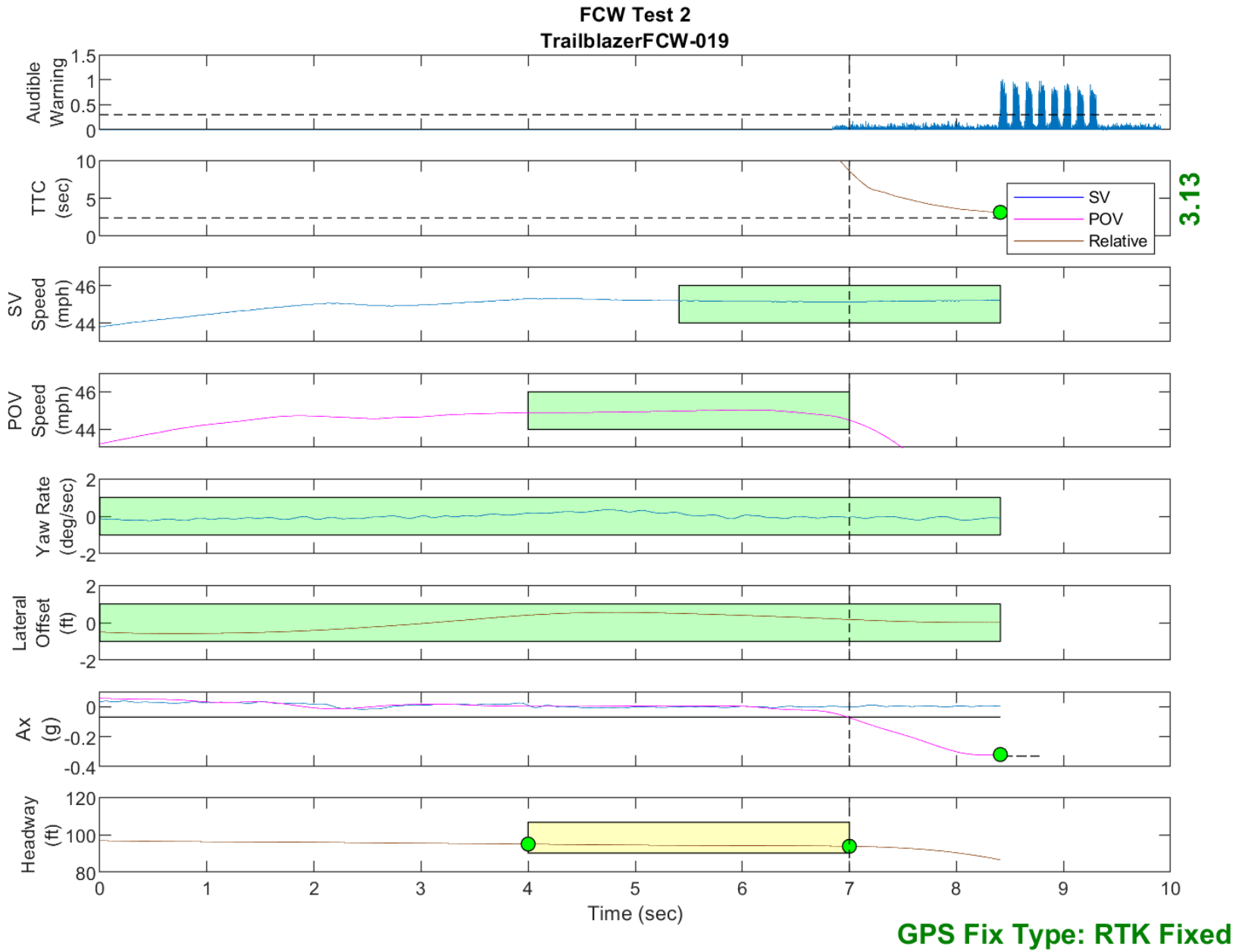


Figure D25. Time History for Run 19, FCW Test 2, Audible Warning

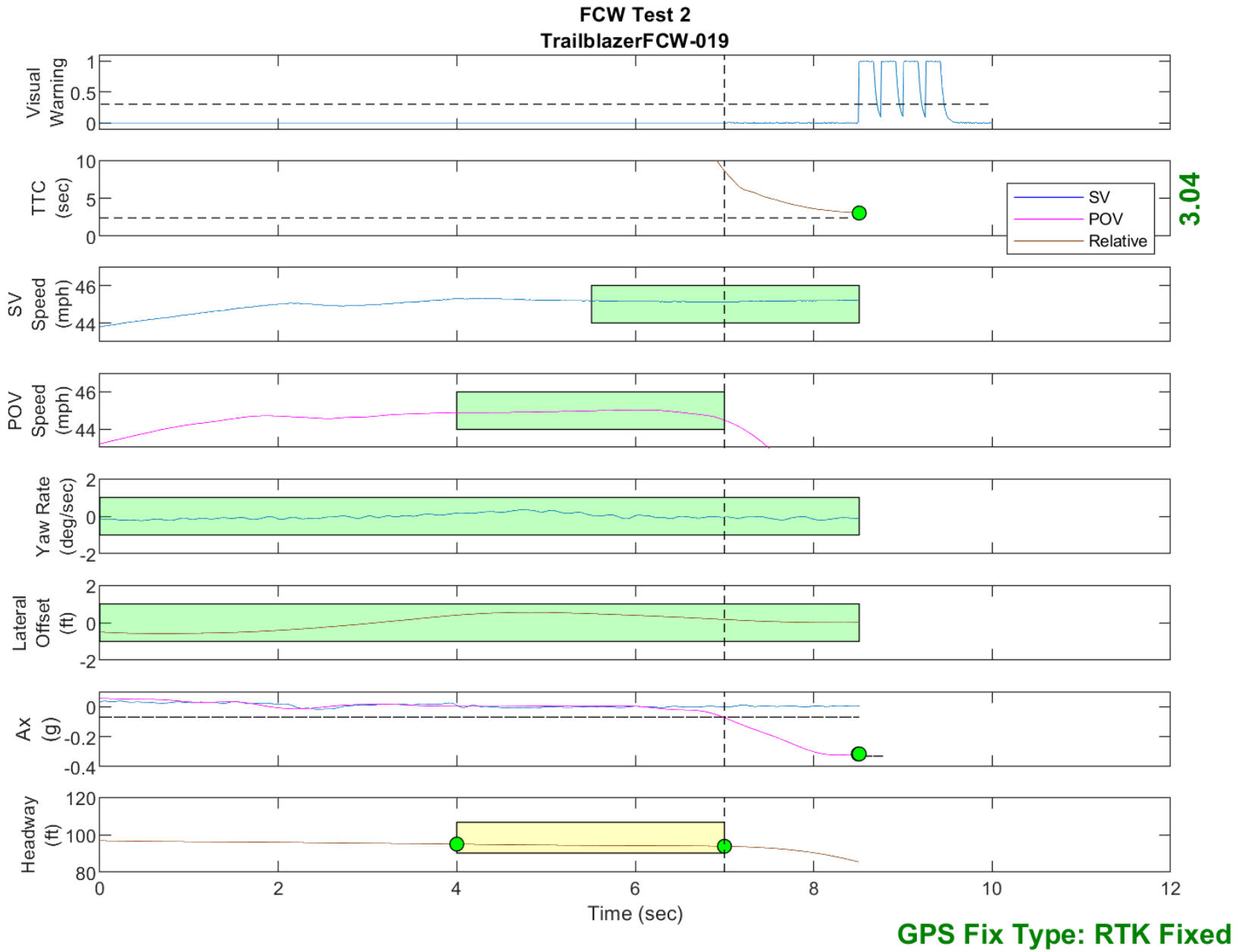


Figure D26. Time History for Run 19, FCW Test 2, Visual Warning

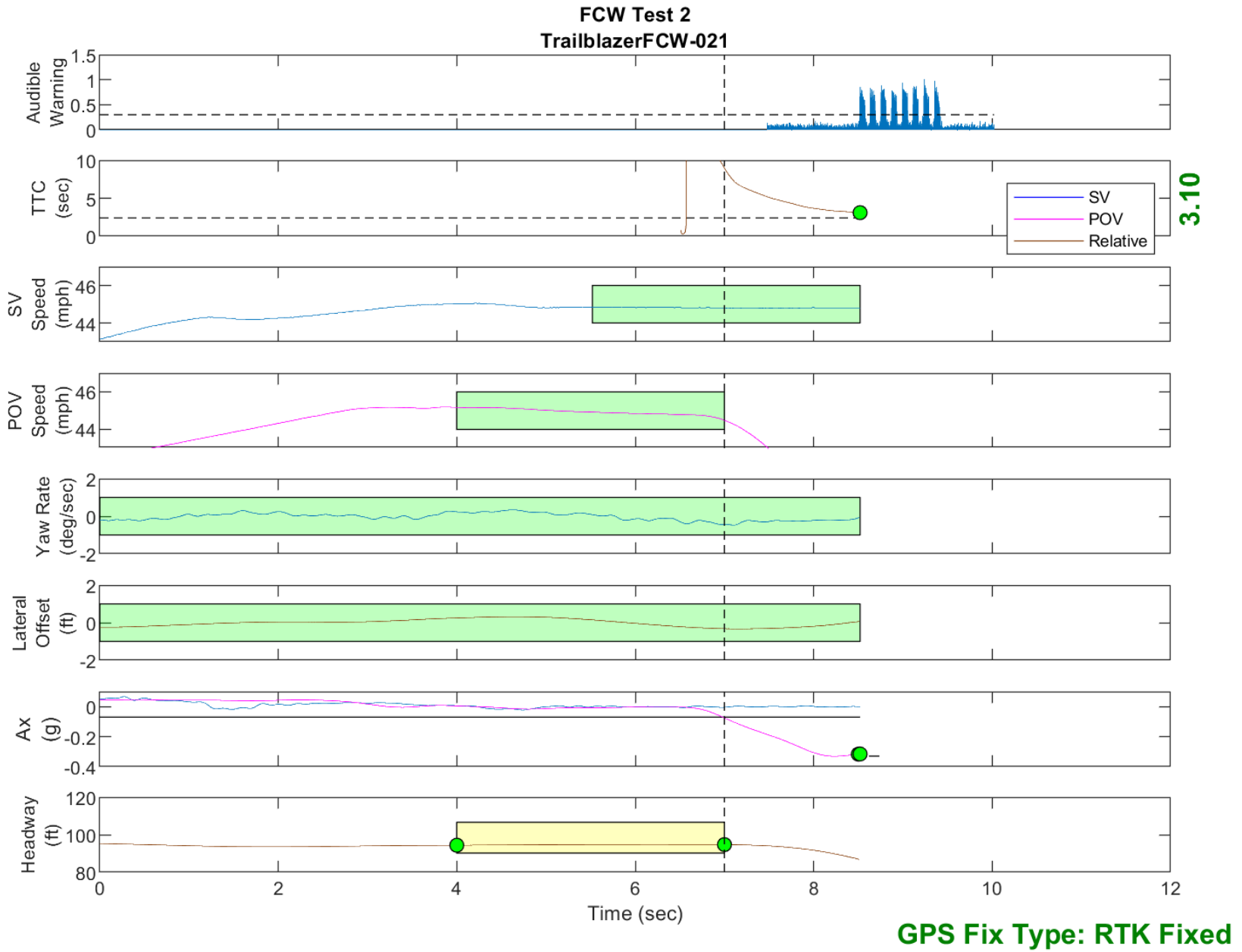


Figure D27. Time History for Run 21, FCW Test 2, Audible Warning

