

**OCAS-DRI-FCW-13-013**

**NCAP FORWARD COLLISION WARNING CONFIRMATION TEST**

**2013 Infiniti JX35**

**DYNAMIC RESEARCH, INC.**

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Torrance, California 90501



**24 October 2012**

**Final Report**

**Prepared Under Contract No.: DTNH22-08-D-00095**

**U. S. DEPARTMENT OF TRANSPORTATION  
National Highway Traffic Safety Administration  
Office of Crash Avoidance Standards  
1200 New Jersey Avenue, SE  
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Approval Date: 24 October 2012

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| 15. Supplementary Notes                                                                                                                                                                                                                                                                                                                                                      |                                                          |                                                                                                                                                                                                                                               |           |
| 16. Abstract<br><br>These tests were conducted on the subject 2013 Infiniti JX35 in accordance with the specifications of the Office of Crash Avoidance Standards most current Test Procedure in docket NHTSA-2006-26555 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 "Forward Collision Warning Confirmation", March 2010. 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 SUMMARY**

2013 Infiniti JX35

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VIN: 5N1ALOMN3DC3xxxx

Test Date: 10/2/2012

Forward Collision Warning setting: Default

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: GENERAL TEST AND VEHICLE PARAMETER DATA**  
**(Page 1 of 2)**  
**2013 Infiniti JX35**

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**TEST VEHICLE INFORMATION**

VIN: 5N1AL0MN3DC3xxxx

Body Style: SUV

Color: Grey

Date Received: 9/24/2012

Odometer Reading: 58 mi

Engine: 3.5 L V-6

Transmission: CVT

Final Drive: FWD

Is the vehicle equipped with:

ABS X Yes        No

Adaptive Cruise Control X Yes        No

Collision Mitigating Brake System X Yes        No

**DATA FROM VEHICLE'S CERTIFICATON LABEL**

Vehicle manufactured by: Nissan Motor Company, Ltd.

Date of manufacture: 08/12

**DATA FROM TIRE PLACARD:**

Tires size as stated on Tire Placard: Front: 235/55 R20

Rear: 235/55 R20

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

Rear: 240 kPa (35 psi)

**FORWARD COLLISION WARNING**  
**DATA SHEET 2: GENERAL TEST AND VEHICLE PARAMETER DATA**  
**(Page 2 of 2)**  
**2013 Infiniti JX35**

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**TIRES**

Tire manufacturer and model: Bridgestone Dueler H/P Sport AS

Front tire size: 235/55 R20

Rear tire size: 235/55 R20

**VEHICLE ACCEPTANCE**

**Verify the following before accepting the vehicle**

- ☒ All options listed on the "window sticker" are present on the test vehicle
- ☒ Tires and wheel rims are the same as listed.
- ☒ There are no dents or other interior or exterior flaws.
- ☒ The vehicle has been properly prepared and is in running condition.
- ☒ Verify that spare tire, jack, lug wrench, and tool kit (if applicable) is located in the vehicle cargo area.

**FORWARD COLLISION WARNING**  
**DATA SHEET 3: TEST CONDITIONS (Page 1 of 2)**  
**2013 Infiniti JX35**

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**GENERAL INFORMATION**

Test date: 10/2/2012

**AMBIENT CONDITIONS**

Air temperature: 36.7 C (98 F)

Wind speed: 1.5 m/s (3.5 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)**  
**2013 Infiniti JX35**

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**WEIGHT**

Weight of vehicle as tested including driver and instrumentation

Left Front: 658.2 kg (1451 lb)

Right Front 588.3 kg (1297 lb)

Left Rear 556.1 kg (1226 lb)

Right Rear 513.0 kg (1131 lb)

Total: 2315.6 kg (5105 lb)

## FORWARD COLLISION WARNING

### DATA SHEET 4: FORWARD COLLISION WARNING SYSTEM OPERATION

(Page 1 of 3)

2013 Infiniti JX35

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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 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.

Warning light consists of orange car image telltale that appears in the top center of the common display area of the IP. The telltale flashes on and off as the forward vehicle is approached. An audible alert with a frequency of 1000 Hz chimes several times.



## **DATA SHEET 4: FORWARD COLLISION WARNING SYSTEM OPERATION**

## 2013 Infiniti JX35

The warning system switch (on-off button) is on the left side of the dashboard. It is marked with a vehicle with two circles and a loudspeaker. The button includes an indicator lamp that indicates system status. The system can also be disabled via a menu system using buttons on the left spoke of the steering wheel (using a checkbox via Setting--> Driver Assistance--> Driver Aids--> Forward--> Warning (FCW) )

## **FORWARD COLLISION WARNING**

### **DATA SHEET 4: FORWARD COLLISION WARNING SYSTEM OPERATION**

**(Page 3 of 3)**

#### **2013 Infiniti JX35**

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

If yes please provide a full description.

*The system will not detect pedestrians, animals, or obstacles in the roadway; oncoming vehicles in the same lane*

*The system will not detect another vehicle under the following conditions;*

- When the sensor gets dirty and it is impossible to detect the distance from the vehicle ahead; when driving into strong light (for example sunlight)*
- When the reflectors on the vehicle ahead are positioned high or close to each other*
- When the visibility is low*
- When snow or road spray from travelling vehicle is splashed*
- When excessively heavy baggage is loaded in the rear seat or cargo area*
- When abruptly accelerating or decelerating*
- On a steep downhill slope or roads with sharp curves*
- When there is a highly reflective object near the vehicle ahead*
- When towing a trailer*
- When the vehicle ahead is offset*
- When the vehicle ahead is extremely close*
- When the sensor detects an obstruction of the radar signal due to dirt, adhesive material, or similar objects on the front bumper*
- If a vehicle in front suddenly cuts in front*

*The system is deactivated automatically if the vehicle is parked in direct sunlight in high temperature conditions*

*The system is deactivated below approximately 10 mph*

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.

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) on a Straight Road
- 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.

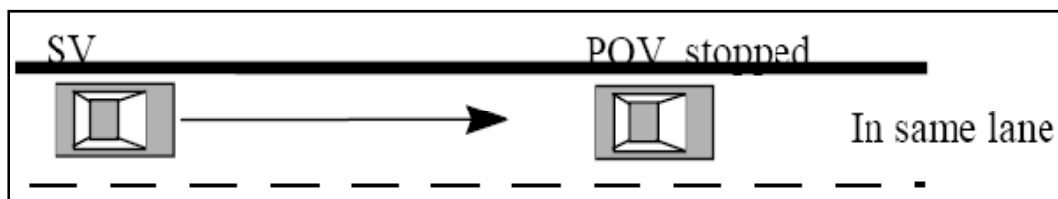


Figure 1. Depiction of Test 1

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. (Note: TTC values were computed in accordance with Ref 1). The TTC for this test was calculated by considering the speeds of the subject vehicle (SV) and the lead vehicle (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 kph), 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 the SV approaches the rear of the POV.

The SV was driven at a nominal speed of 45 mph (72.4 kph) 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 percent 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 kph) for a period of three seconds prior to (1) the required FCW alert or (2) before the range fell to less than 90 percent 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 the required FCW alert occurred, or before the range fell to less than 90 percent 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  $\pm 1$  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. If the first five of the seven individual test trials satisfied the criteria, additional trials to verify that two consecutive failures did not take place were not performed.

## 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.

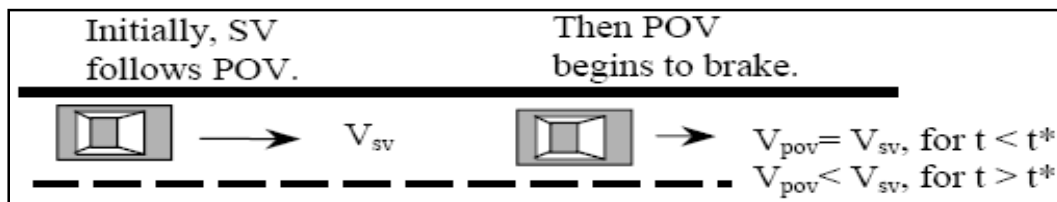


Figure 2. Depiction of Test 2

### 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<sup>1</sup>.

### b. Procedure

<sup>1</sup>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).

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 kph), 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.

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 kph) 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 kph) for a period of 3 seconds prior to (1) the required FCW alert or (2) before the range fell to less than 90 percent 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  $\pm 1$  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

$\pm 0.03g$ , 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 (1)  $500 ms$  after the first local deceleration peak occurs, to (2) the time when the FCW alert first occurred.

- The tolerance for the headway from the SV to the POV was  $\pm 8.2 ft (\pm 2.5 m)$ , 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 the required FCW alert occurred, or before the range fell to less than 90 percent 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. If the first five of the seven individual test trials satisfied the criteria, additional trials to verify that two consecutive failures did not take place were not performed.

### 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 issue a timely alert. As depicted in Figure 3, the scenario was conducted with a closing speed equal to  $25.0 mph (40.2 kph)$ .



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 kph) in the center of the lane of travel.

The SV was driven at 45.0 mph (72.4 kph), 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.,  $TTC = 1.8$  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 kph) for a period of 3 seconds prior to (1) the required FCW alert or (2) before the range fell to less than 90 percent 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 kph) 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  $\pm 1$  deg/sec during the test.
- SV driver could not apply any force to the brake pedal before the required FCW alert occurred, or before the range fell to less than 90 percent 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. If the first five of the seven individual test trials satisfied the criteria, additional trials to verify that two consecutive failures did not take place were not performed.

## **B. Principal Other Vehicle**

The vehicle used as the Principal Other Vehicle (POV) was a 2000 Honda Accord. This satisfied the test requirement of Ref 1 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.

As part of the pre-test instrumentation verification process, the tonal frequency of the audible warning was determined through use of the PSD (Power Spectral Density) function in Matlab. This was accomplished in order to identify the center frequency around which a band-pass filter was applied to subsequent

audible warning data such that the beginning of the audible warning could be programmatically determined. The band-pass filter used for the audible warning signal was a phase-less, forward-reverse pass, 5<sup>th</sup> order elliptical (Cauer) digital filter, with 3 dB peak-to-peak ripple, minimum stop-band attenuation of 60 dB, and a pass-band of center frequency  $\pm 5\%$  of the identified center frequency.

**TABLE 1. TEST INSTRUMENTATION AND EQUIPMENT**

| Type                                                                                                     | Output                                                                                                                                                                 | Range                                                                                                                                                                              | Accuracy, Other Primary Specs                                                                                                                                                 | Mfr, Model                                                        |
|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Tire Pressure Gauge                                                                                      | Vehicle Tire Pressure                                                                                                                                                  | 0-100 psi<br>0-690 kPa                                                                                                                                                             | 0.5 psi<br>3.45 kPa                                                                                                                                                           | Ashcroft,<br>D1005PS                                              |
| Platform Scales                                                                                          | Vehicle Total, Wheel,<br>and Axle Load                                                                                                                                 | 8000 lb<br>35.6 kN                                                                                                                                                                 | ± 1.0% of applied load                                                                                                                                                        | Intercomp,<br>SWII                                                |
| Differential Global<br>Positioning System                                                                | Position, Velocity                                                                                                                                                     | Latitude: ± 90 deg<br>Longitude: ± 180 deg<br>Altitude: 0-18 km<br>Velocity: 0-1000 knots                                                                                          | Horizontal Position: ± 1 cm<br>Vertical Position: ± 2 cm<br>Velocity: 0.05 km/h                                                                                               | Trimble GPS<br>Receiver,<br>5700 (base station<br>and in-vehicle) |
| Multi-Axis Inertial<br>Sensing System                                                                    | Position;<br>Longitudinal, Lateral,<br>and Vertical Accels;<br>Lateral, Longitudinal and<br>Vertical Velocities;<br>Roll, Pitch, Yaw Rates;<br>Roll, Pitch, Yaw Angles | Latitude: ± 90 deg<br>Longitude: ± 180 deg<br>Altitude: 0-18 km<br>Velocity: 0-1000 knots<br>Accel: ± 100 m/s <sup>2</sup><br>Angular Rate: ± 100 deg/s<br>Angular Disp: ± 180 deg | Position: ± 2 cm<br>Velocity: 0.05 km/h<br>Accel: ≤ 0.01% of full range<br>Angular Rate: ≤ 0.01% of full<br>range<br>Roll/Pitch Angle: ± 0.03 deg<br>Heading Angle: ± 0.1 deg | Oxford Technical<br>Solutions (OXTS),<br>Inertial +               |
| Real-Time Calculation<br>of Position and<br>Velocity Relative to<br>Lane Markings (LDW)<br>and POV (FCW) | Distance and Velocity to<br>lane markings (LDW)<br>and POV (FCW)                                                                                                       | Lateral Lane Dist: ± 30 m<br>Lateral Lane Velocity:<br>± 20 m/sec<br>Longitudinal Range to POV:<br>± 200 m<br>Longitudinal Range Rate:<br>± 50 m/sec                               | Lateral Distance to Lane Marking:<br>± 2 cm<br>Lateral Velocity to Lane Marking:<br>± 0.02m/sec<br>Longitudinal Range: ± 3 cm<br>Longitudinal Range Rate: ± 0.02<br>m/sec     | Oxford Technical<br>Solutions (OXTS),<br>RT-Range                 |

**TABLE 1. TEST INSTRUMENTATION AND EQUIPMENT (CONTD)**

| Type                                                                                                      | Output                                                                                                                                                                                              | Range                                                     | Accuracy, Other Primary Specs                                                                                                  | Mfr, Model                              |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Data Acquisition System<br><br>[Includes amplification, anti-aliasing, and analog to digital conversion.] | Record Time; Position; Velocity; Distance to lane markings; Headway distance; Closing Velocity; Lateral, Longitudinal, and Vertical Accels; Roll, Yaw, and Pitch Rates; Roll, Yaw and Pitch Angles. | Sufficient to meet or exceed individual sensors           | Sound digitized at 10 kHz, all other channels digitized at 100 Hz. Accuracy is sufficient to meet or exceed individual sensors | SoMat, eDaq ECPU processor              |
|                                                                                                           |                                                                                                                                                                                                     |                                                           |                                                                                                                                | SoMat, High level Board EHLS            |
| Microphone                                                                                                | Sound (to measure time at alert)                                                                                                                                                                    | Max SPL: 139 dB/SPL<br>Frequency Response: 40 Hz – 20 kHz | ≤ 3 dB over Freq. Resp. Range                                                                                                  | Sennheiser, e614                        |
| Light Sensor                                                                                              | Light intensity (to measure time at alert)                                                                                                                                                          | Spectral Bandwidth: 440-800 nm                            | Rise time < 10 msec                                                                                                            | DRI designed and developed Light Sensor |
| Accelerometer                                                                                             | Acceleration (to measure time at alert)                                                                                                                                                             | ± 5g                                                      | ≤ 3% of full range                                                                                                             | Silicon Designs, 2210-005               |
| Coordinate Measurement Machine                                                                            | Inertial Sensing System Coordinates                                                                                                                                                                 | 0-8 ft<br>0-2.4 m                                         | ± .0020 in.<br>± .051 mm<br>(Single point articulation accuracy)                                                               | Faro Arm, Fusion                        |

## APPENDIX A

### Photographs

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Figure A1. Front View of Subject Vehicle



Figure A2. Rear View of Subject Vehicle



## 2013 JX35 FWD

### CHOOSE TO BE INSPIRED

Standard Equipment Included at No Extra Charge

#### PERFORMANCE:

3.5-liter V6 engine  
265 horsepower  
248 lb-ft torque  
Front-wheel drive  
Infiniti Drive Mode Selector with Standard, Sport, Snow, and Eco modes, controls throttle response and transmission mapping  
Continuously Variable Transmission (CVT) with manual shift mode  
18-inch, 5-spoke-split aluminum-alloy wheels with 235/65R18 all-season tires  
Independent strut front and multi-link rear suspension  
Front and rear stabilizer bars

#### LUXURY:

Leather-appointed seats  
Heated 8-way power driver's seat  
Heated 6-way power passenger front seat  
Multi-mode second-row seat with easy third-row access  
60/40-split folding/reclining/sliding second-row bench seat  
50/50-split folding/reclining third-row seat  
Kasane Washi interior trim  
Automatic on/off High Intensity Discharge (HID) bi-functional xenon headlights  
Front fog lights  
Power sliding tinted glass moonroof with one-touch open/close, tilt feature and sliding sunshade  
Tri-Zone Automatic Temperature Control  
Rear-seat heater vents under first and second-row seats  
Rear console-mounted and third-row side trim air vents  
Sequential welcome lighting  
Power remote rear liftgate  
Power tilt/telescopic steering column  
Power folding and heated outside mirrors

#### TECHNOLOGY:

RearView Monitor  
7-inch color vehicle information display  
Infiniti Intelligent Key  
Illuminated Push Button Ignition  
Bluetooth® Hands-free Phone System  
6-speaker audio system with AM/FM/CD with MP3 playback capability  
Infiniti Intelligent-View Display  
USB connection port for iPod® interface and other compatible devices  
SiriusXM™ Satellite Radio\*\*\*\*  
Auxiliary audio/video input jacks in center console

#### SAFETY AND SECURITY:

Driver and Front Passenger, Side-Impact, and Curtain Air Bags with rollover sensor  
3-point height adjustable front seat belts with pretensioners and load limiters  
Lower Anchors and Tethers for Children (LATCH)(second-row outboard only)  
Child seat top tether anchor on second-row center seat, and third-row passenger's side seat  
4-wheel Anti-lock Braking System (ABS)  
Brake Assist  
Electronic Brake force Distribution  
Vehicle Dynamic Control (VDC) with Traction Control System (TCS)  
Tire Pressure Monitoring System (TPMS) with Tire Inflation Indicator  
Vehicle Security System  
Infiniti Vehicle Immobilizer System

\*\*\*\*3 months of SiriusXM™ Service included; subscription sold separately; not available to buyers in AK or HI; some features not available in all markets.

++ Optional equipment replaces standard equipment

Manufacturer's Suggested Retail Base Price: \$40,650.00

#### Options Included by Manufacturer

ROOF RAILS 490.00  
REAR BUMPER PROTECTOR 205.00  
TECHNOLOGY PACKAGE 3,100.00

Back-Up Collision Intervention® (BCI)  
Heated Steering Wheel  
Remote Engine Start  
Intelligent Brake Assist with Forward Collision Warning  
Blind Spot Warning & Intervention  
Lane Departure Warning & Prevention  
Intelligent Cruise Control (full-speed range)  
Distance Control Assist and more

#### THEATER PACKAGE

Dual 7-inch color monitors 1,700.00

Two wireless headphones with remote  
Auxiliary audio/video input jacks and 120v power outlet for 2nd row  
Rear headphone jacks & volume control

#### DELUXE TOURING PACKAGE

20-inch, aluminum-alloy wheels++  
Bose® Cabin Surround® sound system++ (replaces Bose® Premium Sound system)  
Advanced Climate Control System (ACCS)  
Power-controlled front seats++  
Power second-row seats (outboard only)  
Sensing windshield wipers++  
2nd/3rd-row moonroof & power sunshade

#### PREMIUM PACKAGE

Maple interior accents++  
Infiniti Connection™ \*\*\*\* 4,950.00  
Infiniti Hard Drive Navigation  
8-inch VGA color touch-screen display++  
Infiniti Voice Recognition  
NavTraffic & NavWeather\*\*\*\*  
Zagat Survey® restaurant guide  
Around View® Monitor with Moving Object Detection and Front and Rear Sonar  
Bose® 13-speaker Premium Sound System++  
Streaming audio via Bluetooth®  
Dual occupant memory system  
Driver's seat 2-way power lumbar adjust  
Enhanced Intelligent Key and more++

DESTINATION CHARGES 950.00

Total\* \$54,995.00

\*\*\*\*\* Requires compatible GSM/GPRS cellular network. Initial 12 months of services included complimentary. Signal strength may vary or not exist. Standard text rates apply. After 12 months, subscription required.

### EPA DOT Fuel Economy and Environment

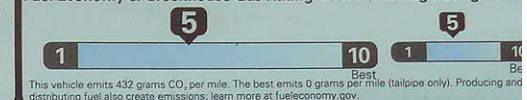
**Fuel Economy**  
**21** MPG  
combined city/hwy  
**18** city  
**24** highway  
**4.8** gallons per 100 miles

Small SUVs range from 16 to 32 MPG.  
The best vehicle rates 112 MPGe.

**You spend \$1,900**  
more in fuel costs over 5 years compared to the average new vehicle.

**Annual fuel cost \$2,700**

### Fuel Economy & Greenhouse Gas Rating (tailpipe only) Smog Rating (tailpipe)



Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 23 MPG and costs \$11,500 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$3.80 per gallon. MPG is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

**fueleconomy.gov**

Calculate personalized estimates and compare vehicles

### GOVERNMENT 5-STAR SAFETY RATINGS

**Overall Vehicle Score Not Rated**  
Based on the combined ratings of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight.

| Frontal Crash                                                                                                          | Driver Passenger | Not Rated |
|------------------------------------------------------------------------------------------------------------------------|------------------|-----------|
| Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight. |                  |           |

| Side Crash                                    | Front seat Rear seat | Not Rated |
|-----------------------------------------------|----------------------|-----------|
| Based on the risk of injury in a side impact. |                      |           |

| Rollover                                                 | Not Rated |
|----------------------------------------------------------|-----------|
| Based on the risk of rollover in a single-vehicle crash. |           |

Star ratings range from 1 to 5 stars (\*\*\*\*\* with 5 being the highest).  
Source: National Highway Traffic Safety Administration (NHTSA)  
[www.safercar.gov](http://www.safercar.gov) or 1-888-327-4236

### TOTAL OWNERSHIP EXPERIENCE

Every Infiniti Vehicle includes Infiniti's:

- 4-Year/60,000 Mile Basic Limited Warranty Coverage \*\*
- 6-Year/70,000 Mile Powertrain Limited Warranty Coverage \*\*
- 7-Year/Unlimited Mileage Corrosion Limited Warranty Coverage \*\*
- 24-hour Roadside Assistance \*\*
- Complimentary Service Loan Car \*\*\*
- Infiniti Personal Assistant \*\*\*

\*\* Please see the Infiniti Warranty Information booklet for details.  
\*\*\* Please ask your Infiniti retailer for details.

### DELIVERY

**VEHICLE COLORS:**  
EXT: DIAMOND SLATE  
INT: GRAPHITE

**FINAL ASSEMBLY POINT:**  
SMYRNA  
**TRANSPORT METHOD:**  
TRUCK  
**DEALER:**

VIN: 5N1AL0MN3DC3  
EMS: 50 STATE EMISSIONS  
MDL: 84113-318552 K50-G  
OPT: C-B10B93C03F02H01K01 P01S55Z66

20120814191813R107112

\*Does not include dealer installed options and accessories, local taxes or license fees. This label has been applied pursuant to federal law. Do not remove prior to delivery ultimate purchaser.

Figure A3. Window Sticker (Monroney Label)

MFD BY NISSAN MOTOR CO., LTD.