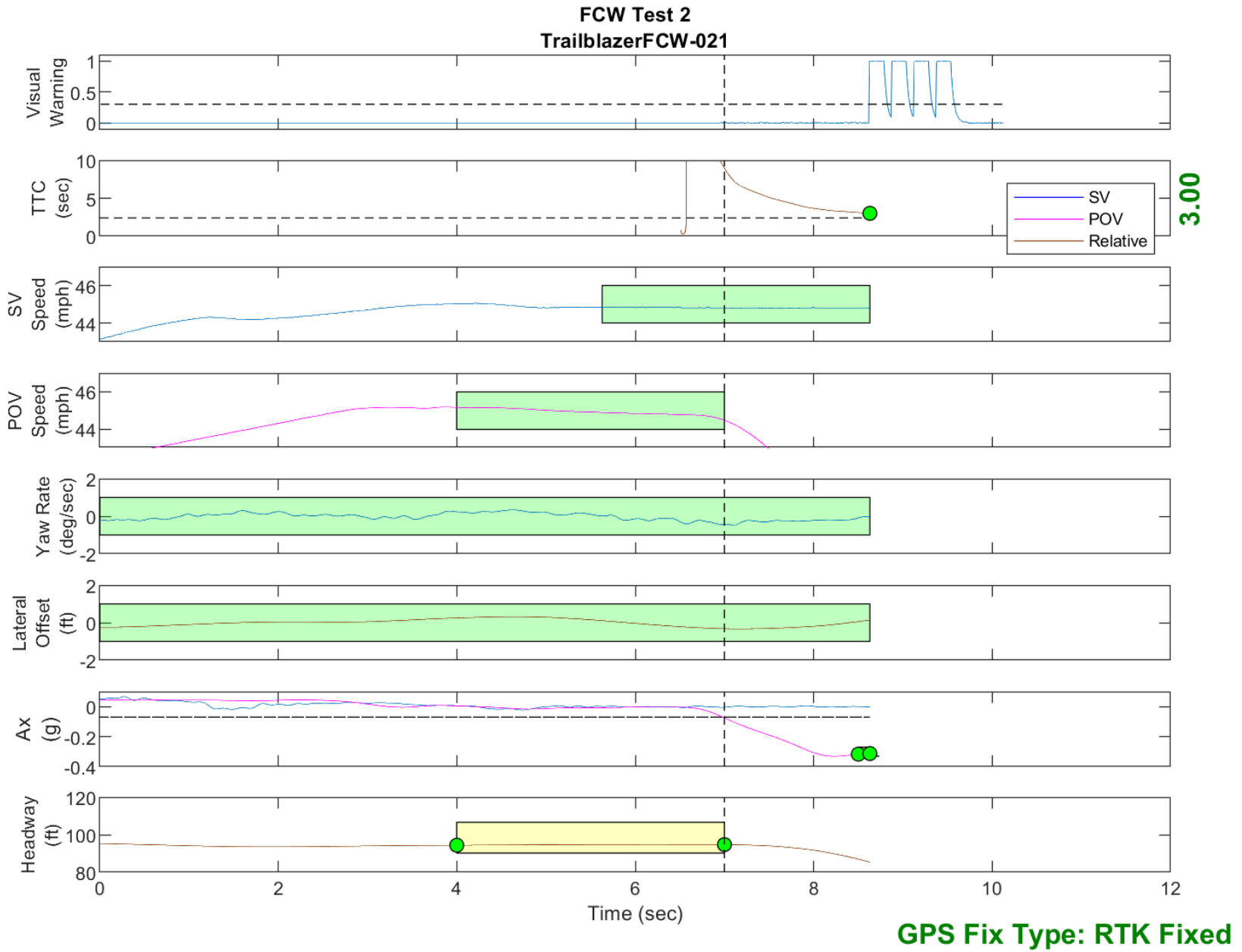


Figure D28. Time History for Run 21, FCW Test 2, Visual Warning

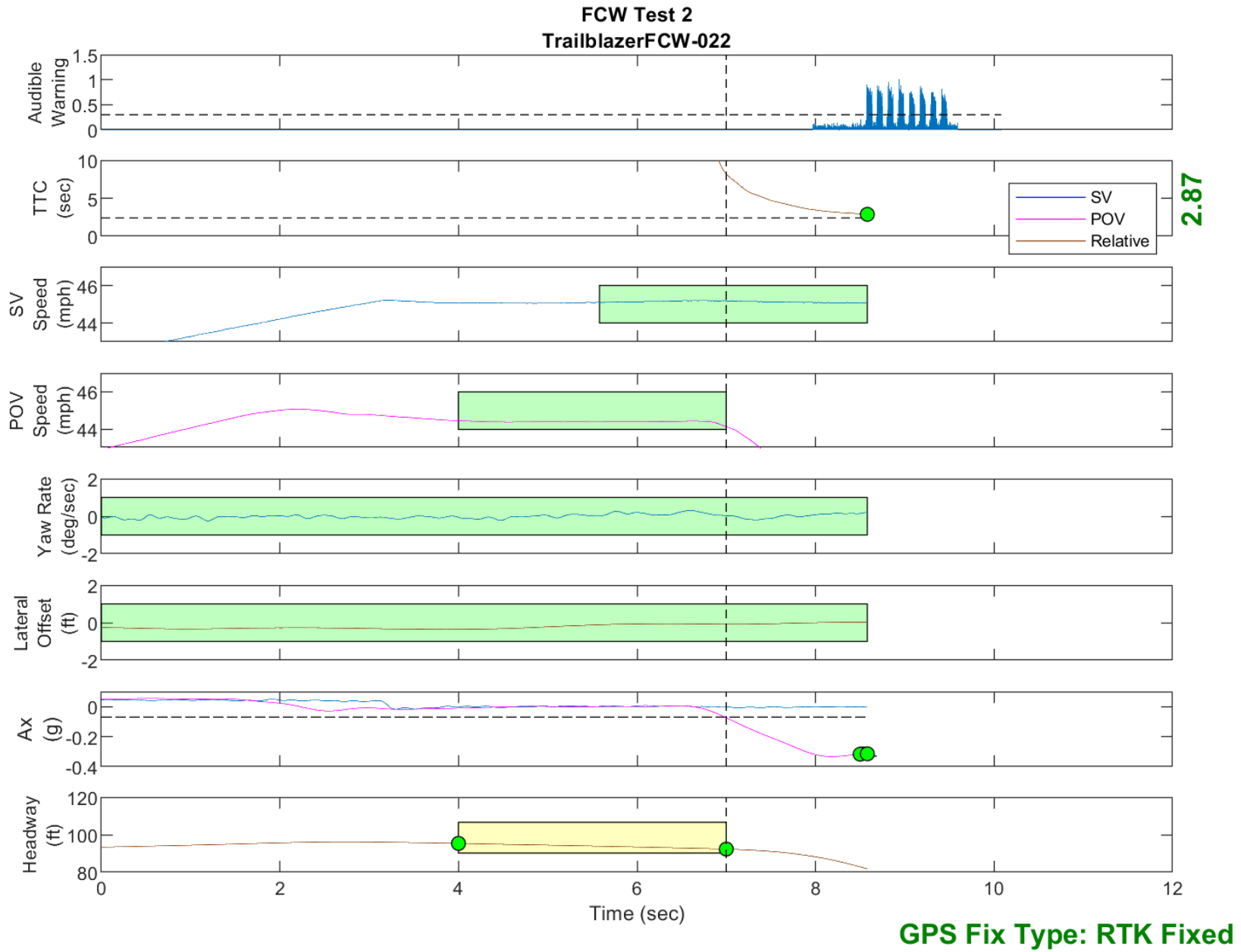


Figure D29. Time History for Run 22, FCW Test 2, Audible Warning

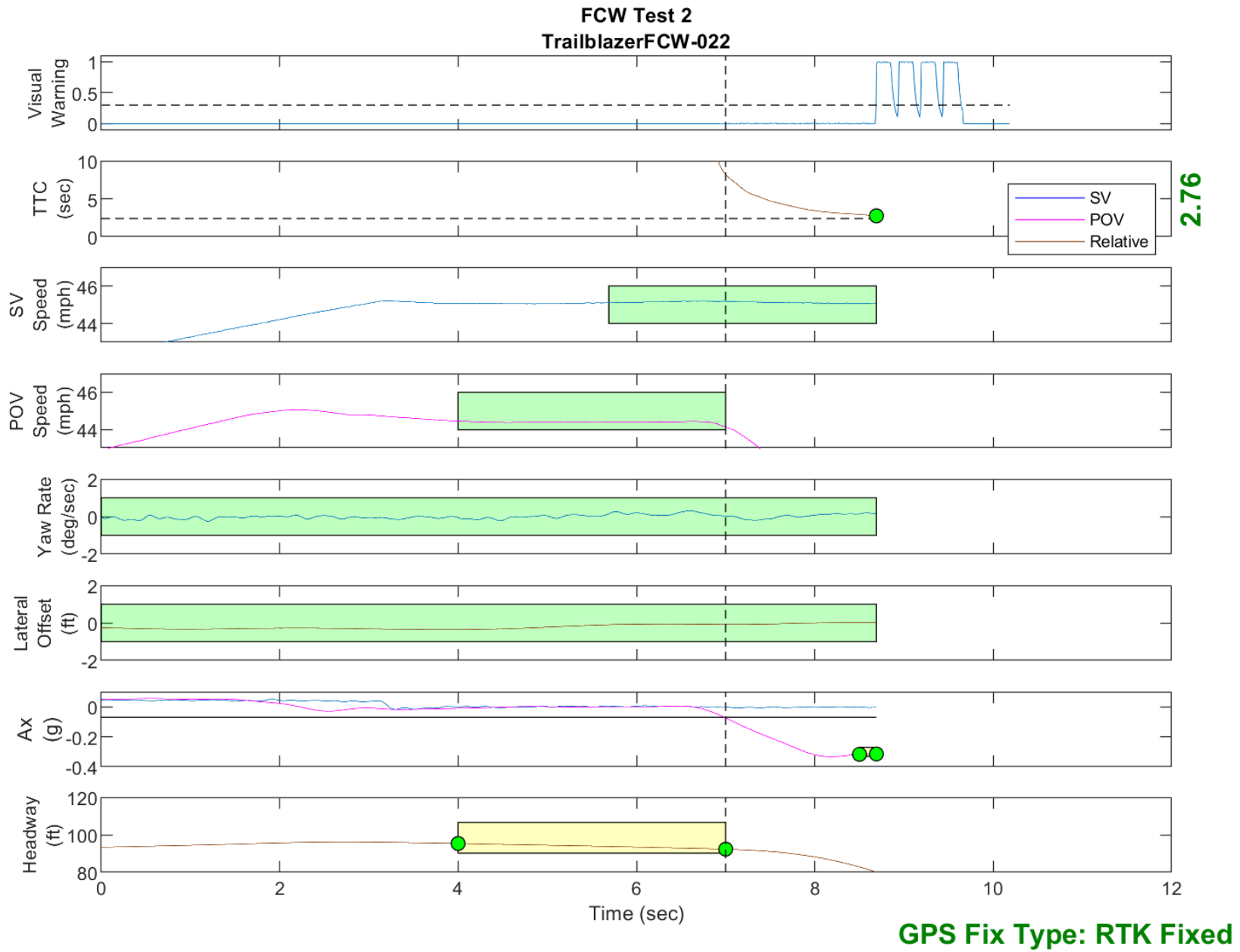


Figure D30. Time History for Run 22, FCW Test 2, Visual Warning