DATE: 08/12

GVWR: 2715 KG  
5986 LB

GAWR FR.: 1325 KG  
2921 LB

WITH P235/55R20 TIRES  
20 X 7.5 RIMS AT 35 PSI  
COLD SINGLE

GAWR RR.: 1415 KG  
3120 LB

WITH P235/55R20 TIRES  
20 X 7.5 RIMS AT 35 PSI  
COLD SINGLE

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

5N1AL0MN3DC 31

MPV 048

MODEL: JLJALTWL50EU7C-F

COLOR: K50 TRIM: G ZS30A



Figure A4. Vehicle Certification Label



Figure A5. Front View of Principal Other Vehicle



Figure A6. Rear View of Principal Other Vehicle

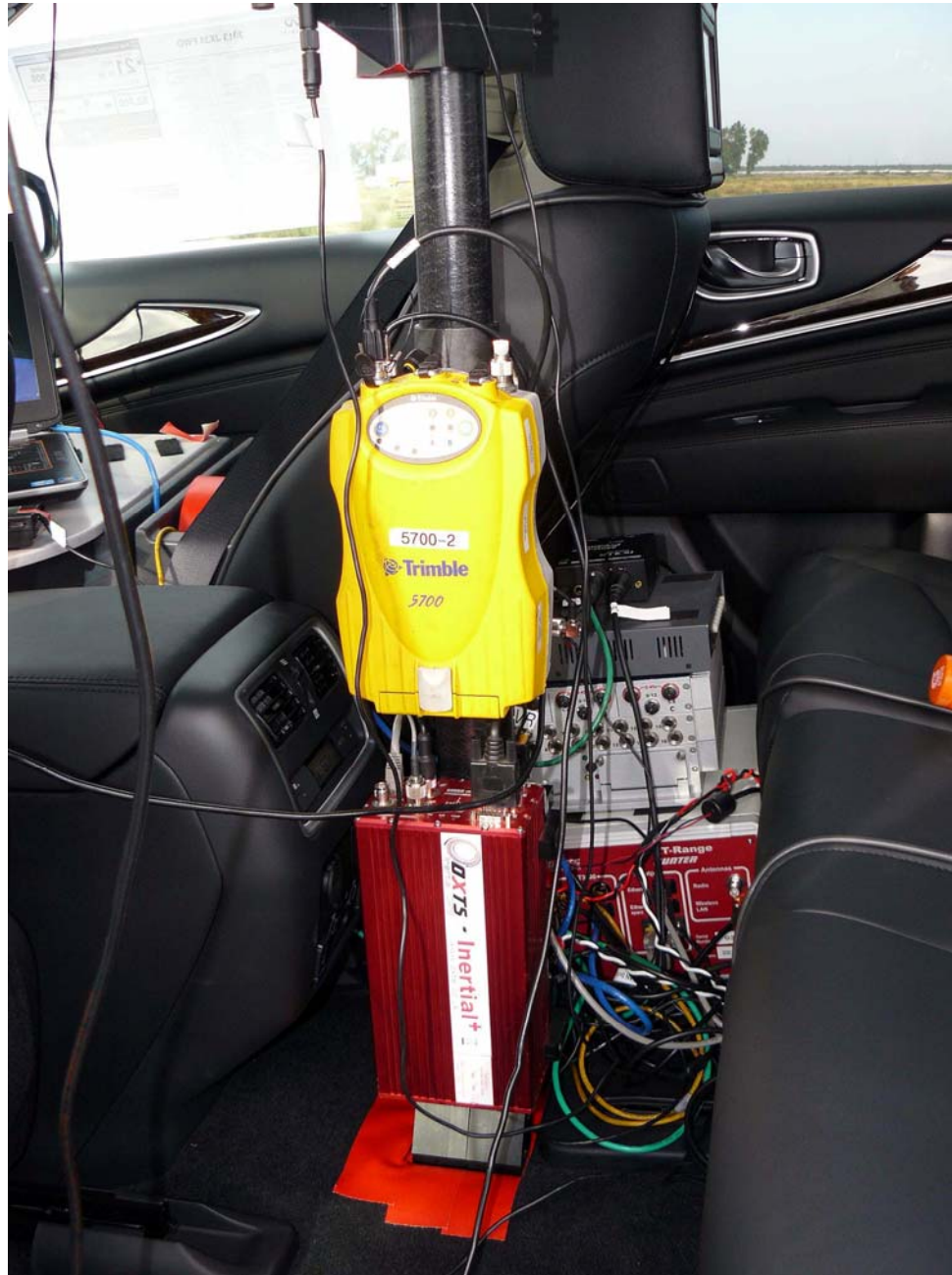


Figure A7. DGPS and Inertial Measurement Unit Installed in Subject Vehicle

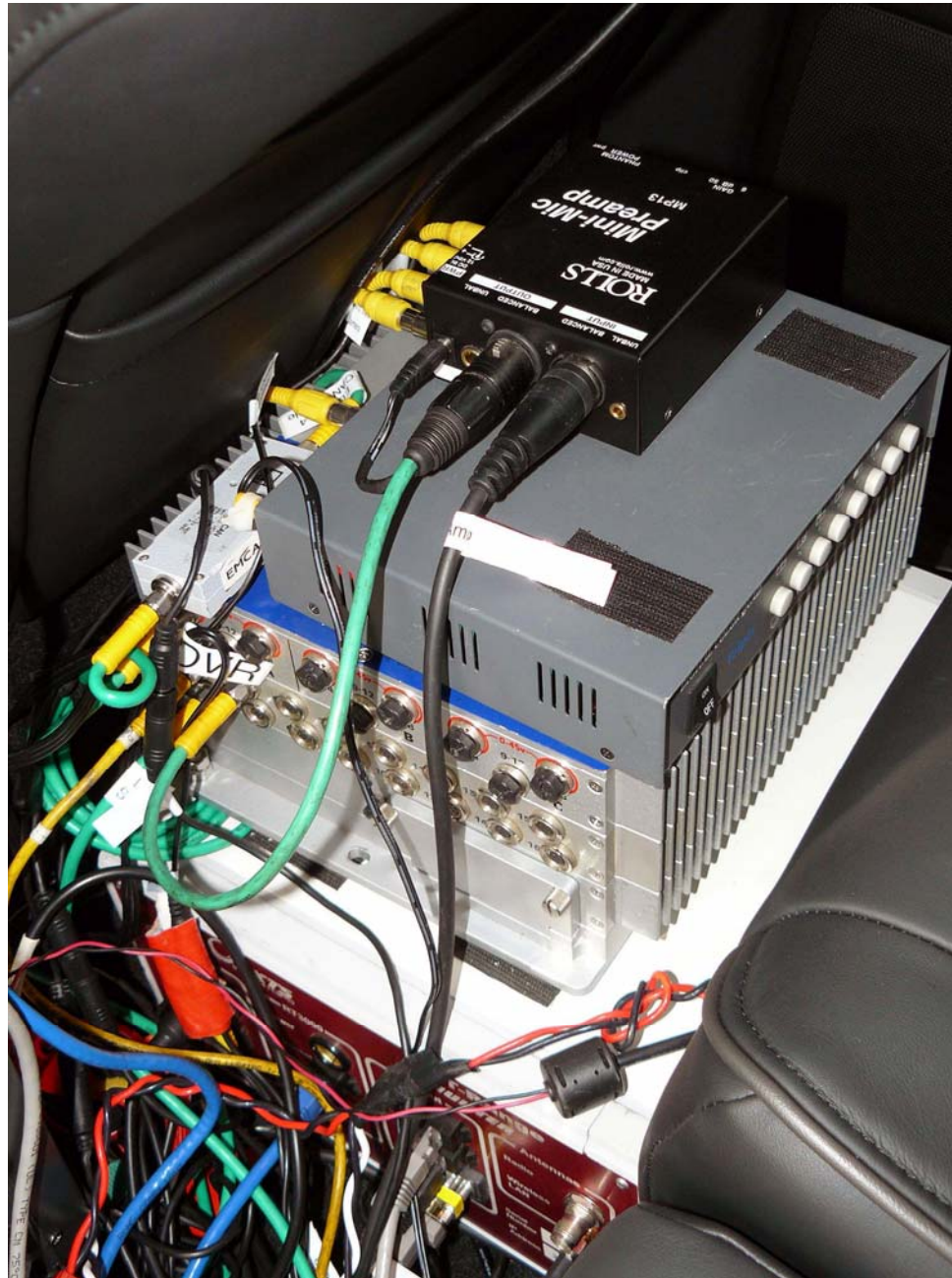


Figure A8. Data Acquisition System Installed in Subject Vehicle



Figure A9. Computer Installed in Subject Vehicle



Figure A10. Brake Actuation System Installed in Principal Other Vehicle

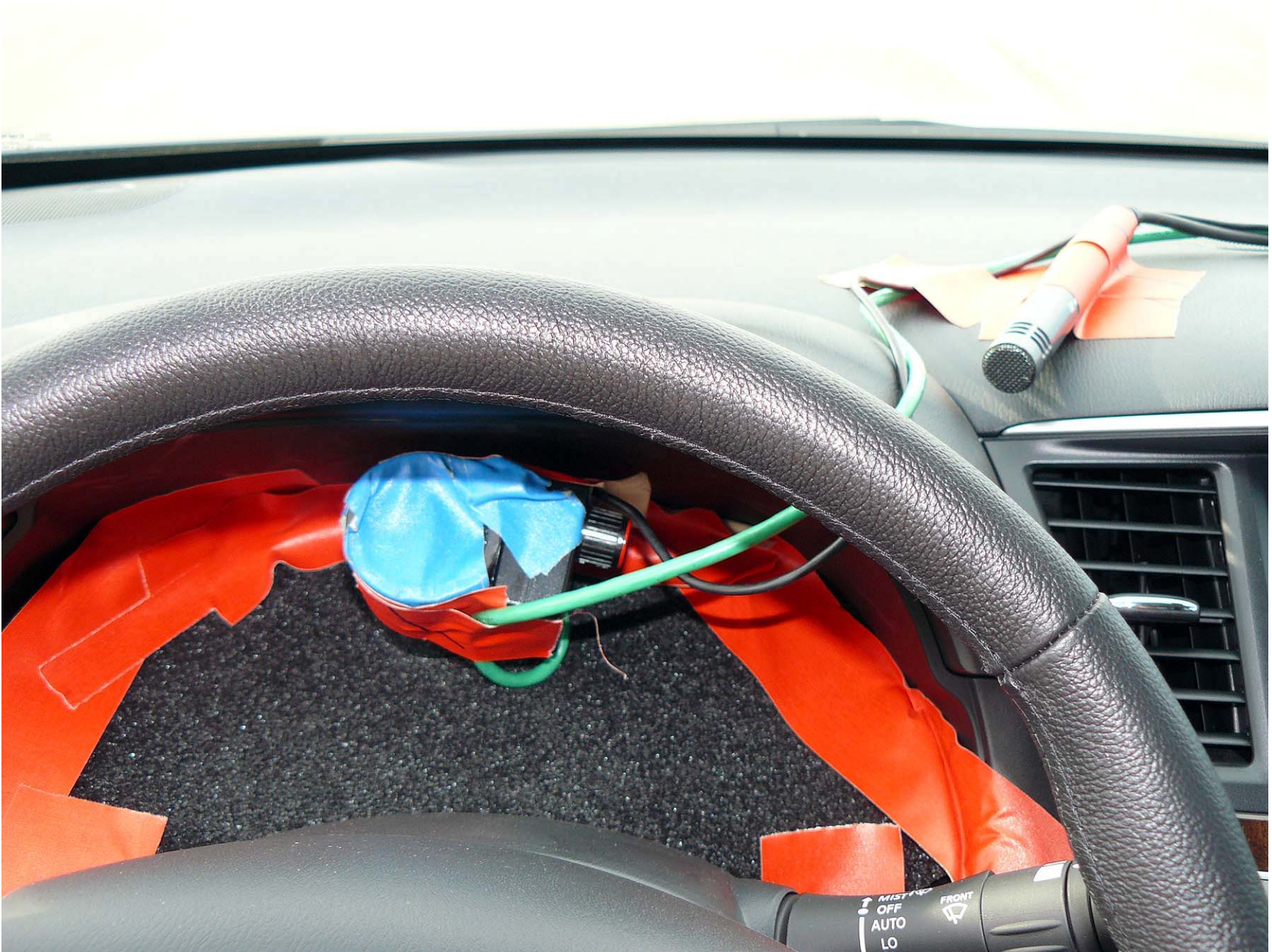


Figure A11. Sensors for Detecting Acoustic and Visual Alerts



Figure A12. Display for Vehicle Ahead Detected



Figure A13. Visual Warning Display



Figure A14. Menus for Selecting FCW

## APPENDIX B

### Excerpts from Owner's Manual

### Driving Aids (if so equipped)

To change the status, warnings or turn on or off any of the systems/warnings displayed in the "Driving Aids" menu.

Use the  button to select and the ENTER button to change a menu item:

- Forward
  - Warning (FCW) 
  - Assistance (DCA) 
  - Distance — Long/Short
- Lane
  - Warning (LDW) 
  - Assistance (LDP) 
- Blind Spot
  - Warning (BSW) 
  - Assistance (BSI) 
  - Brightness — Bright/STD/Dark

### Back-up Collision Interv.(ention) (if so equipped)

The back-up collision intervention system can be changed to be ON when the ignition switch is placed in the ON position and to Auto Resume.

Use the  button to select and the ENTER button to change a menu item:

- Ignition On Status – On/Off

### Intelligent Brake Assist (if so equipped)

The intelligent brake assist system can be enabled/disabled in the vehicle information display.

Use the  button to select and the ENTER button to change a menu item:

### Main Menu Selection

The items that display can be turned enabled/disabled when the ignition switch is placed in the ON position. To change the items that display.

Use the  button to select and the ENTER button to change a menu item.

### Driver Assistance (if so equipped)

The driver assistance system can be enabled/disabled to display in the vehicle information display when the ignition switch is placed in the ON position

From the "Main Menu Selection" select "Driver Assistance" to display in the vehicle information display when the ignition is placed in the ON position.

### Trip Computer

The trip computer can be enabled/disabled to display in the vehicle information display when the ignition switch is placed in the ON position.

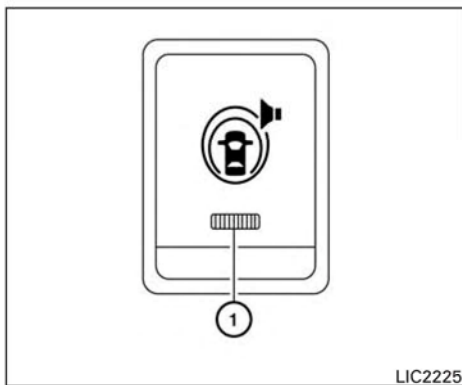
From the "Main Menu Selection" select "Trip Computer" to display in the vehicle information display when the ignition is placed in the ON position.

### Tire Pressures

The tire pressures can be enabled/disabled to display in the vehicle information display when the ignition switch is placed in the ON position.

From the "Main Menu Selection" select "Tire Pressures" to display in the vehicle information display when the ignition is placed in the ON position.

### WARNING SYSTEMS SWITCH (if so equipped)



The warning systems switch is used to turn on and off the warning systems (Forward Collision Warning (FCW), Lane Departure Warning (LDW) and Blind Spot Warning (BSW) systems) that are activated using the settings menu on the center display.

When the warning systems switch is turned off, the indicator ① on the switch is off. The indicator will also be off if all of the warning systems are deactivated using the settings menu.

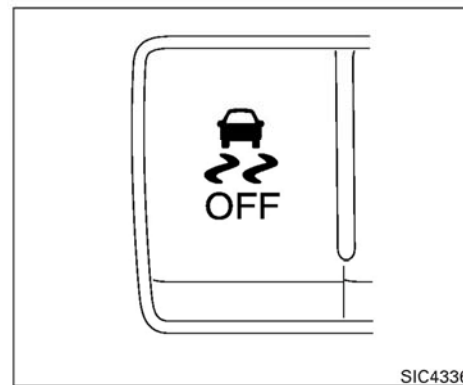
The FCW system will sound a warning chime and the vehicle ahead detection indicator light blinks to alert the driver if the vehicle is traveling close to

the vehicle ahead. (See "Forward Collision Warning (FCW) system" in the "Starting and driving" section).

The LDW system will sound a warning chime and blink LDW/LDP indicator light (orange) to alert the driver if the vehicle is traveling close to either the left or the right of a traveling lane with detectable lane markers. (See "Lane Departure Warning (LDW) system/Lane Departure Prevention (LDP) system" in the "Starting and driving" section).

The BSW system will turn on the BSW/Blind Spot Intervention (BSI) indicator lights, located next to the outside mirrors, if the radar sensors detect a vehicle in the detection zone. If the turn signal is activated in the direction of the detected vehicle, a chime sounds twice and the BSW/BSI indicator light will flash. (See "Blind Spot Warning (BSW) system/Blind Spot Intervention™ (BSI) system" in the "Starting and driving" section).

### VEHICLE DYNAMIC CONTROL (VDC) OFF SWITCH



The vehicle should be driven with the Vehicle Dynamic Control (VDC) system on for most driving conditions.

If the vehicle is stuck in mud or snow, the VDC system reduces the engine output to reduce wheel spin. The engine speed will be reduced even if the accelerator is depressed to the floor. If maximum engine power is needed to free a stuck vehicle, turn the VDC system off.

To turn off the VDC system, push the VDC OFF switch. The  indicator will come on.

Push the VDC OFF switch again or restart the engine to turn on the system. See "Vehicle Dynamic Control (VDC) system" in the "Starting and driving" section.

**Instruments and controls 2-41**

## FORWARD COLLISION WARNING (FCW) SYSTEM (if so equipped)

**If it is not possible to set the system or the indicator stays on, it may indicate that the system is malfunctioning. Although the vehicle is still driveable under normal conditions, have the vehicle checked at an INFINITI retailer.**

### Sensor maintenance

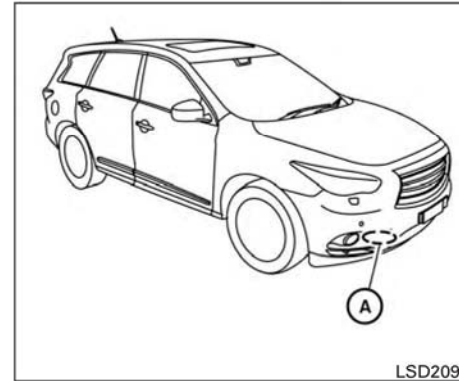
#### How to handle the sensor:

The sensor for the DCA system is common with Intelligent Cruise Control and is located behind the front bumper.

To handle the sensor, see "Intelligent Cruise Control (ICC) system (Full speed range)" in this section.

The Forward Collision Warning (FCW) system will warn the driver by a warning light and chime when your vehicle is getting close to the vehicle ahead in the traveling lane.

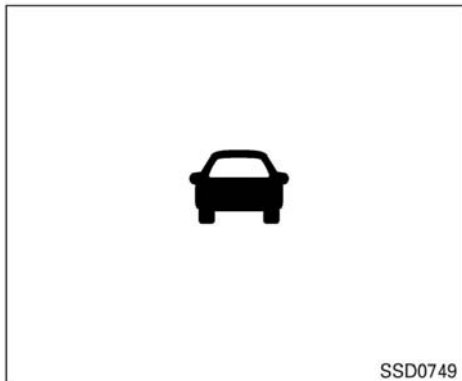
The FCW system will function when your vehicle is driven at speeds of approximately 10 MPH (15 km/h) and above.



The FCW system uses the distance sensor (A) located behind the front bumper to measure the distance to the vehicle ahead. When the system judges that your vehicle is getting close to the vehicle ahead in the travel lane, the vehicle ahead detection indicator light on the instrument panel blinks and a warning chime sounds.

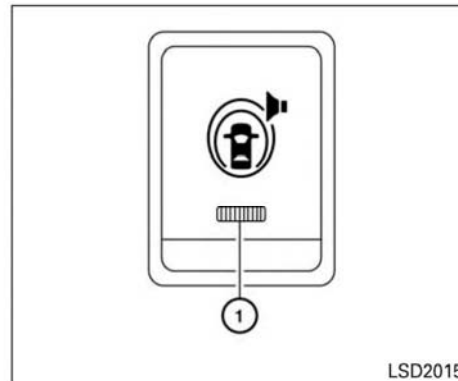
The FCW system will be turned on/off by pushing the warning systems switch. The warning systems ON indicator light (1) on the switch will illuminate when the system is off.

**Starting and driving 5-77**



Vehicle ahead detection light

SSD0749



LSD2015

#### Warning systems switch PRECAUTIONS ON FCW SYSTEM

##### **⚠ WARNING**

- The FCW system is intended to warn you before a collision but will not avoid a collision. It is the driver's responsibility to stay alert, drive safely and be in control of the vehicle at all times.
- As there is a performance limit, the system may not provide a warning in certain conditions.

- The system will not detect the following objects:
  - Pedestrians, animals or obstacles in the roadway
  - Oncoming vehicles in the same lane
- The system will not detect another vehicle under the following conditions:
  - When the sensor gets dirty and it is impossible to detect the distance from the vehicle ahead.
  - When driving into a strong light (for example, sunlight)
- The sensor generally detects the signals returned from the reflectors on a vehicle ahead. Therefore, the system may not function properly under the following conditions:
  - When the reflectors of the vehicle ahead are positioned high or close to each other (including a small vehicle such as motorcycles).
  - When the sensor area of the front bumper gets dirty or it is impossible to detect the distance from the vehicle ahead.

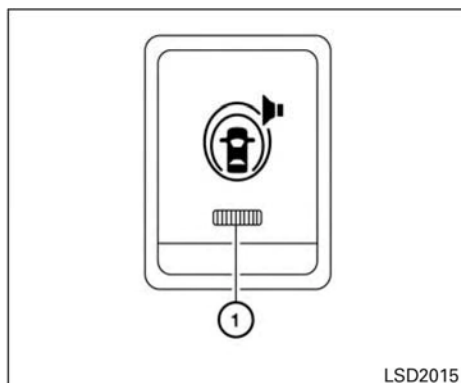
- When visibility is low (such as rain, fog, snow, etc.).
- When snow or road spray from traveling vehicles is splashed.
- When excessively heavy baggage is loaded in the rear seat or the luggage room of your vehicle.
- When abruptly accelerating or decelerating.
- On a steep downhill slope or on roads with sharp curves.
- When there is a highly reflective object near the vehicle ahead (for example, being very close to another vehicle, signboard, etc.)
- When you are towing a trailer.
- Depending on certain road conditions (curved or beginning of a curve), vehicle conditions (steering position or vehicle position), or the preceding vehicle's conditions (position in lane, etc.), the system may not function properly. The system may detect highly reflective objects such as reflectors, signs, white markers, and other stationary objects on the road or near the traveling lane and provide unnecessary warning.

- The system may not function in offset conditions.
- The system may not function when the distance to the vehicle ahead is extremely close.
- The system is designed to automatically check the sensor's functionality. When the sensor detects an obstruction of the radar signals due to dirt, adhesive material, or similar objects to the front bumper, the system will automatically cancel. However, sensor may not detect all obstructive material. In these instances the system may not be able to warn the driver properly. Be sure to check and clean the sensor regularly.
- Excessive noise will interfere with the warning chime sound, and the chime may not be heard.
- A sudden appearance of a vehicle in front (for example, it abruptly cuts in) may not be detected and the system may not warn the driver soon enough.
- The system will be cancelled automatically with a beep sound and the IBA OFF indicator light will illuminate under the following conditions:

- When the sensor area of the front bumper is dirty
- When the system malfunctions

If the IBA OFF indicator light  illuminates with a beep sound, pull off the road to a safe location, stop the vehicle and turn the engine off. Check to see if the front bumper is dirty. If the sensor area of the front bumper is dirty, clean it with a soft cloth and restart the engine. If the sensor window is not dirty, restart the engine. If the IBA OFF indicator light  continues to illuminate even if the IBA system is disabled, have the system checked by an INFINITI retailer.

Starting and driving 5-79



**Warning systems switch**

## FCW SYSTEM OPERATION

The FCW system will function at speeds of approximately 10 MPH (15 km/h) and above, when the system turns on.

The FCW system has an automatic setting mode and a manual setting mode to turn the system on. The setting mode can be changed. In the automatic setting mode, the FCW system is automatically turned on when the ignition switch is placed in the ON position. When the FCW system is on, the warning systems ON indicator light ① on the warning systems switch illuminates. To cancel the FCW system, push the warning systems

switch. The warning systems ON indicator light will turn off. To turn on the system, push the warning systems switch again.

When the warning systems switch is pushed, the LDW and BSW system will also turn on or off simultaneously. See "Lane Departure Warning (LDW) system/Lane Departure Prevention (LDP) system" and "Blind Spot Warning (BSW)/Blind Spot Intervention (BSI)/Back-up Collision Intervention (BCI) systems" in this section.

In the manual setting mode, you need to push the warning systems switch to turn on the system after the ignition switch is placed in the ON position.

The setting mode can be changed using the warning systems switch. To change the setting mode, push and hold the warning systems switch for more than 4 seconds when the warning systems ON indicator is off. When the mode is changed, a chime sounds and the lane departure warning light (orange) flashes.

For the sensor maintenance, see "Intelligent Cruise Control (ICC) system" in this section.

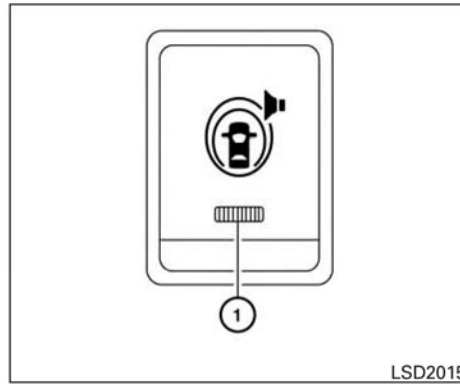
## How to enable/disable the FCW system

Perform the following steps to enable or disable the FCW system.

1. Press the  button until "Settings" displays in the vehicle information display. Use the  to select "Driver Assistance". Then press the ENTER button.
2. Select "Driver Aids", and press the ENTER button.
3. To set the FCW system to on or off, use the  buttons to navigate in the menu and use the ENTER button to select or change an item:
  - Select "Forward" and press the ENTER button.
  - To turn on the warning, use the ENTER button to check box for "Warning (FCW)"

The brightness of the Blind spot warning indicator lights is adjusted automatically depending on the brightness of the ambient light.

A chime sounds if the radar sensors have already detected vehicles when the driver activates the turn signal. If a vehicle comes into the detection zone after the driver activates the turn signal, then only the Blind spot system indicator light flashes and no chime sounds. See "BSW/BSI driving situations" in this section.



The BSW system automatically turns on every time the engine is started, as long as it is activated using the settings menu on the meter display.

When the warning systems switch is turned off, the indicator ① on the switch is off. The indicator will also be off if the BSW, the Lane Departure Warning (LDW) and the Forward Collision Warning (FCW) systems are deactivated.

## How to enable/disable the BSW system

Perform the following steps to enable or disable the BSW system.

1. Press the  button until "Settings" displays in the vehicle information display. Use the  to select "Driver Assistance". Then press the ENTER button.
2. Select "Driver Aids", and press the ENTER button.
3. To set the BSW system to on or off, use the  buttons to navigate in the menu and use the ENTER button to select or change an item:
  - Select "Blind Spot" and press the ENTER button.
  - To turn on the warning, use the ENTER button to check box for "Warning (BSW)"
  - To turn on the system, use the ENTER button to check box for "Assistance (BSI)"
  - Use the ENTER button to toggle through the brightness choices — "Bright / STD /Dark"

## APPENDIX C

### Run Log

Subject Vehicle: **2013 Infiniti JX35**

Date: 2 October 2012

Principal Other Vehicle: 2000 Honda Accord

| Run | Test Type      | Valid Run? | TTCW Sound (sec) | TTCW Light (sec) | TTCW Margin (sec) | Pass/Fail | Notes                                               |
|-----|----------------|------------|------------------|------------------|-------------------|-----------|-----------------------------------------------------|
| 1   | FCW1 (Stopped) | Y          | 2.23             | 2.15             | 0.13              | Pass      |                                                     |
| 2   |                | Y          | 2.30             | 2.22             | 0.20              | Pass      |                                                     |
| 3   |                | N          |                  |                  |                   |           |                                                     |
| 4   |                | Y          | 2.26             | 2.20             | 0.16              | Pass      |                                                     |
| 5   |                | Y          | 2.26             | 2.18             | 0.16              | Pass      | Used a threshold of 0.05 for this run (data spike?) |
| 6   |                | Y          | 2.31             | 2.21             | 0.21              | Pass      | Used a threshold of 0.05 for this run (data spike?) |
| 7   |                | Y          | 2.27             | 2.12             | 0.17              | Pass      |                                                     |
| 8   |                | Y          | 2.27             | 2.19             | 0.17              | Pass      |                                                     |
|     |                |            |                  |                  |                   |           |                                                     |
| 9   | FCW3 (Slower)  | Y          | 3.64             | 3.54             | 1.54              | Pass      |                                                     |
| 10  |                | Y          | 3.66             | 3.60             | 1.66              | Pass      |                                                     |
| 11  |                | Y          | 3.56             | 3.47             | 1.56              | Pass      |                                                     |
| 12  |                | Y          | 3.65             | 3.54             | 1.65              | Pass      |                                                     |
| 13  |                | Y          | 3.67             | 3.60             | 1.67              | Pass      |                                                     |
| 14  |                | Y          | 3.64             | 3.54             | 1.64              | Pass      |                                                     |
| 15  |                | Y          | 3.63             | 3.52             | 1.63              | Pass      |                                                     |

Subject Vehicle: **2013 Infiniti JX35**

Date: 2 October 2012

Principal Other Vehicle: 2000 Honda Accord

| Run | Test Type      | Valid Run? | TTCW Sound (sec) | TTCW Light (sec) | TTCW Margin (sec) | Pass/Fail | Notes                               |
|-----|----------------|------------|------------------|------------------|-------------------|-----------|-------------------------------------|
| 16  | FCW2 (Braking) | N          |                  |                  |                   |           | POV yaw rate high (IMU strut moved) |
| 17  |                | N          |                  |                  |                   |           | POV yaw rate high (IMU strut moved) |
| 18  |                | N          |                  |                  |                   |           | POV yaw rate high                   |
| 19  |                | Y          | 2.72             | 2.63             | 0.32              | Pass      |                                     |
| 20  |                | Y          | 2.82             | 2.71             | 0.42              | Pass      |                                     |
| 21  |                | N          |                  |                  |                   |           | POV yaw rate high                   |
| 22  |                | Y          | 2.85             | 2.78             | 0.45              | Pass      |                                     |
| 23  |                | Y          | 2.74             | 2.64             | 0.34              | Pass      |                                     |
| 24  |                | Y          | 2.82             | 2.74             | 0.42              | Pass      |                                     |
| 25  |                | Y          | 2.81             | 2.75             | 0.41              | Pass      |                                     |
| 26  |                | N          |                  |                  |                   |           | SV speed low                        |
| 27  |                | Y          | 2.65             | 2.56             | 0.25              | 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 and the Principal Other Vehicle, 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.

### Time History Plot Description

Each time history plot consists of data pertinent to the test type under consideration. The data shown in time history plots for test type 2 differs slightly from the data shown in test types 1 and 3, owing to the headway distance criterion which is used exclusively for test type 2.

Time history figures include the following sub-plots:

- Event – indicates timing of warning issued by FCW system. Depending on the type of FCW alert or instrumentation used to measure the alert, this can be any of the following,:
  - o Filtered and rectified sound signal
  - o Filtered and rectified acceleration (e.g., steering wheel vibration)
  - o Light sensor signal
  - o Discrete on/off value
- 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 test type 2, the plot indicating the longitudinal acceleration of the Principal Other Vehicle includes a solid black threshold line indicating the maximum deceleration (-0.33 g) allowed while braking. Exceedance of this threshold is indicated with red shading in the area between the measured time-varying data and 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

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.