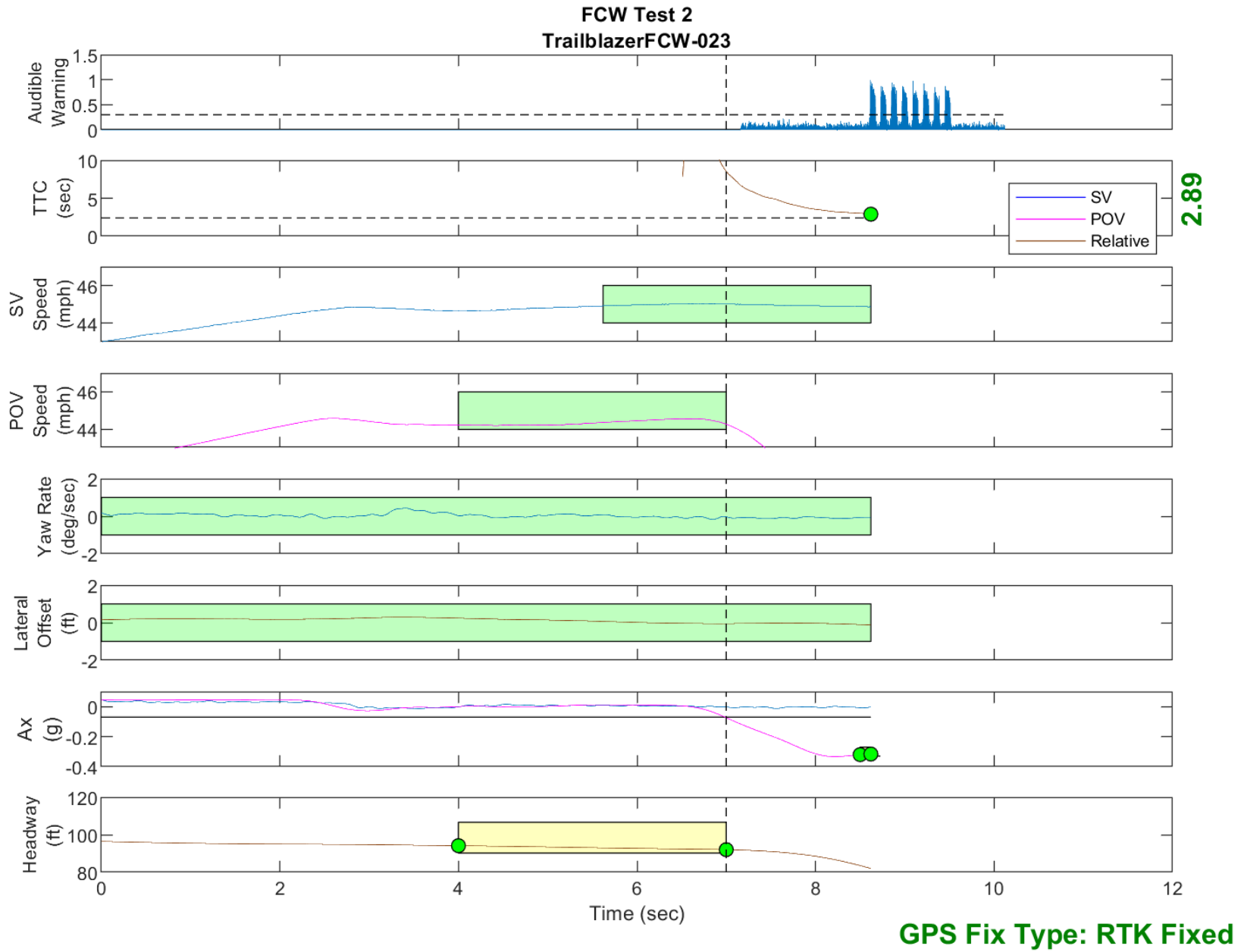


Figure D31. Time History for Run 23, FCW Test 2, Audible Warning

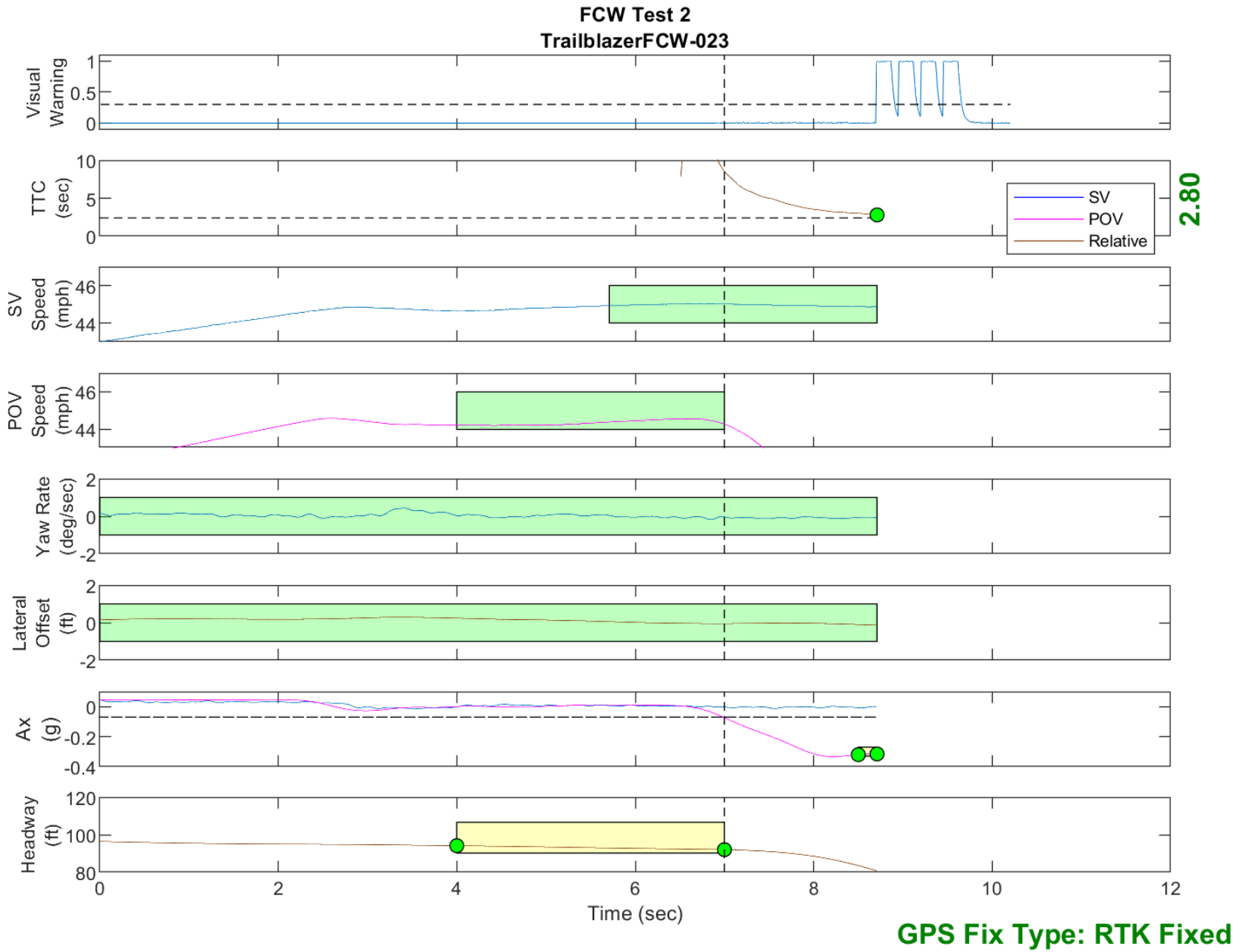


Figure D32. Time History for Run 23, FCW Test 2, Visual Warning

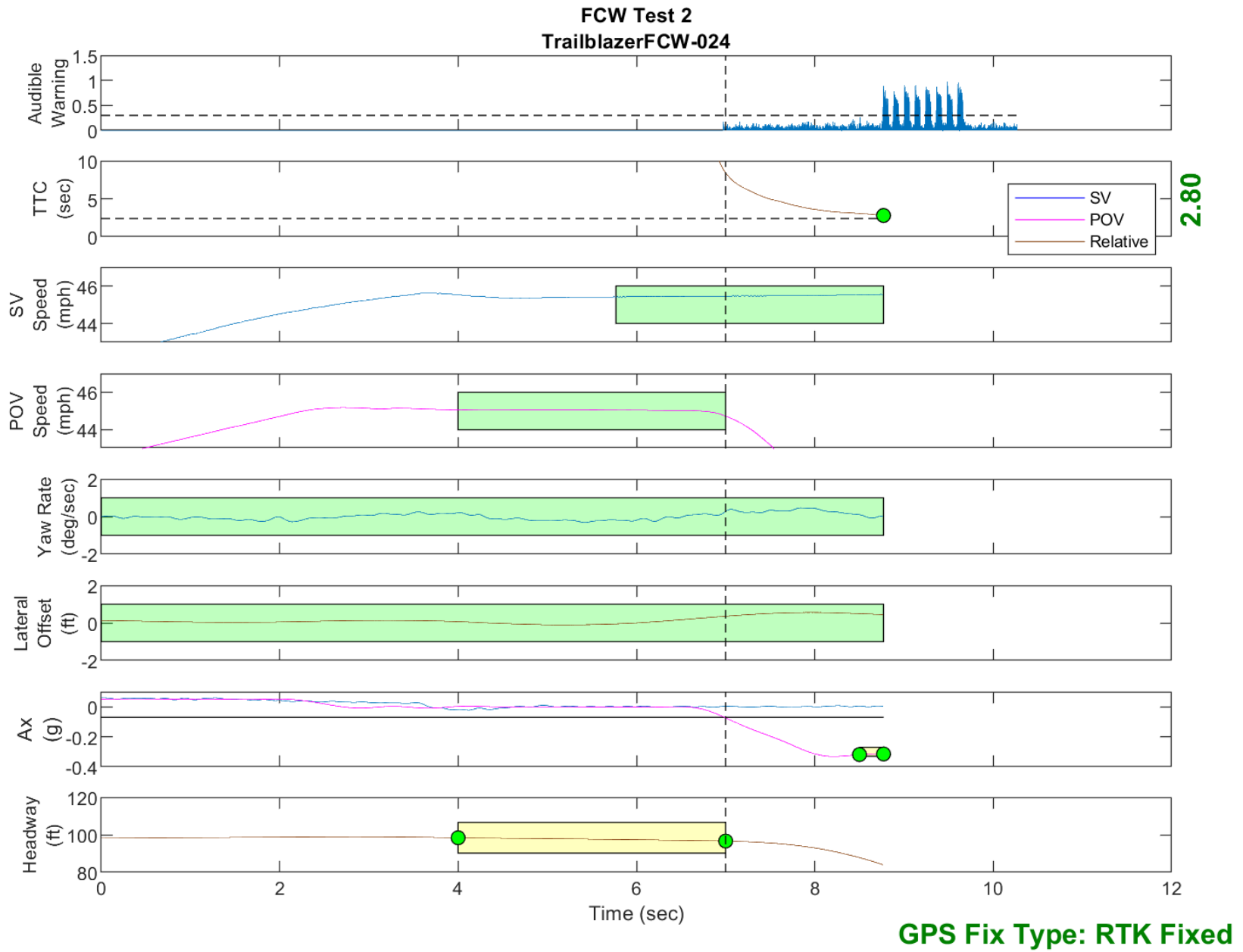


Figure D33. Time History for Run 24, FCW Test 2, Audible Warning