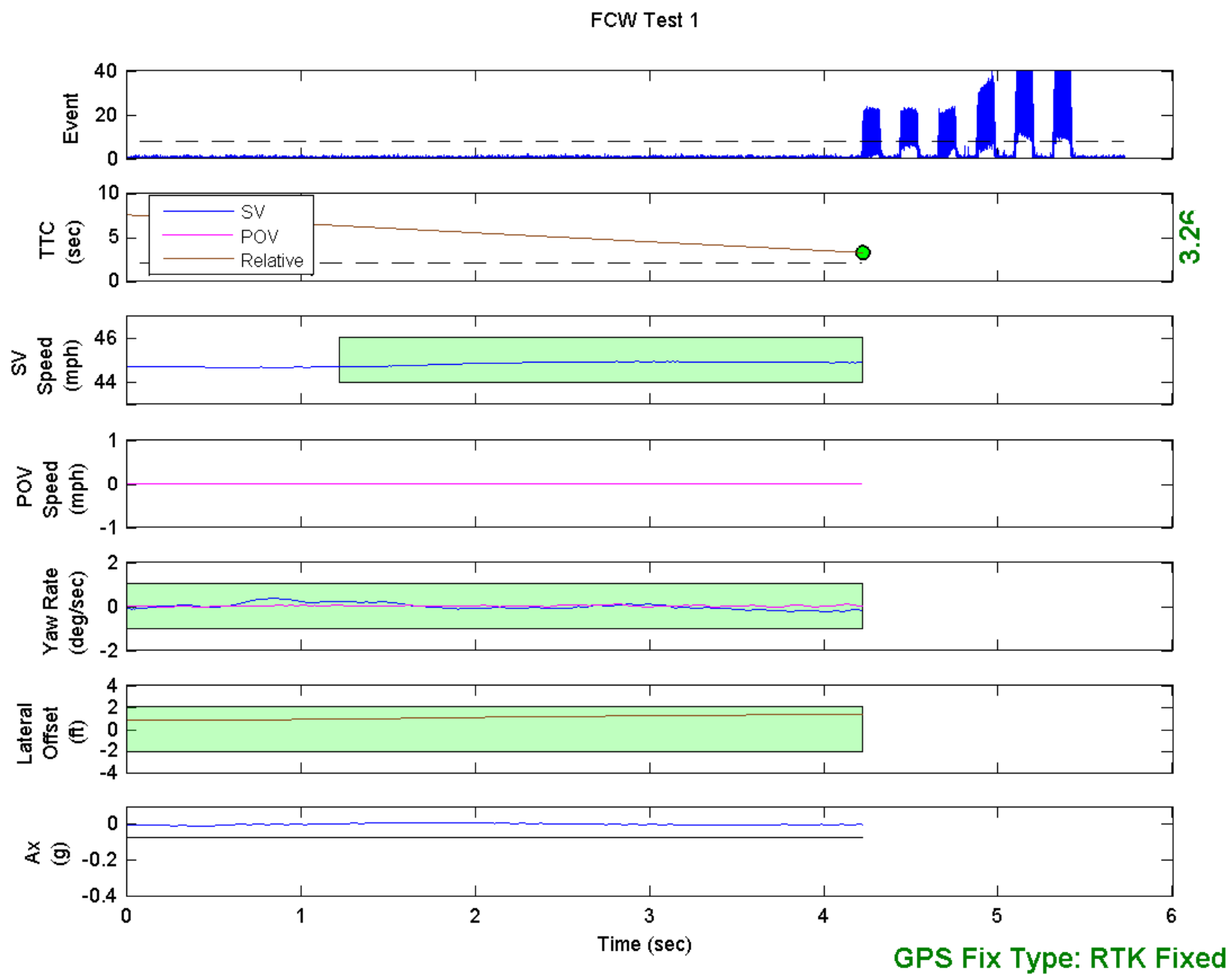


Figure D1. Example Time History for Test Type 1, Passing

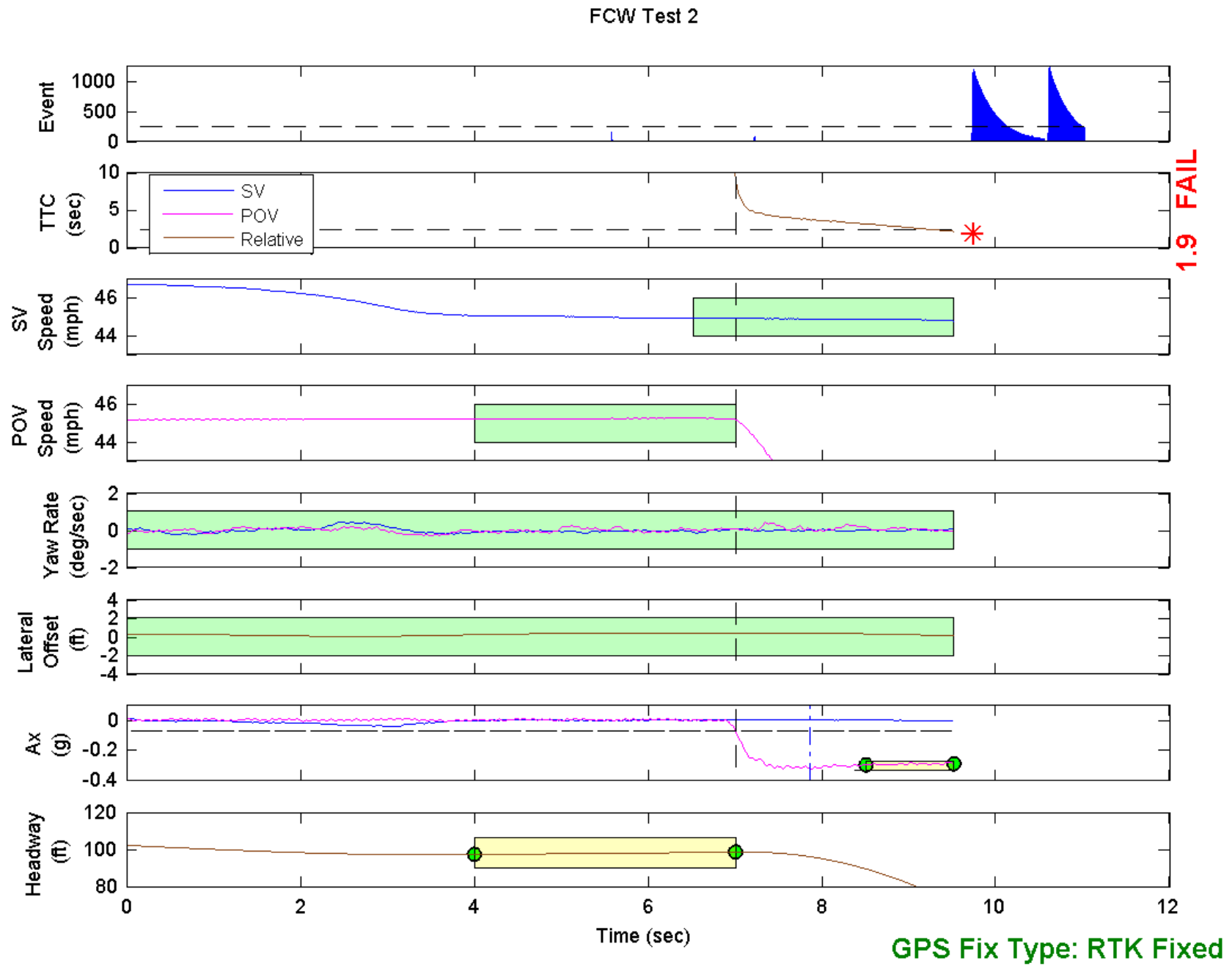


Figure D2. Example Time History for Test Type 2, Failing

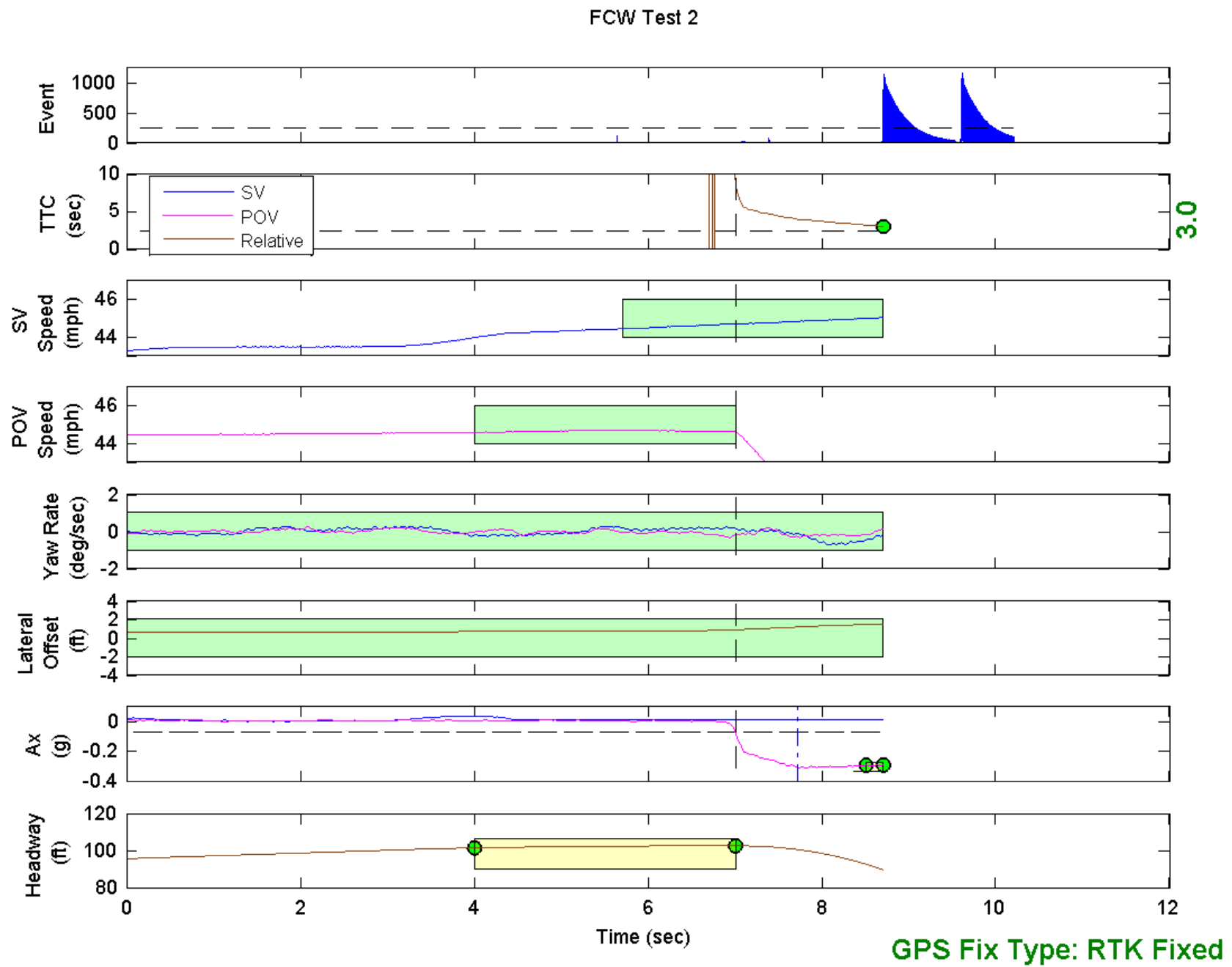


Figure D3. Example Time History for Test Type 2, Passing

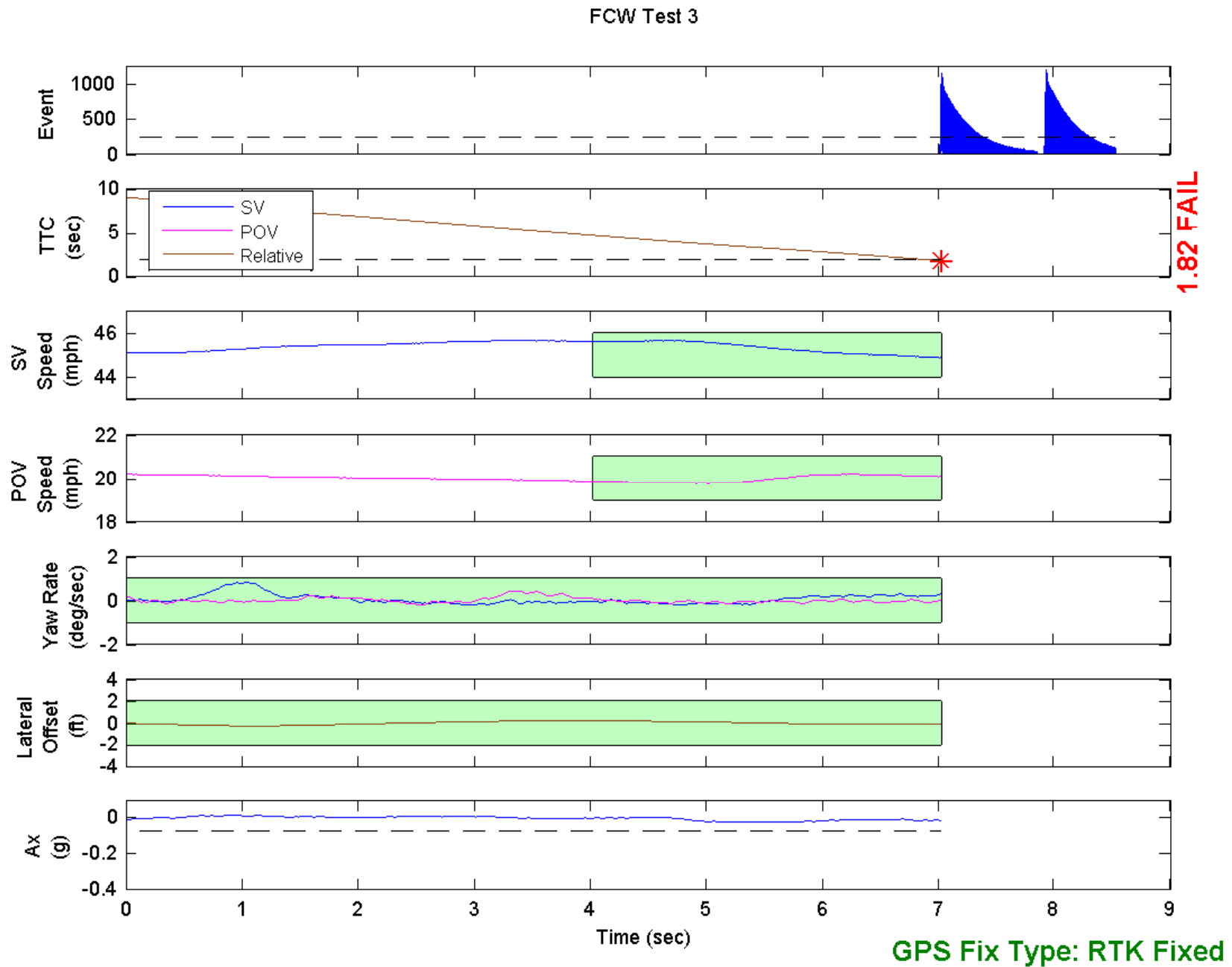


Figure D4. Example Time History for Test Type 3, Failing

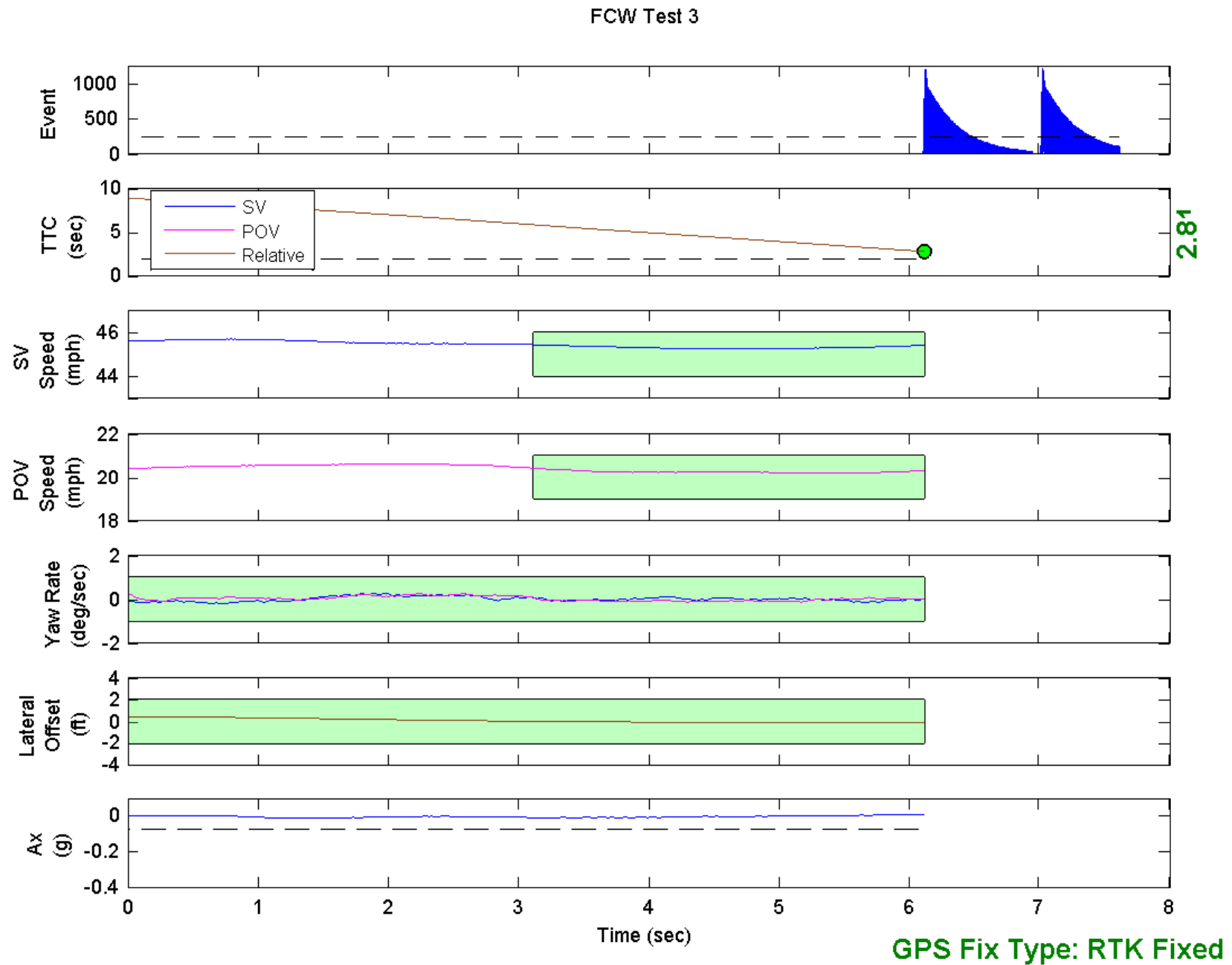


Figure D5. Example Time History for Test Type 3, Passing

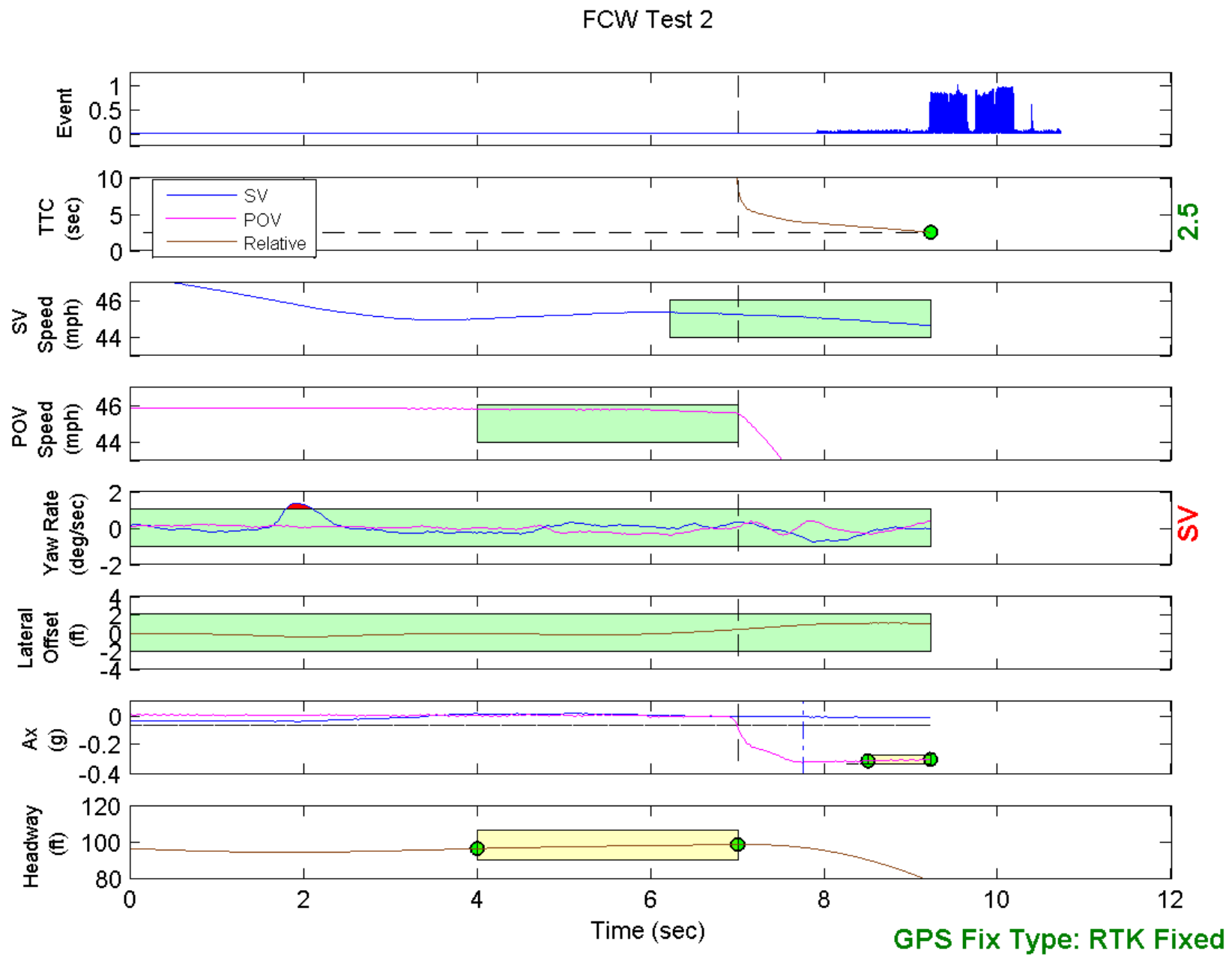


Figure D6. Example Time History for Test Type 2, Invalid Run Due to Subject Vehicle Yaw Rate

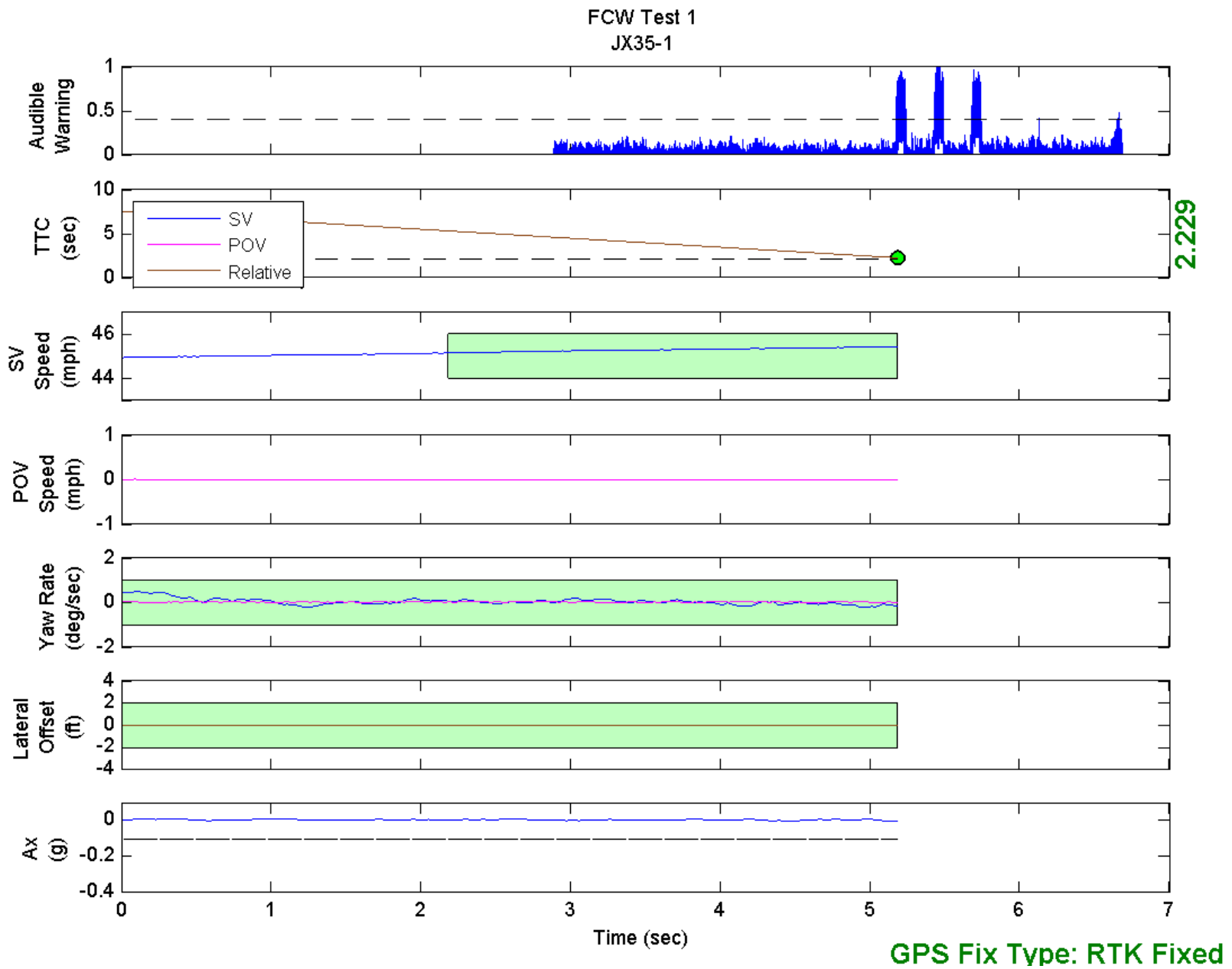


Figure D7. Time History for Run 01, FCW Test 1, Audible Warning

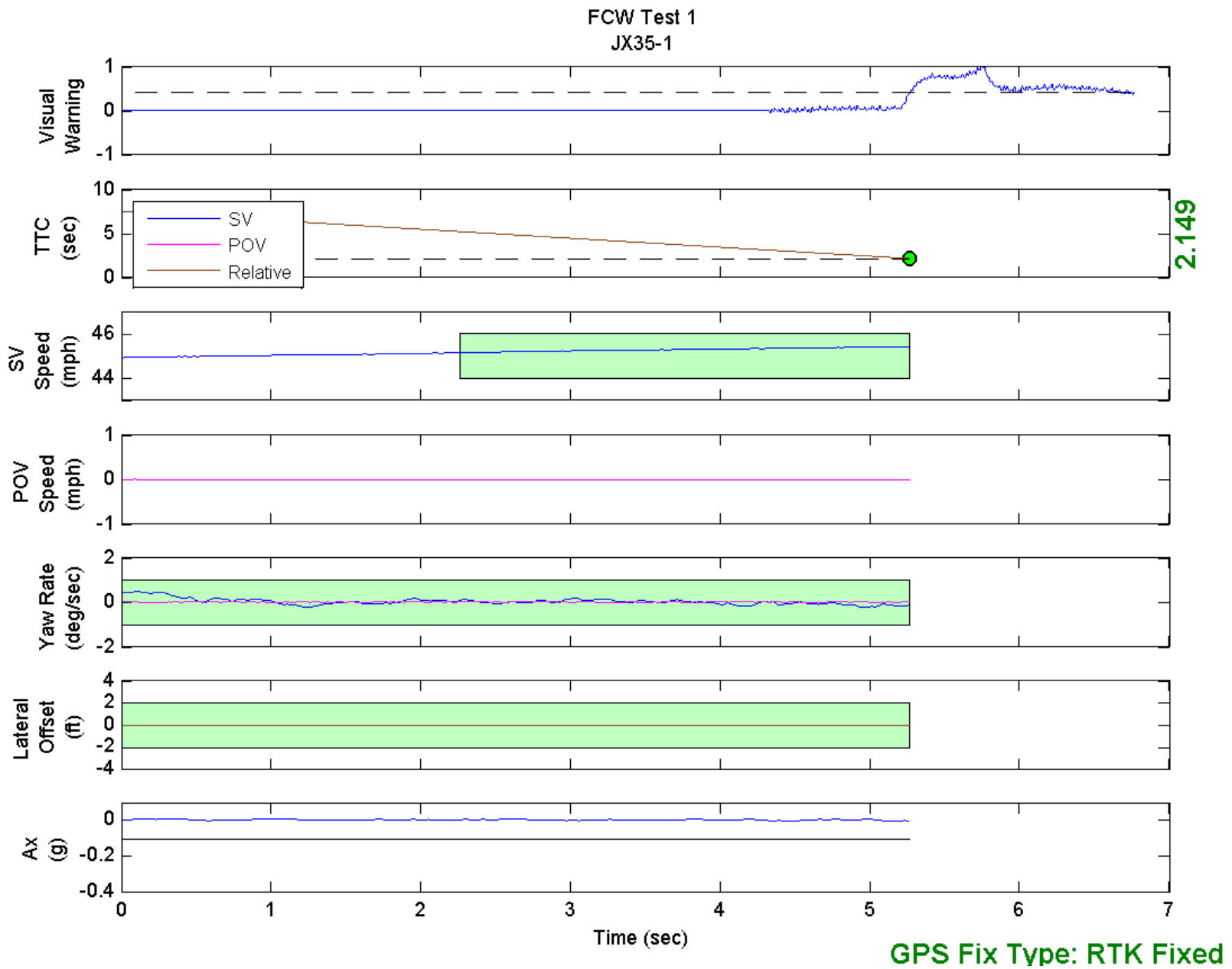


Figure D8. Time History for Run 01, FCW Test 1, Visual Warning

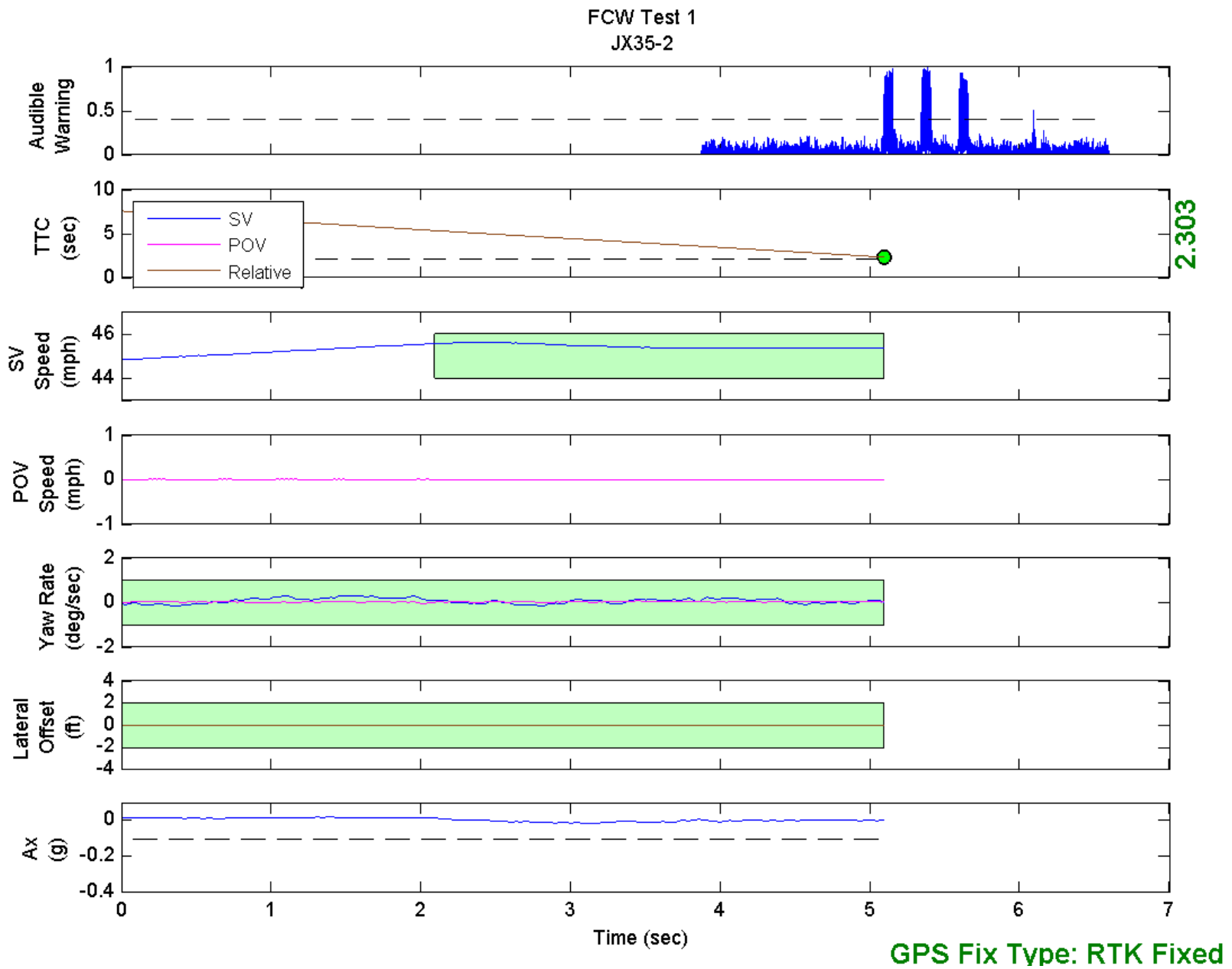


Figure D9. Time History for Run 02, FCW Test 1, Audible Warning

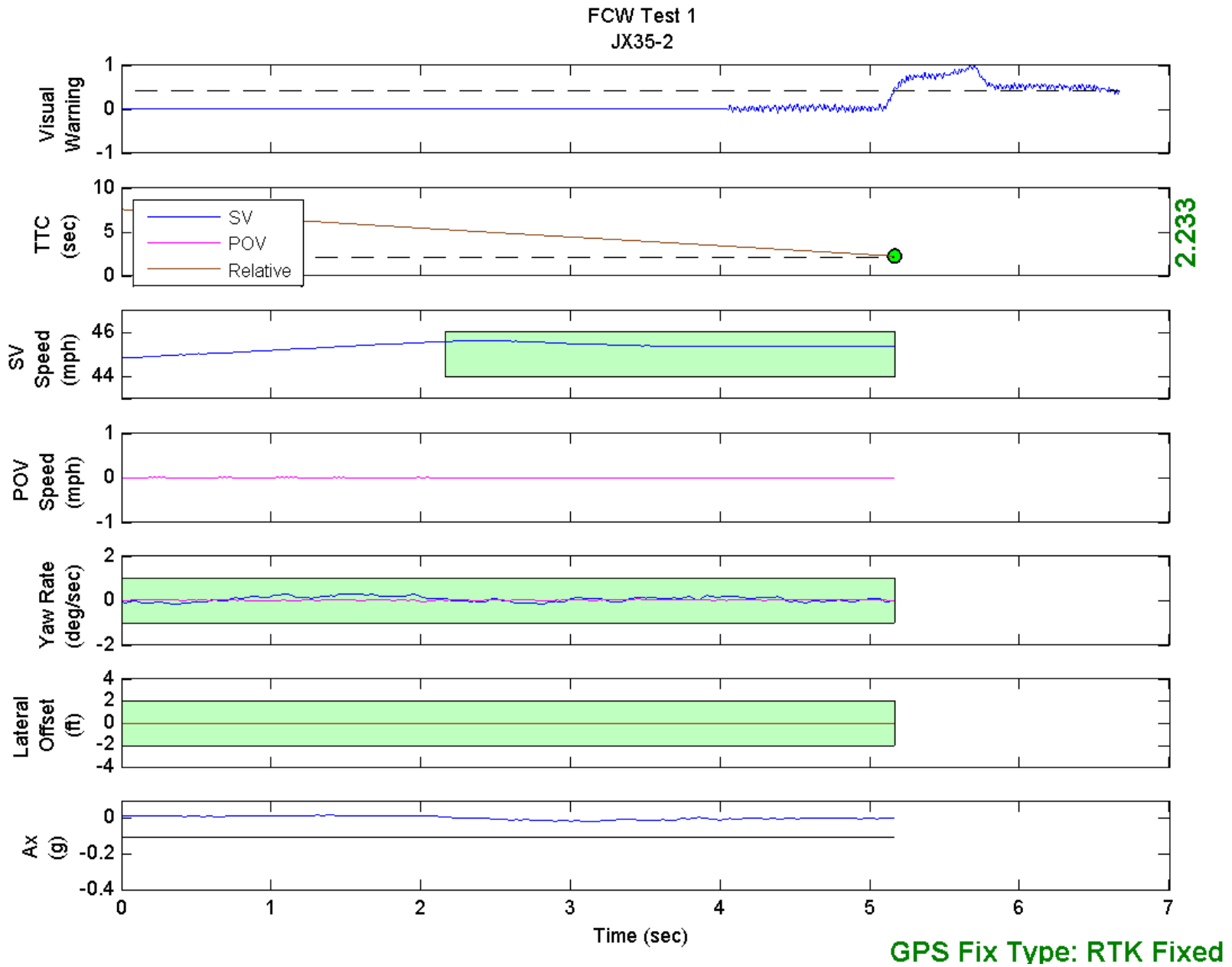