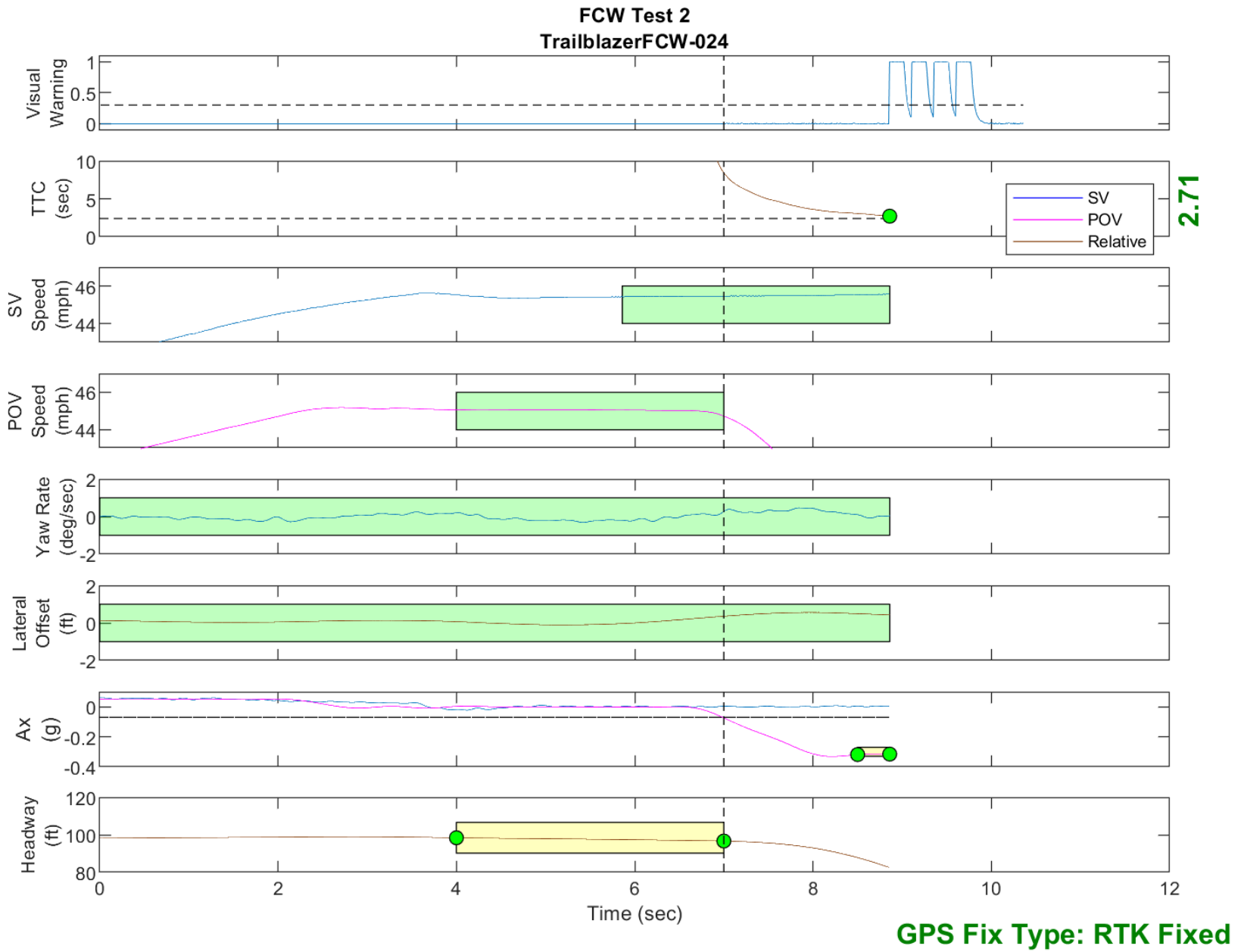


Figure D34. Time History for Run 24, FCW Test 2, Visual Warning

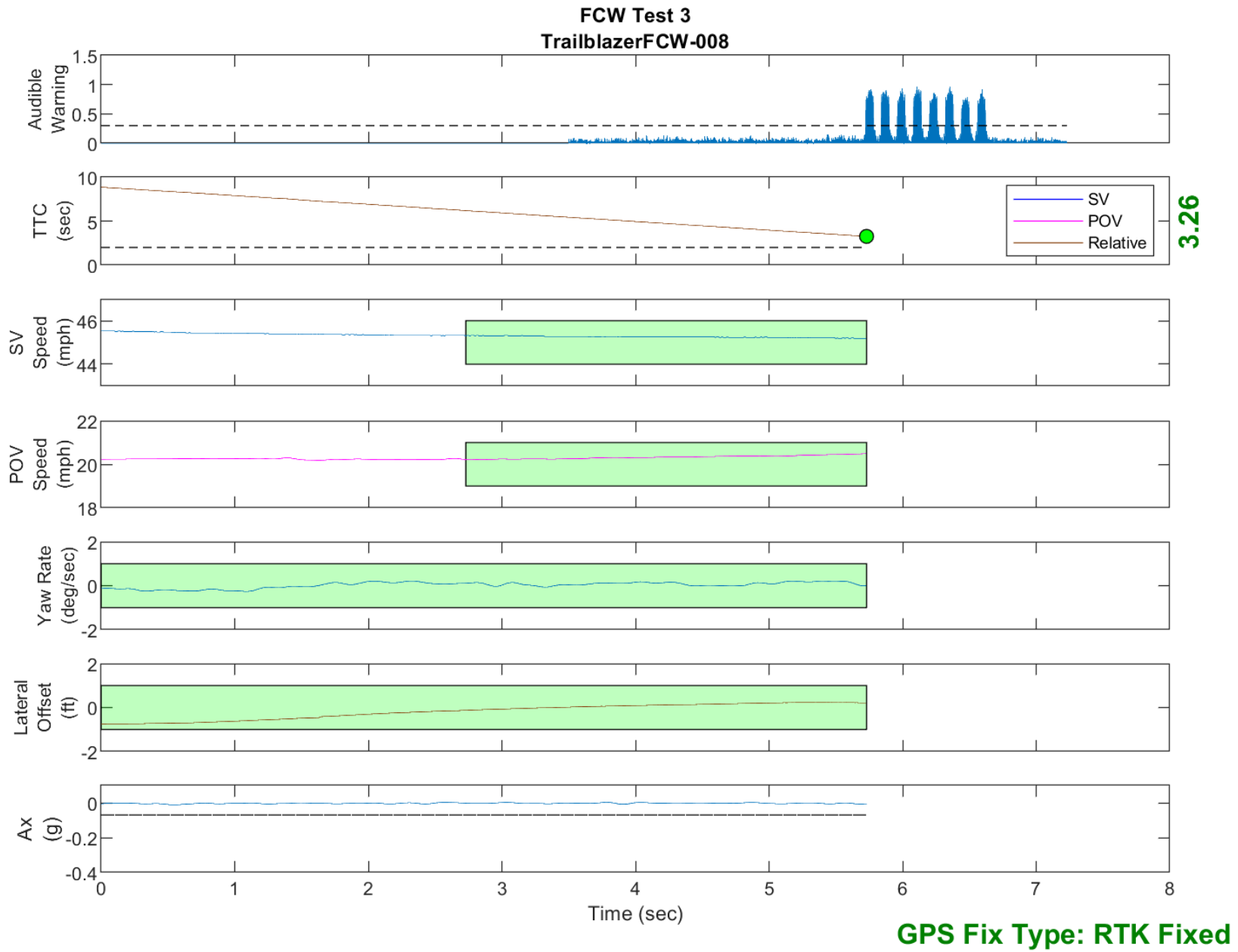


Figure D35. Time History for Run 8, FCW Test 3, Audible Warning

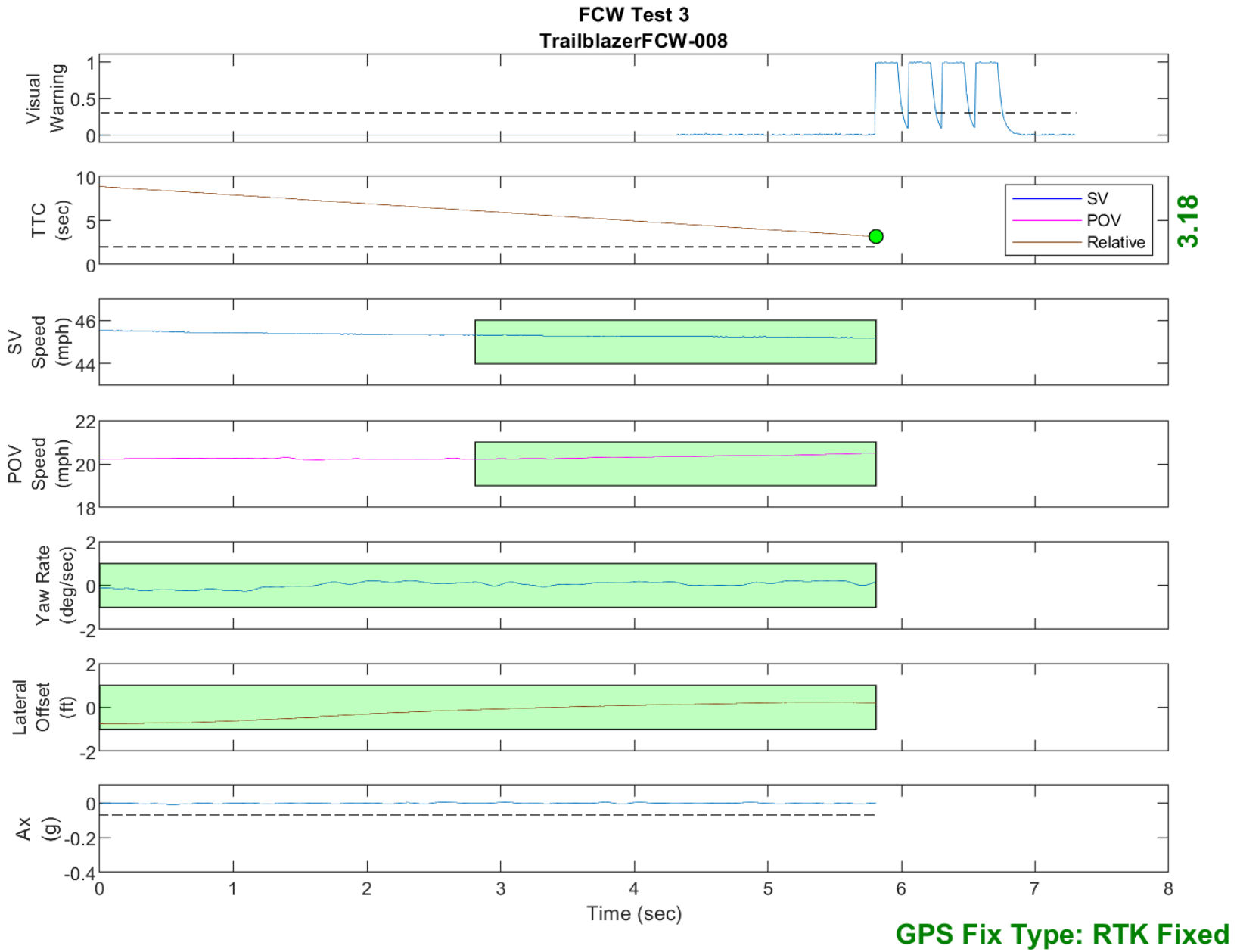


Figure D36. Time History for Run 8, FCW Test 3, Visual Warning