Figure D10. Time History for Run 02, FCW Test 1, Visual Warning

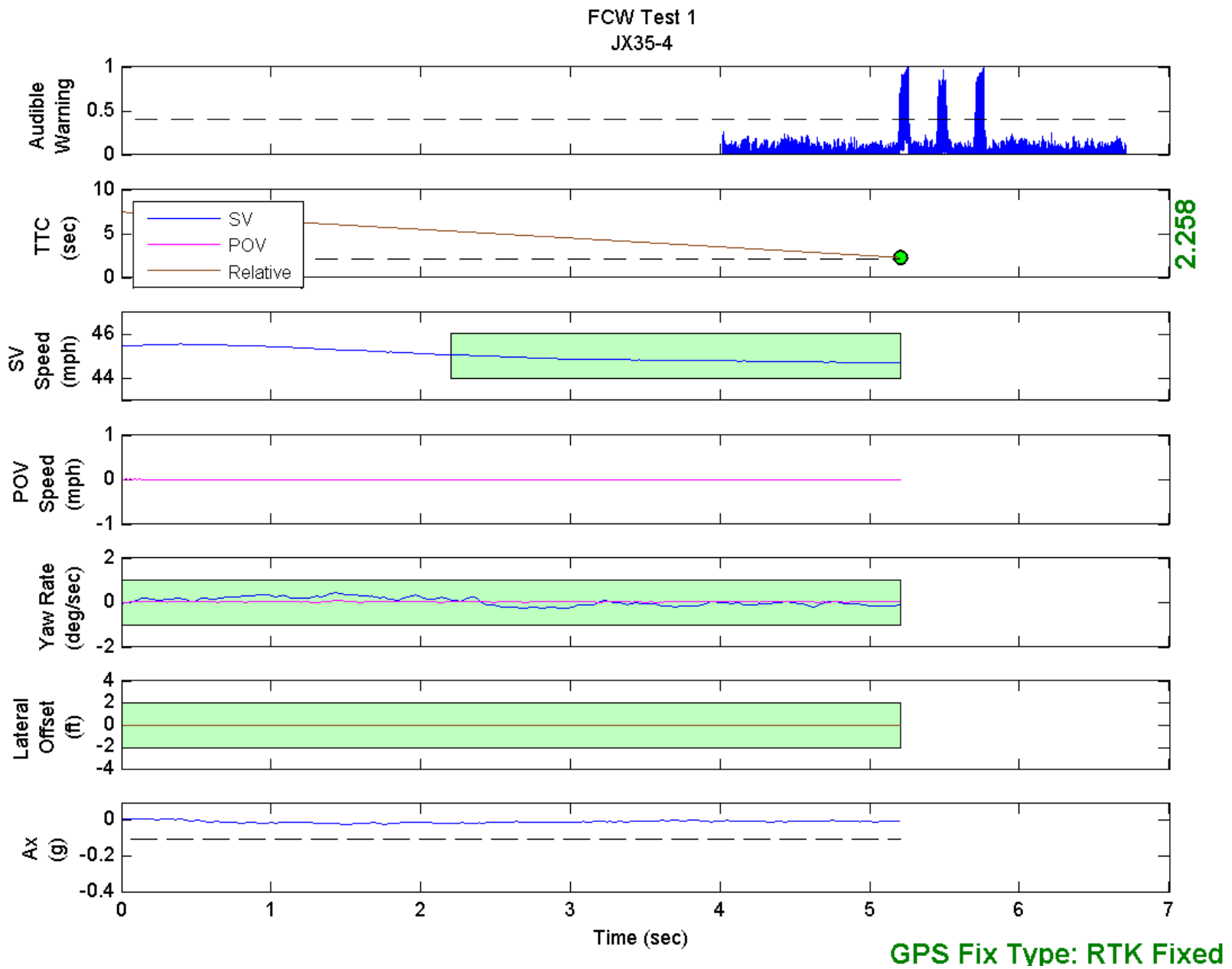


Figure D11. Time History for Run 04, FCW Test 1, Audible Warning

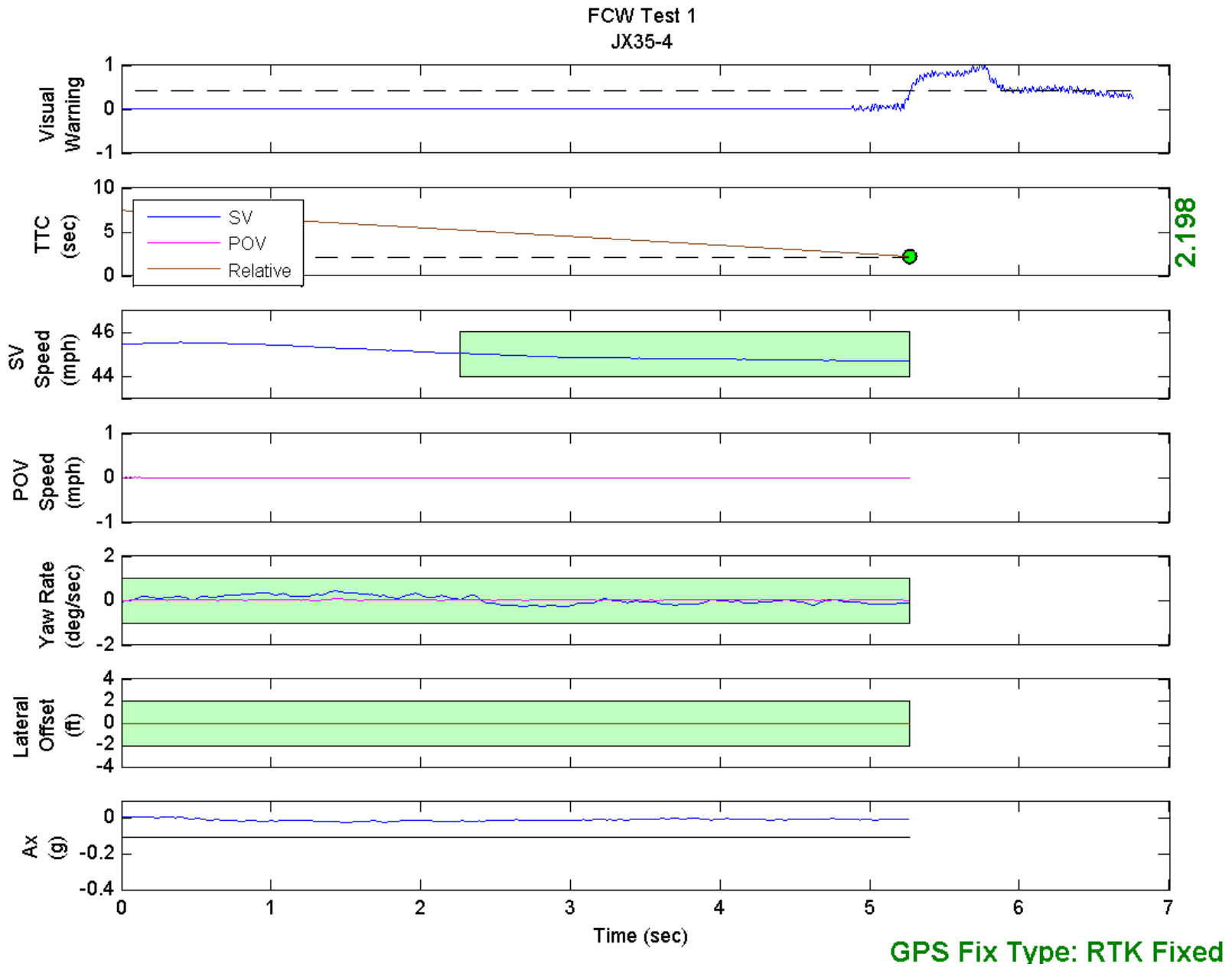


Figure D12. Time History for Run 04, FCW Test 1, Visual Warning

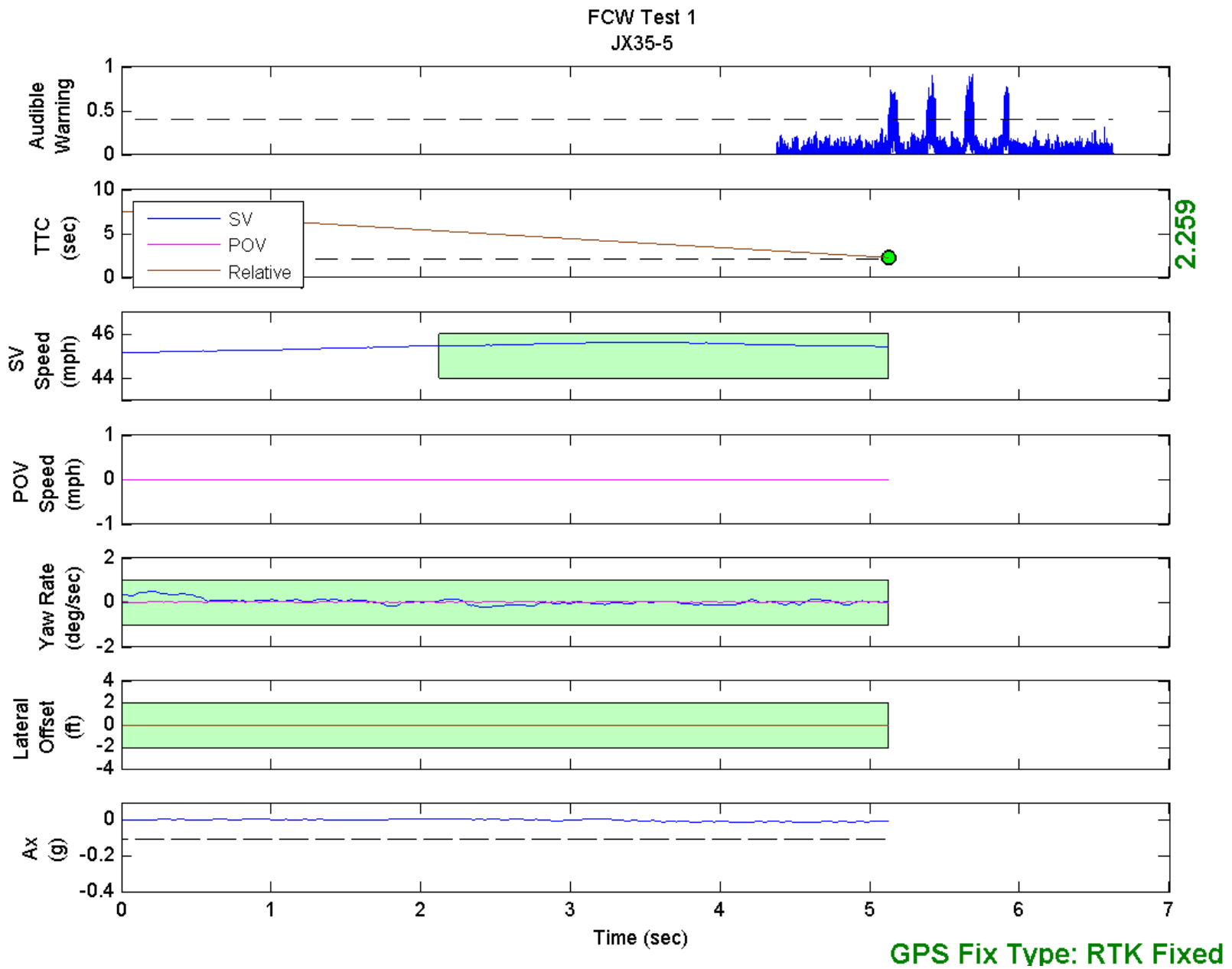


Figure D13. Time History for Run 05, FCW Test 1, Audible Warning

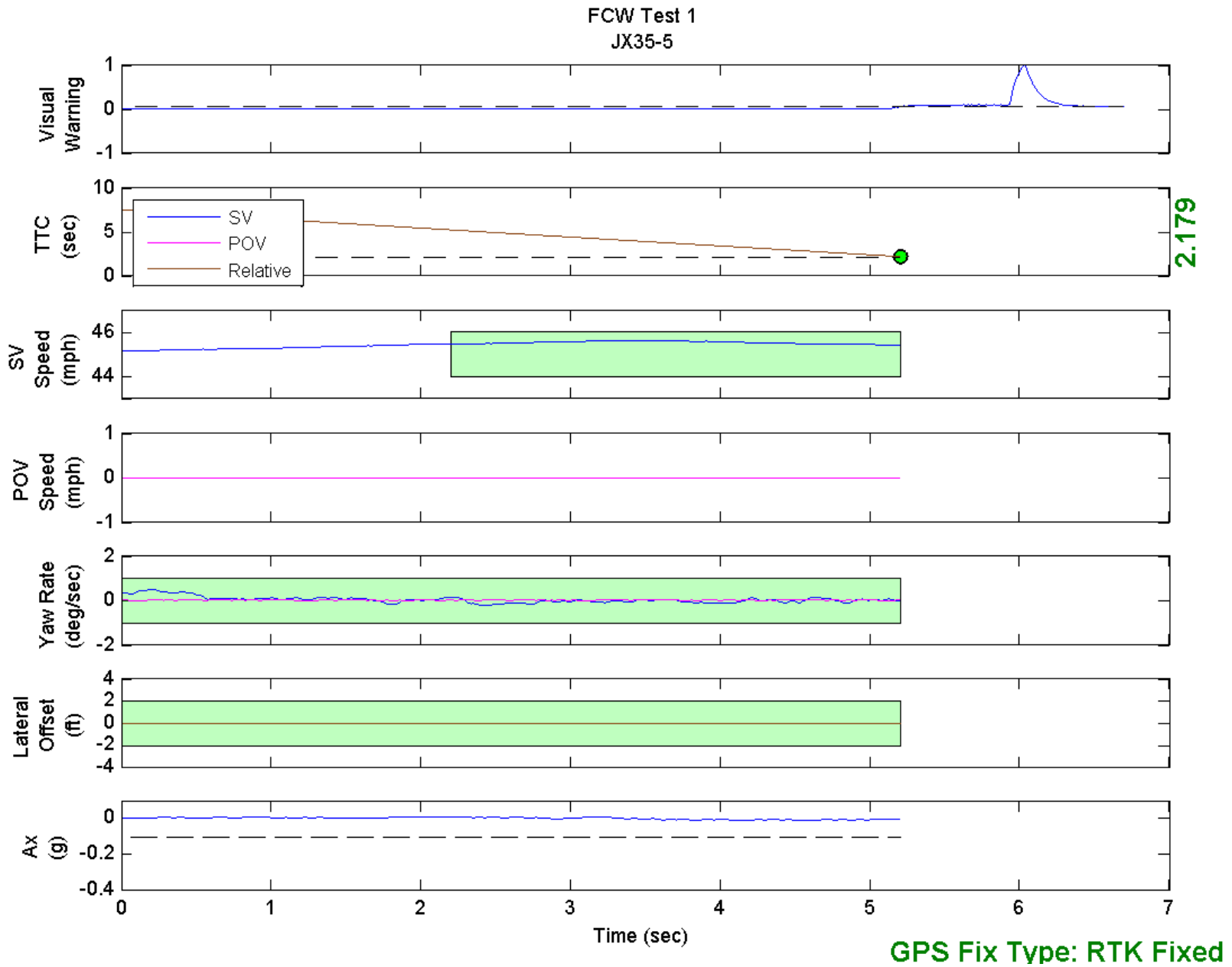