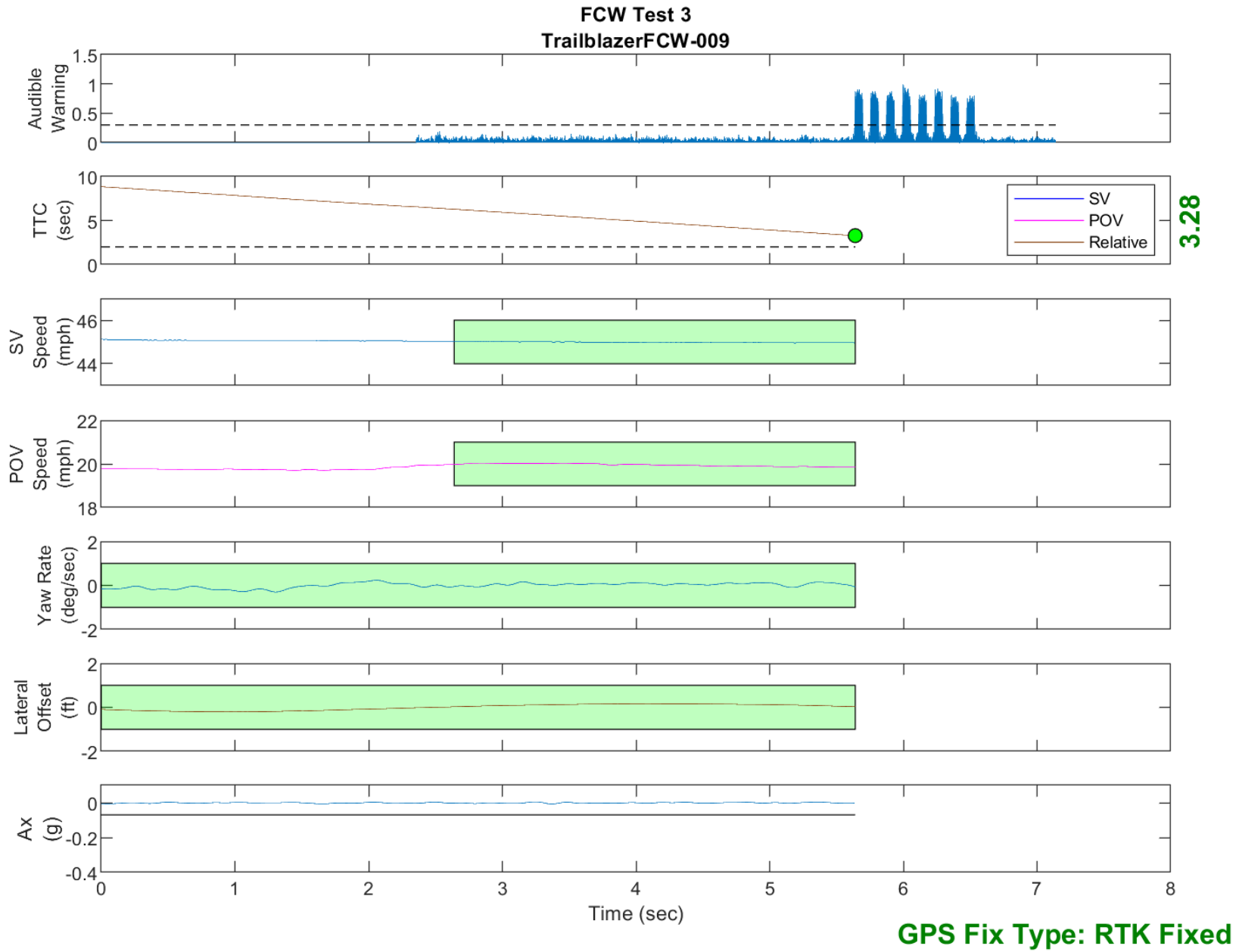


Figure D37. Time History for Run 9, FCW Test 3, Audible Warning

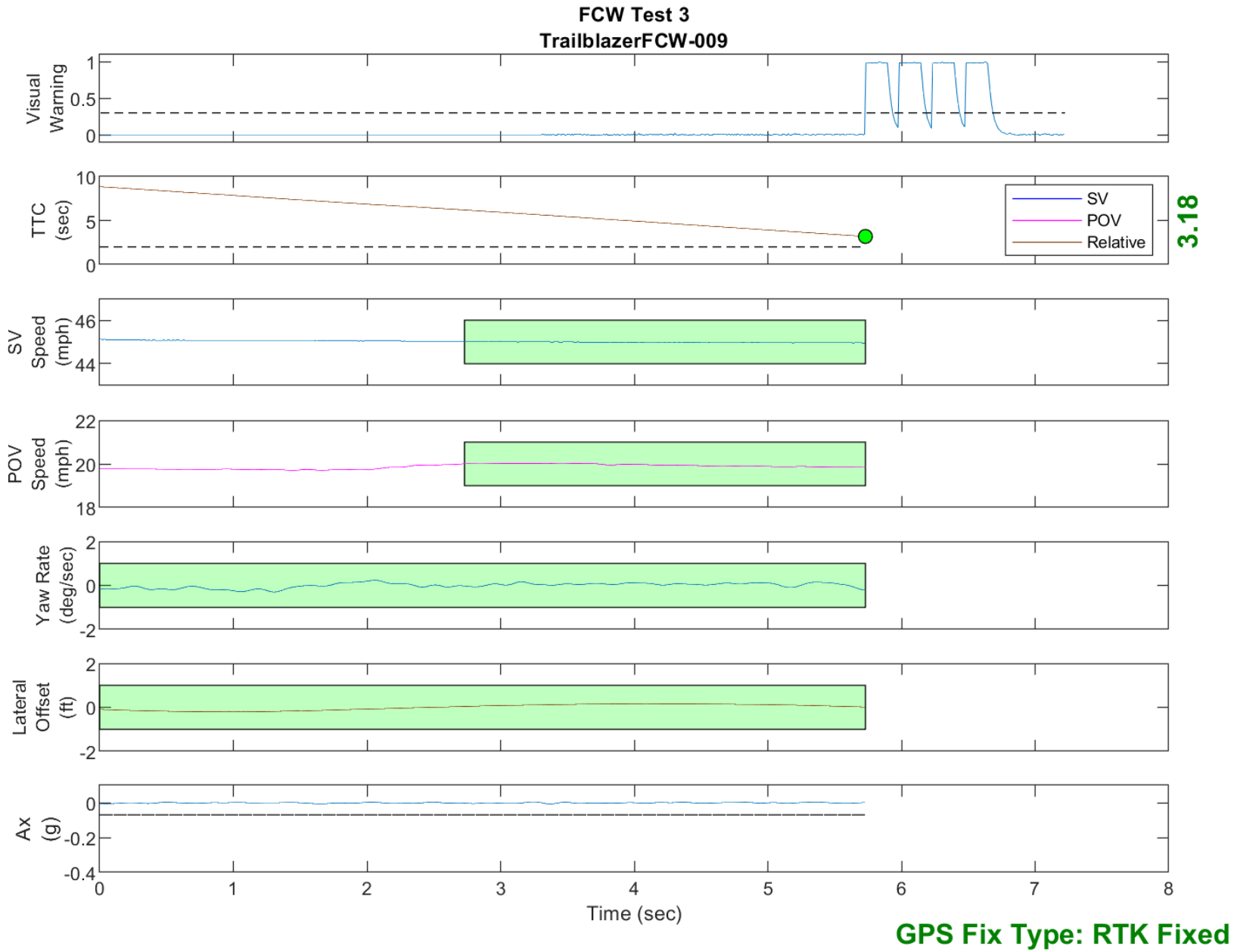


Figure D38. Time History for Run 9, FCW Test 3, Visual Warning

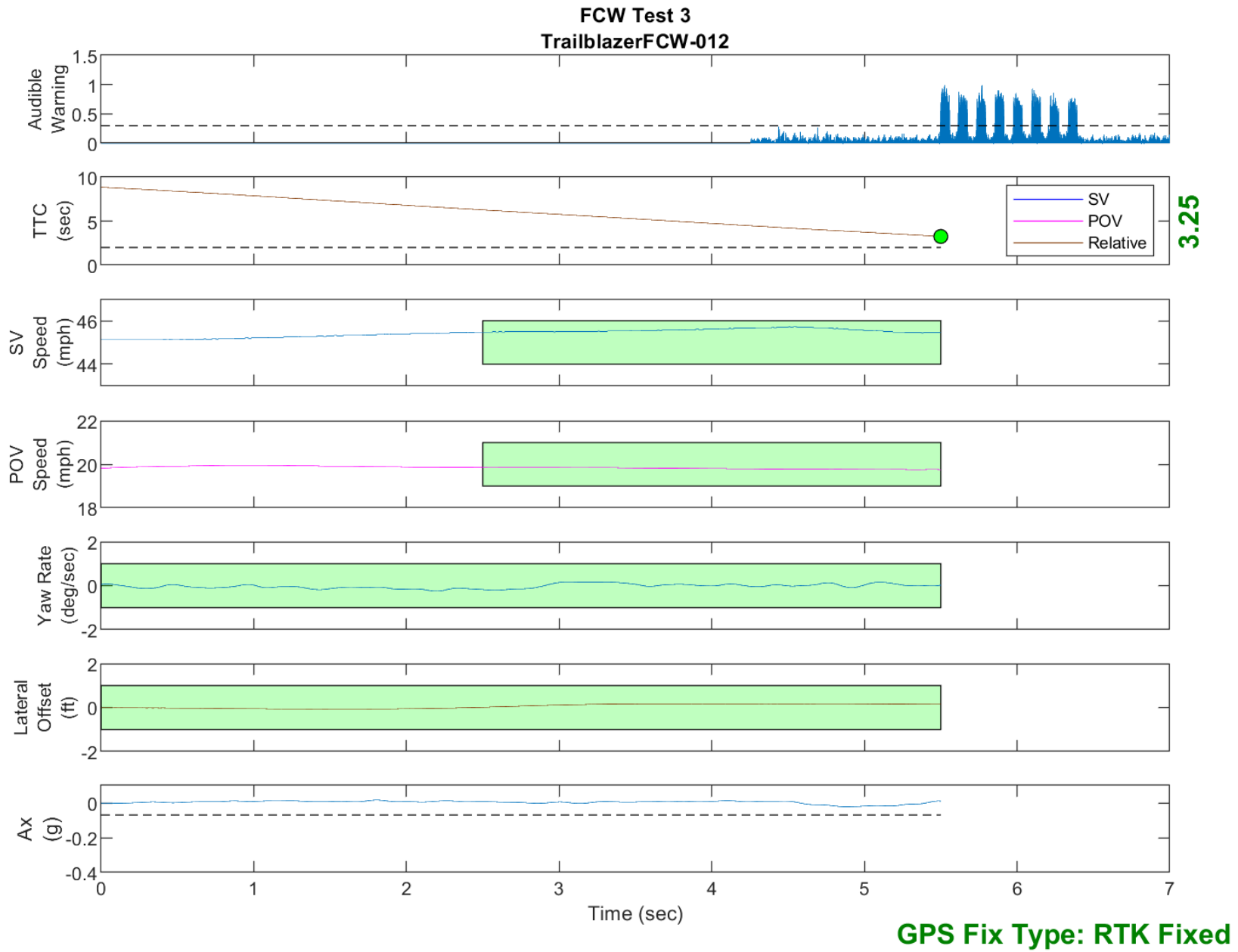


Figure D39. Time History for Run 12, FCW Test 3, Audible Warning

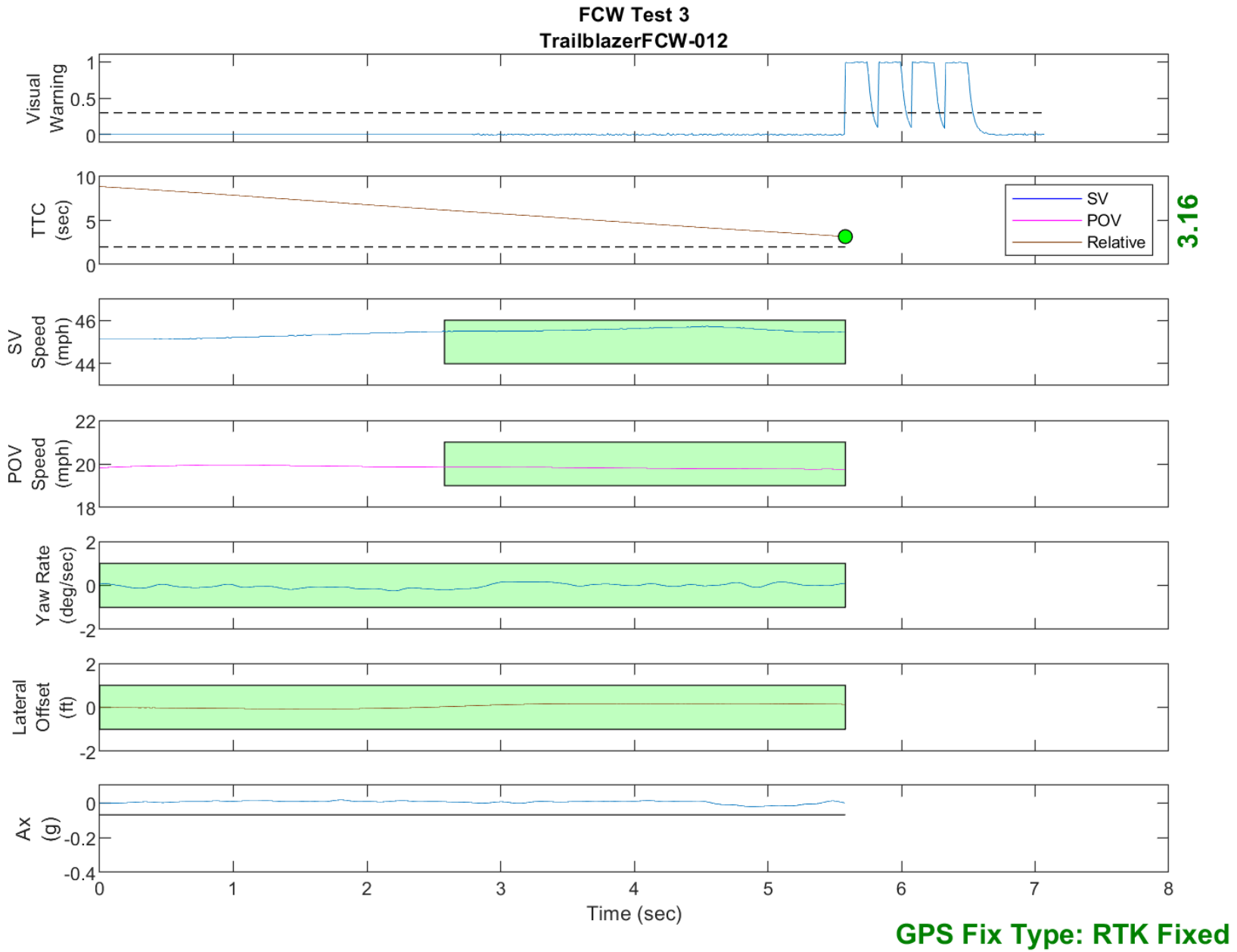


Figure D40. Time History for Run 12, FCW Test 3, Visual Warning

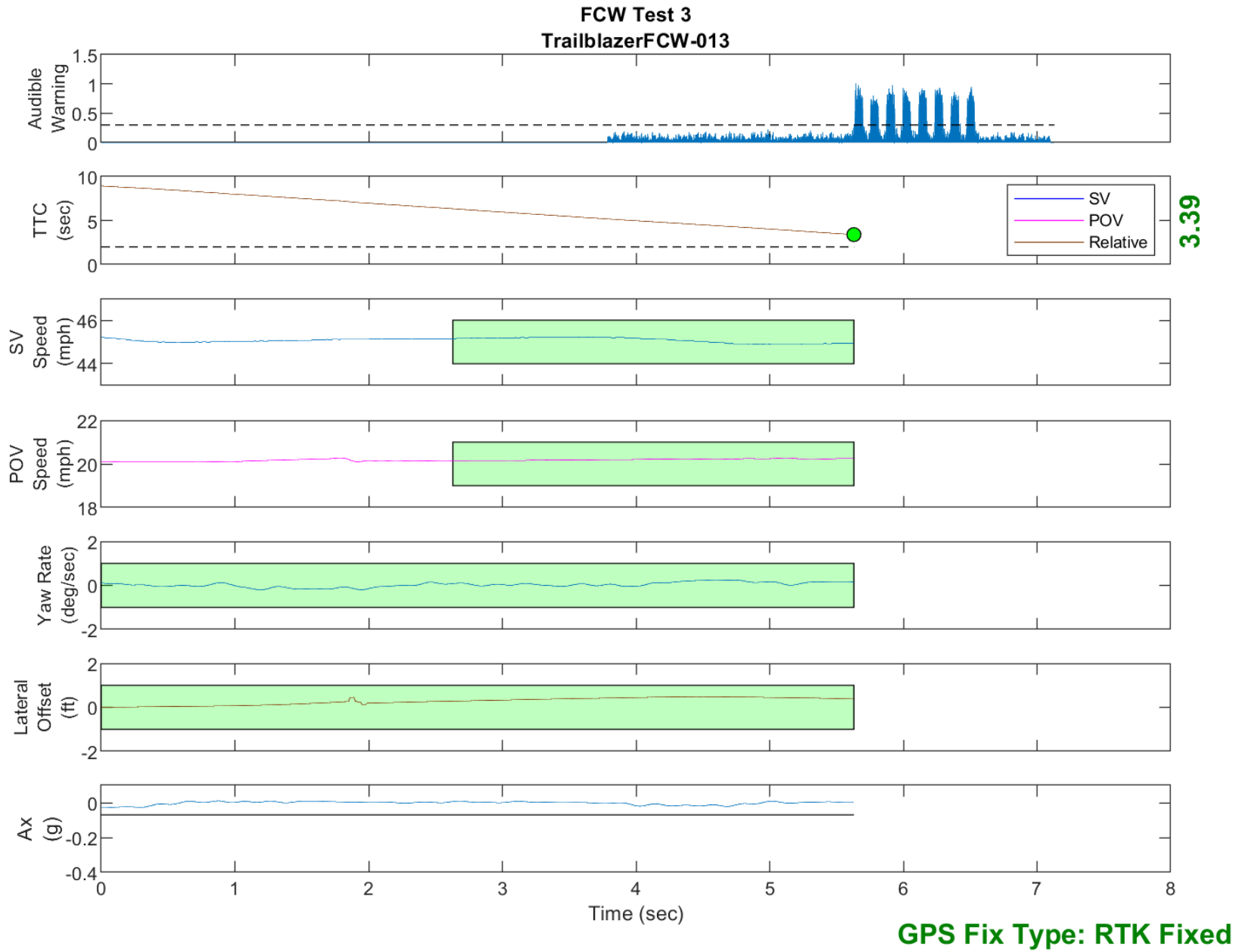


Figure D41. Time History for Run 13, FCW Test 3, Audible Warning

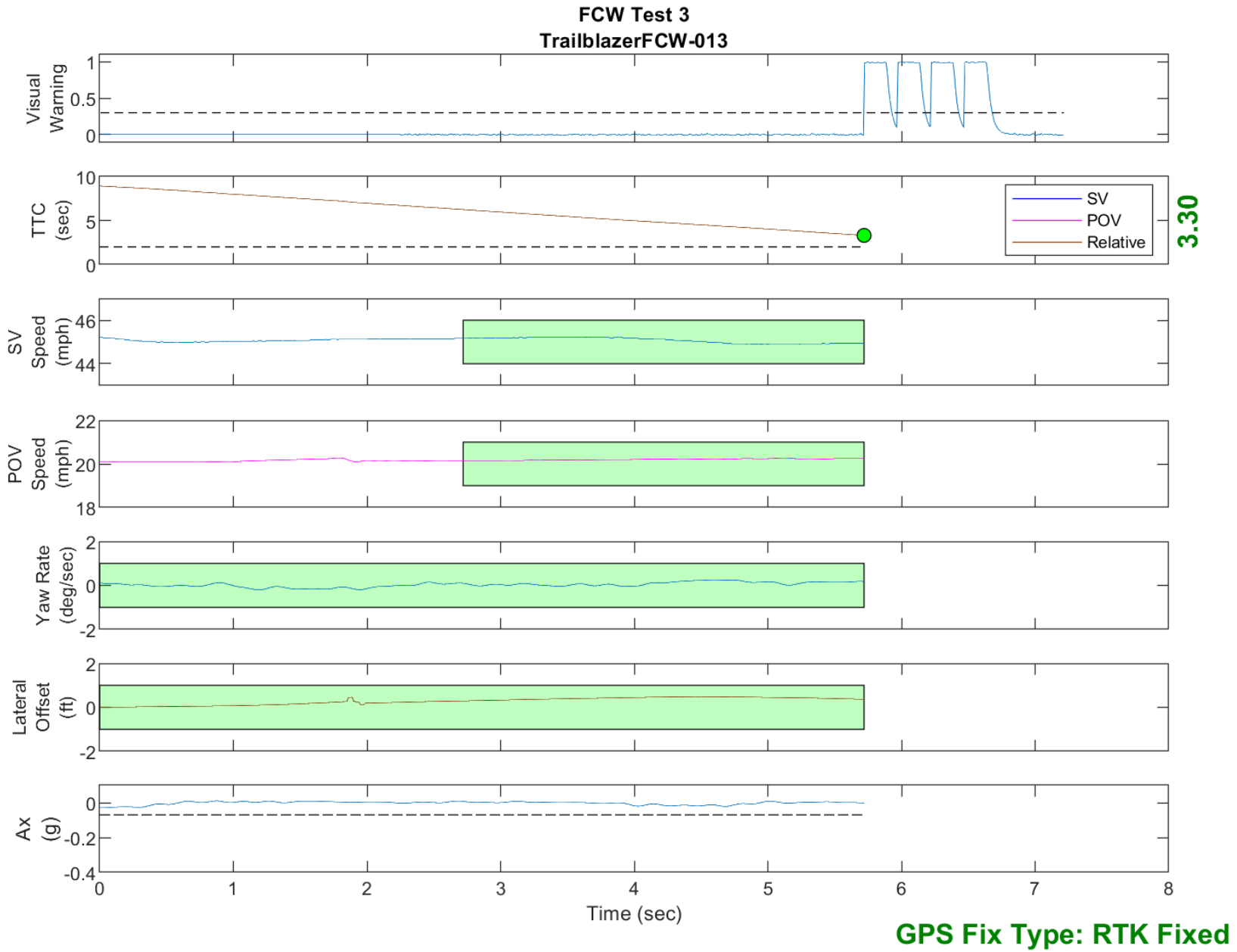


Figure D42. Time History for Run 13, FCW Test 3, Visual Warning

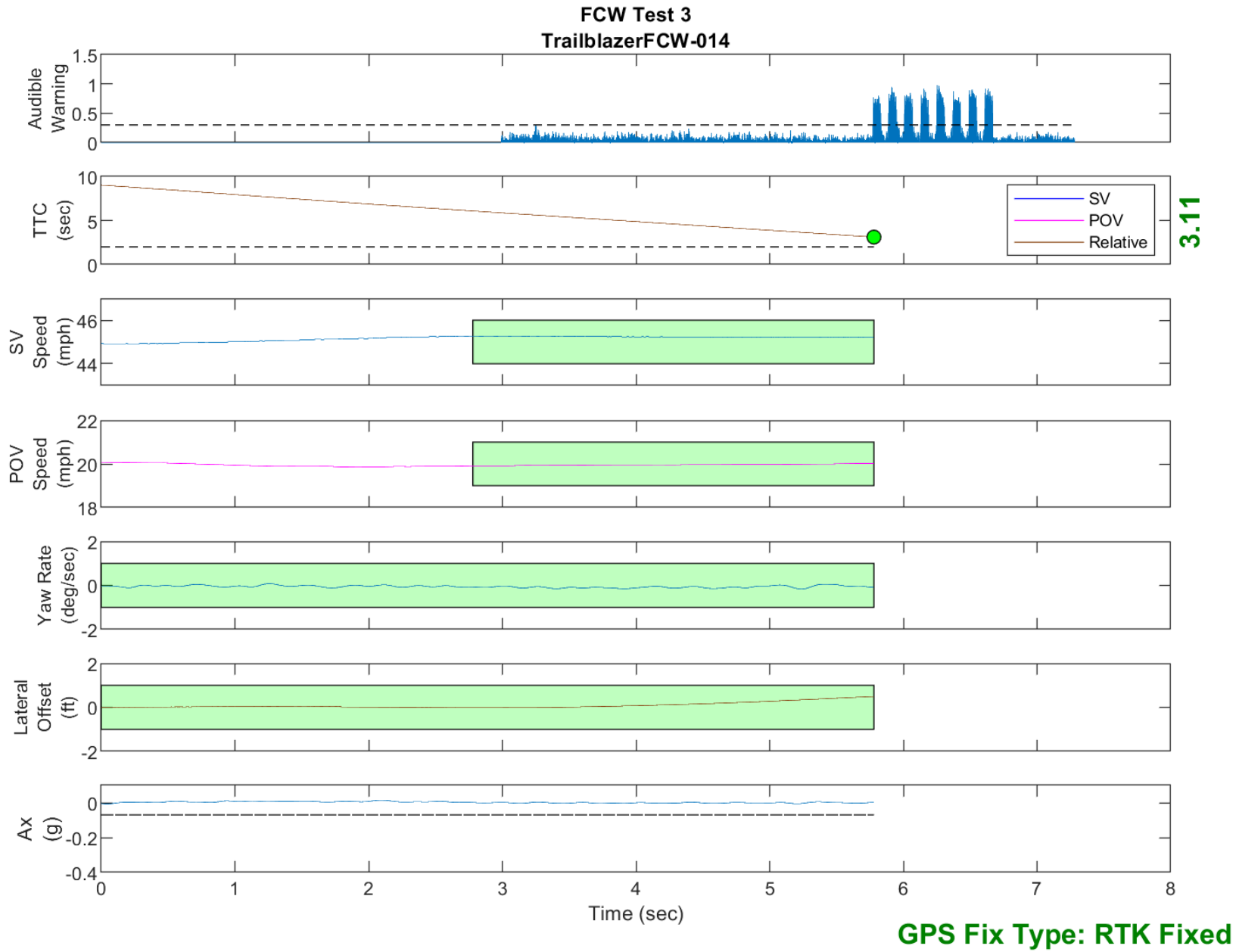


Figure D43. Time History for Run 14, FCW Test 3, Audible Warning

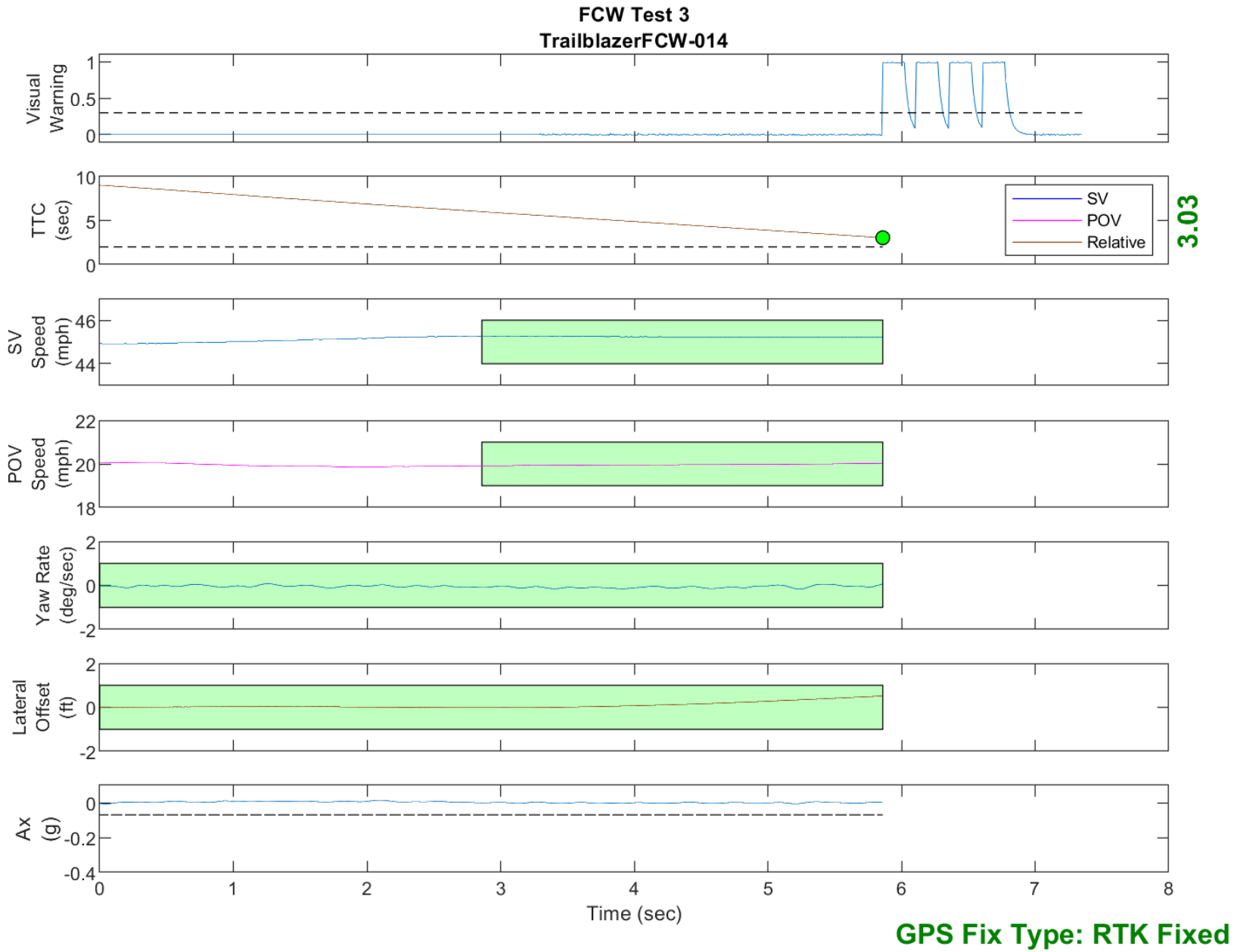


Figure D44. Time History for Run 14, FCW Test 3, Visual Warning

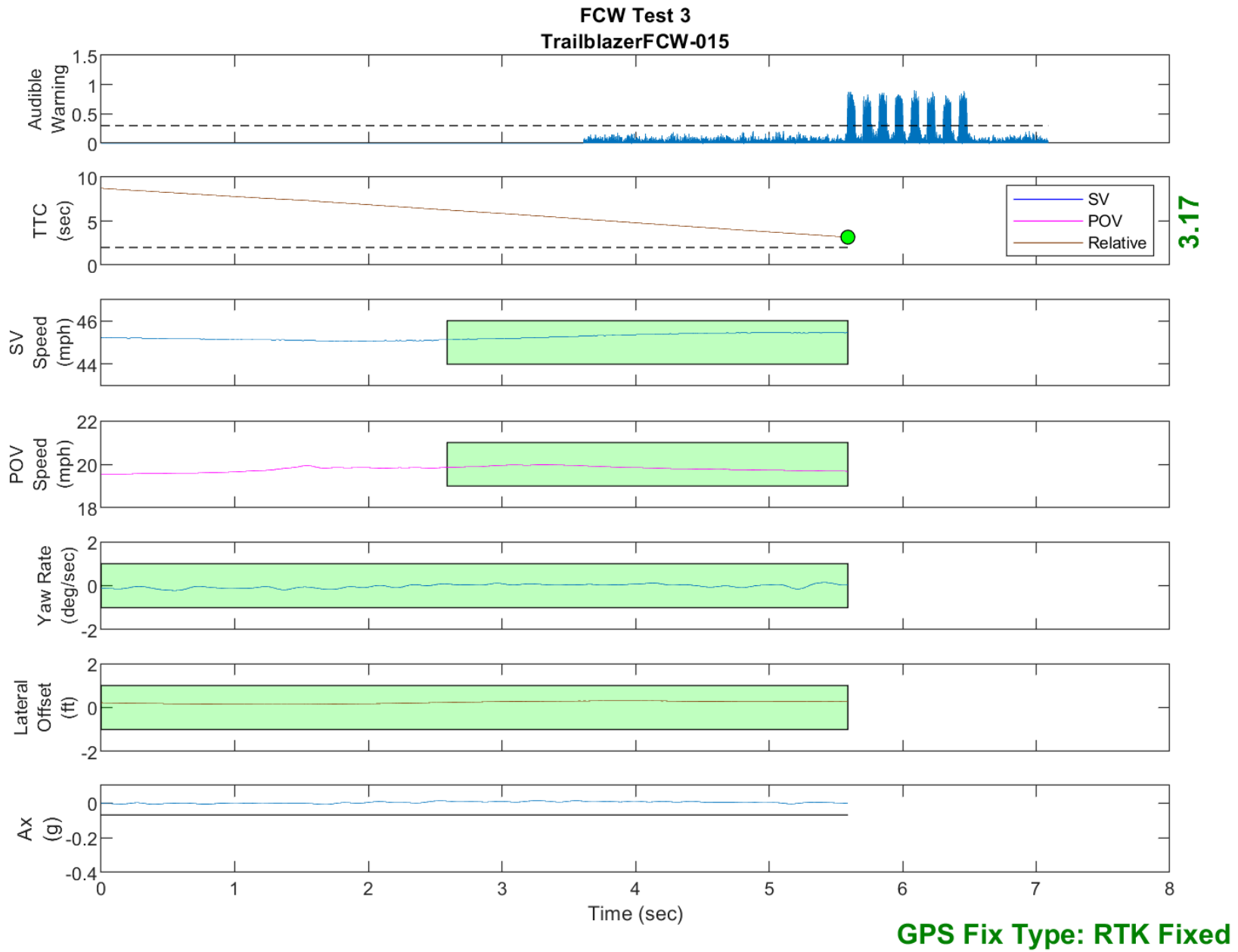


Figure D45. Time History for Run 15, FCW Test 3, Audible Warning

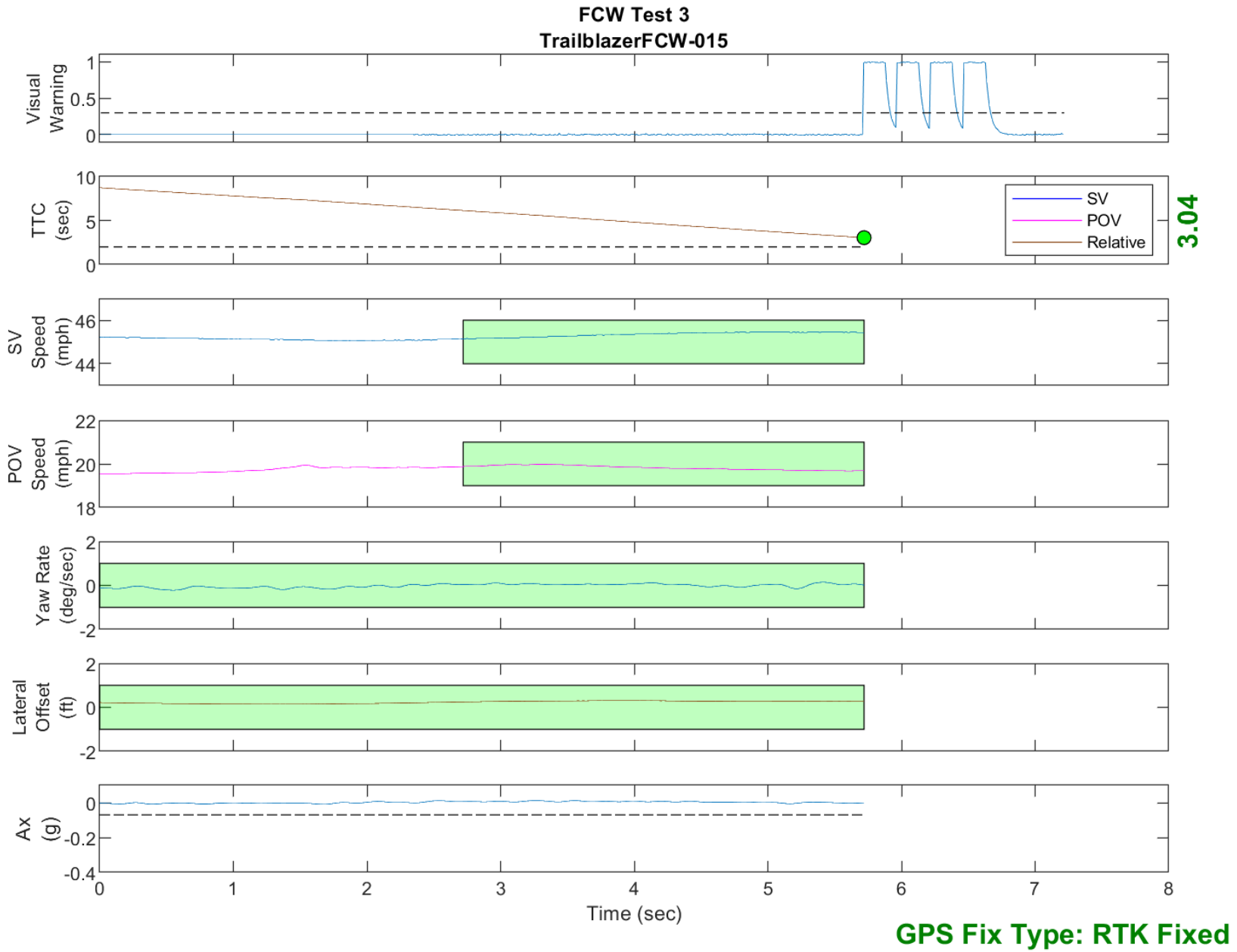


Figure D46. Time History for Run 15, FCW Test 3, Visual Warning

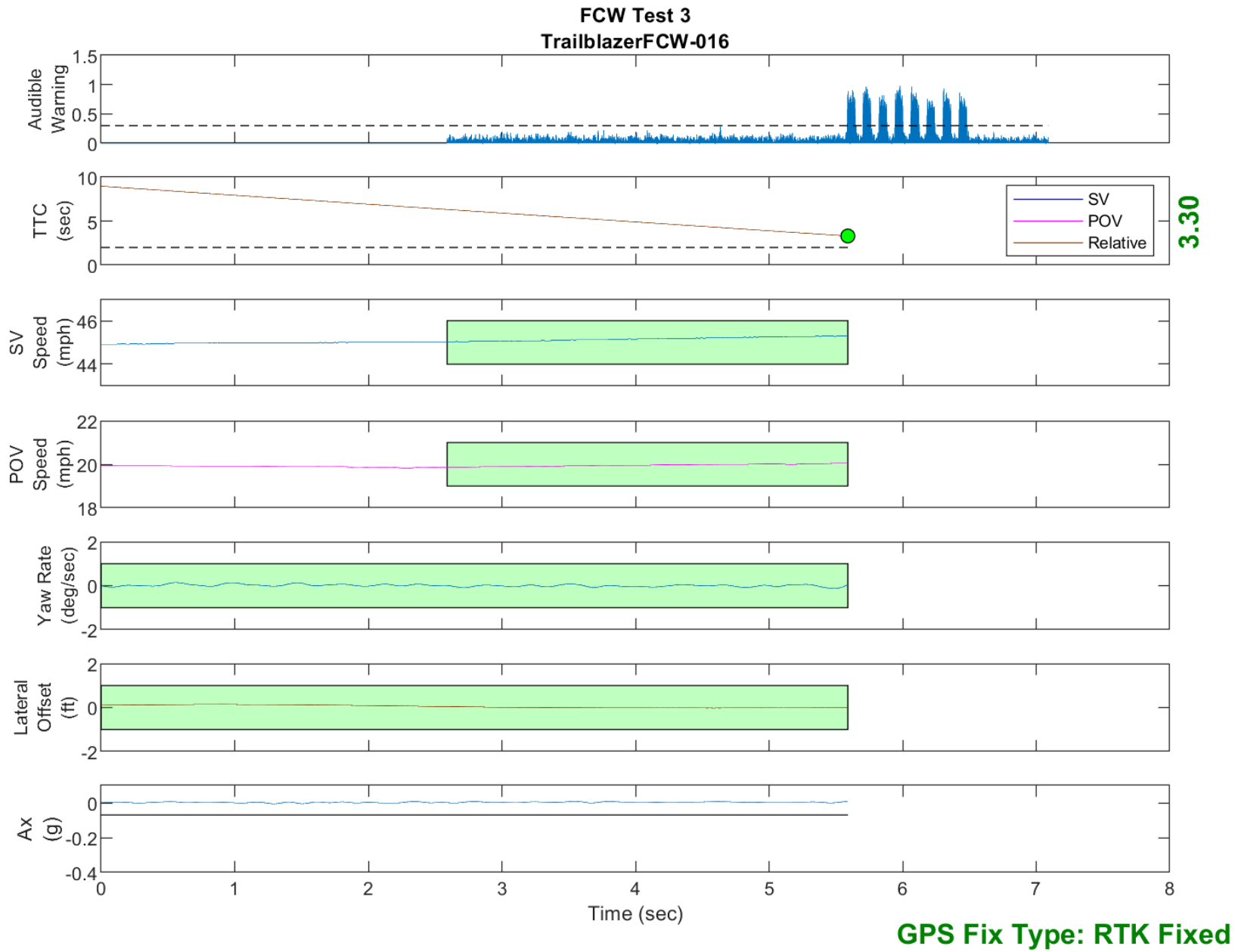


Figure D47. Time History for Run 16, FCW Test 3, Audible Warning

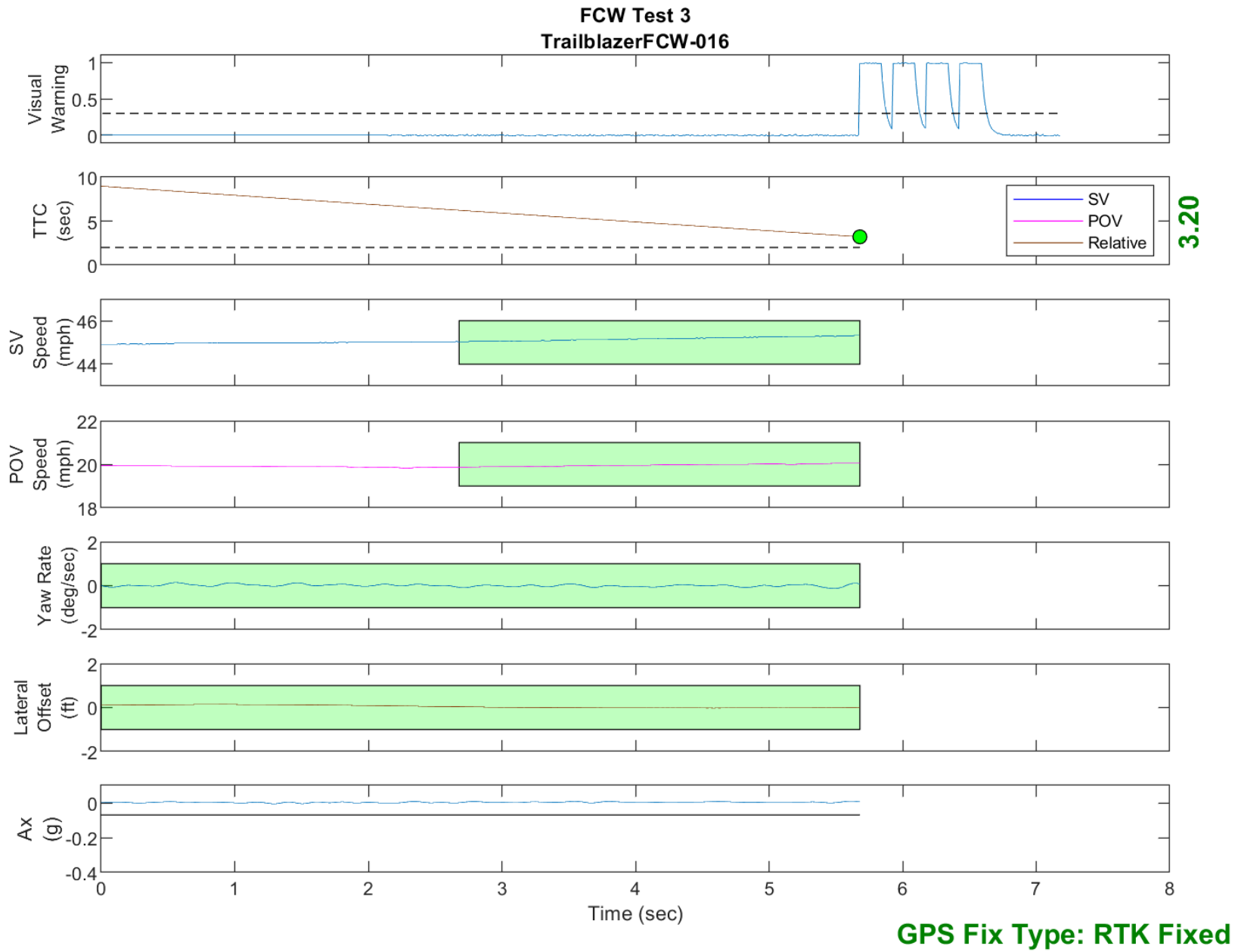


Figure D48. Time History for Run 16, FCW Test 3, Visual Warning