Figure D14. Time History for Run 05, FCW Test 1, Visual Warning

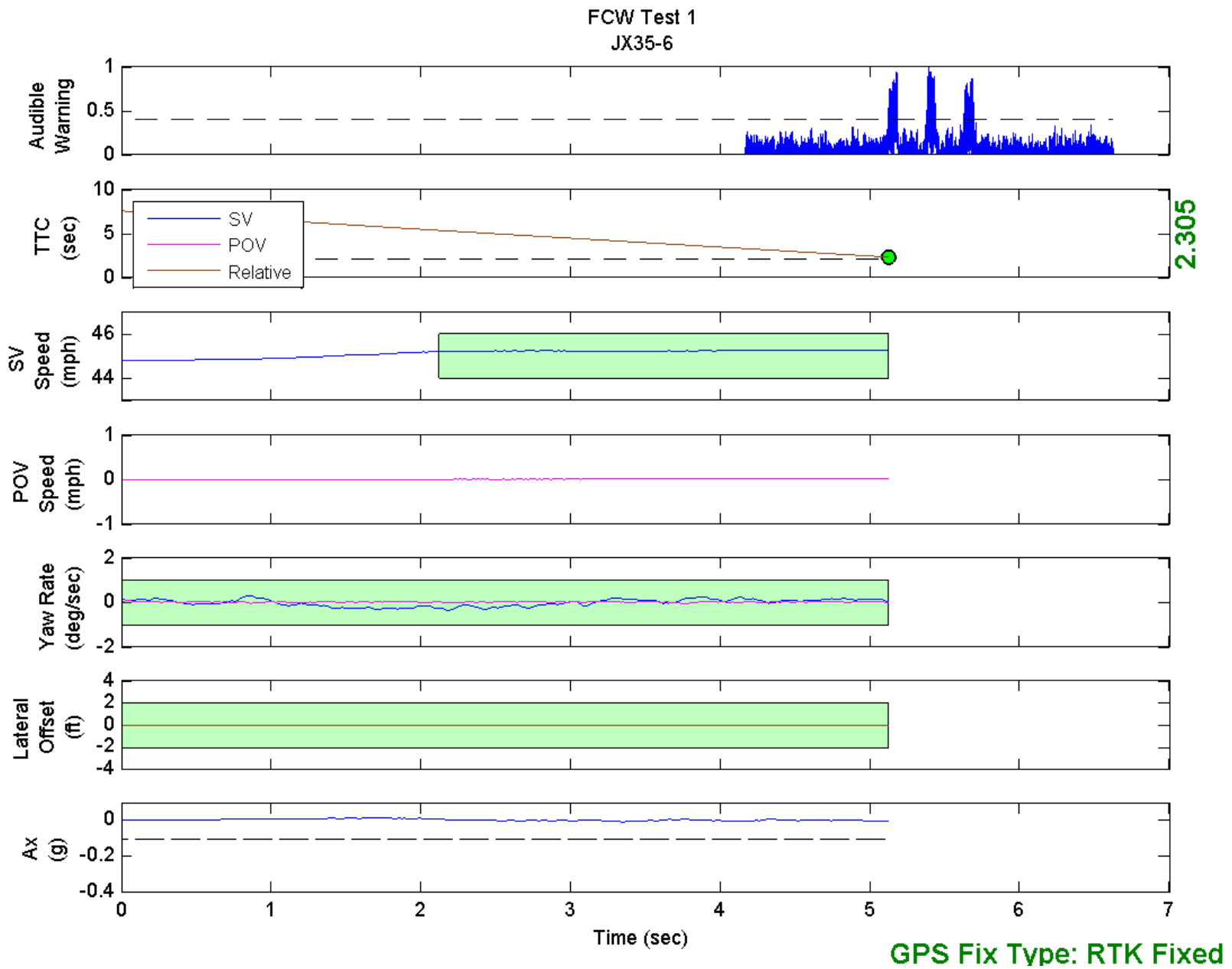


Figure D15. Time History for Run 06, FCW Test 1, Audible Warning

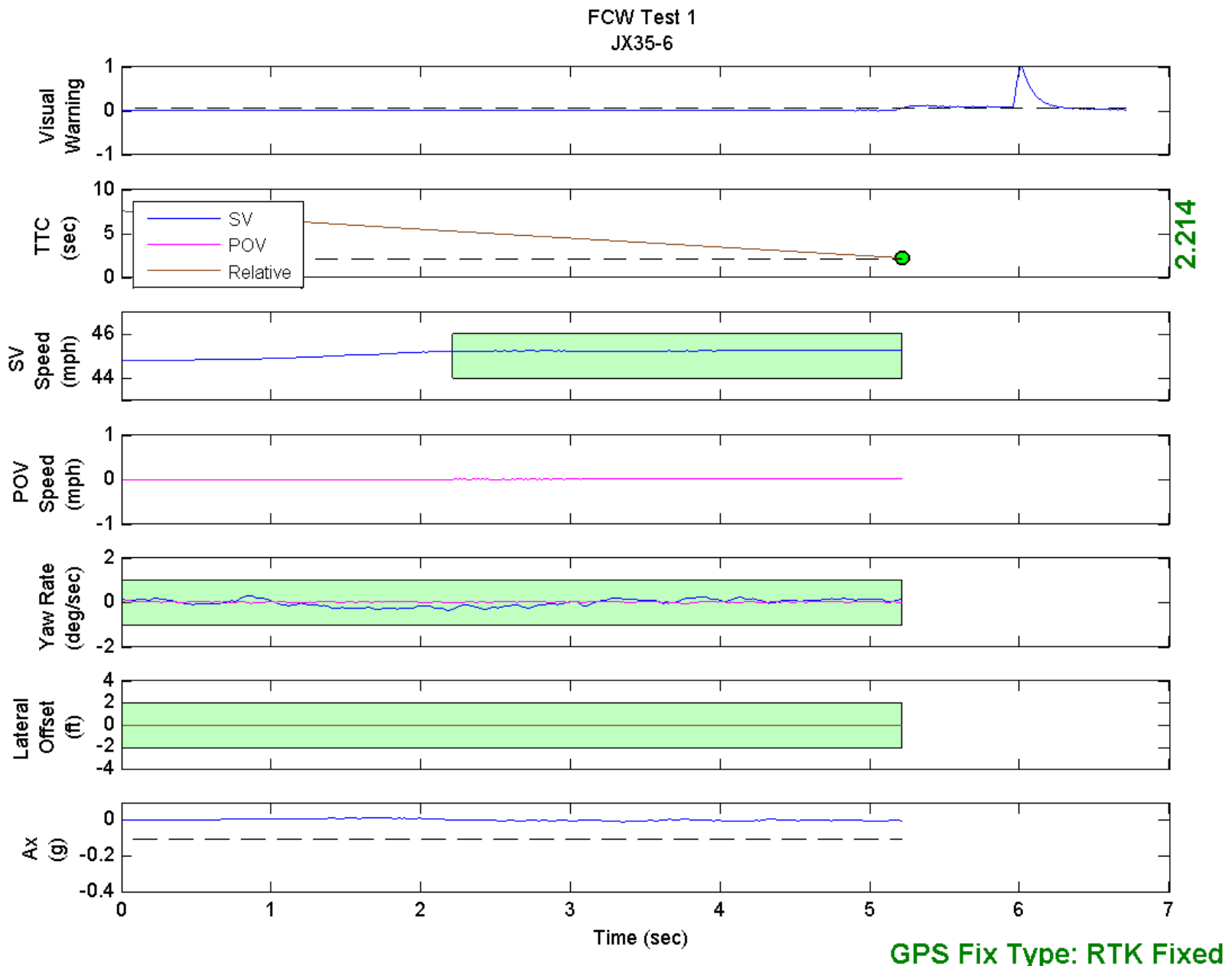


Figure D16. Time History for Run 06, FCW Test 1, Visual Warning

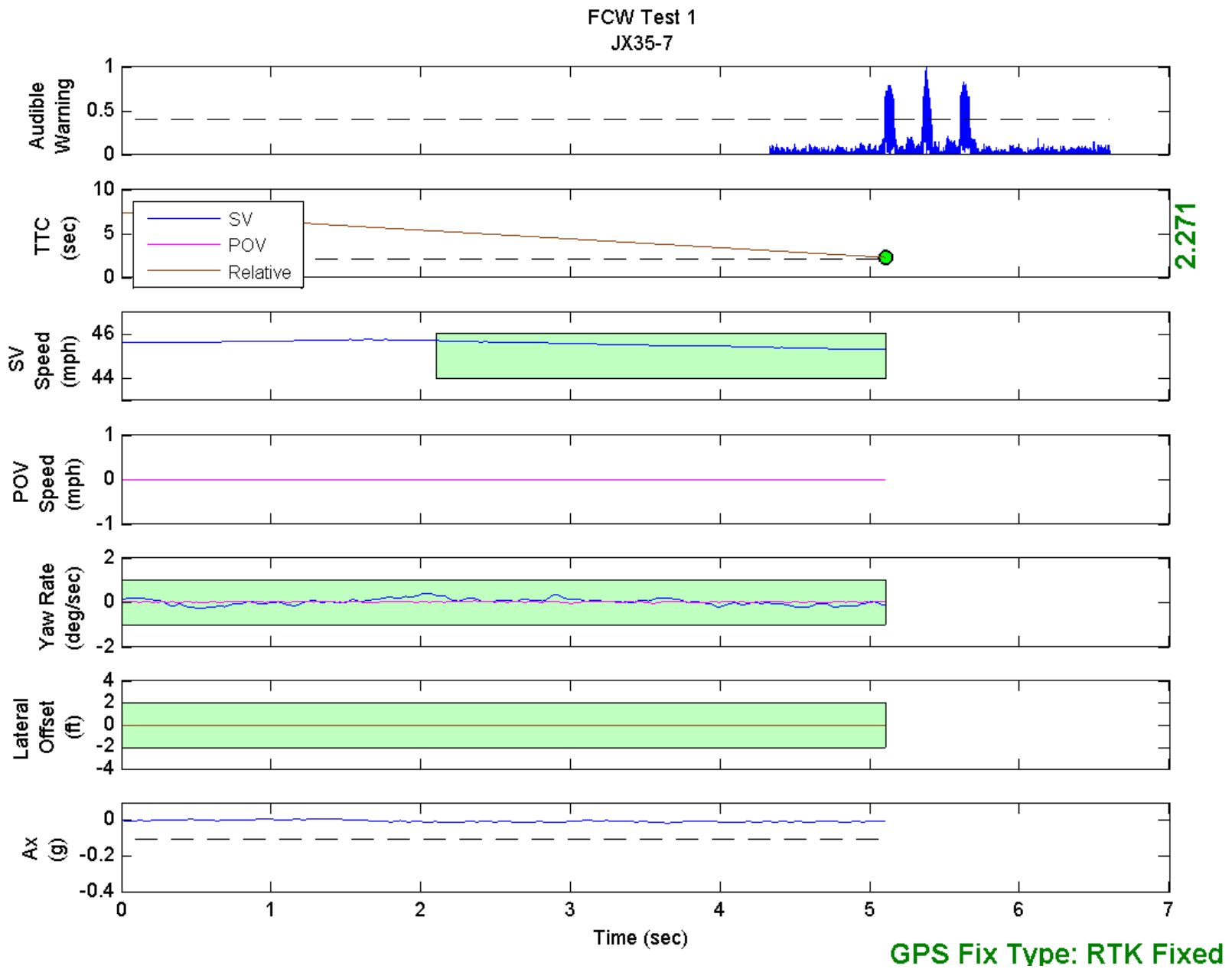


Figure D17. Time History for Run 07, FCW Test 1, Audible Warning

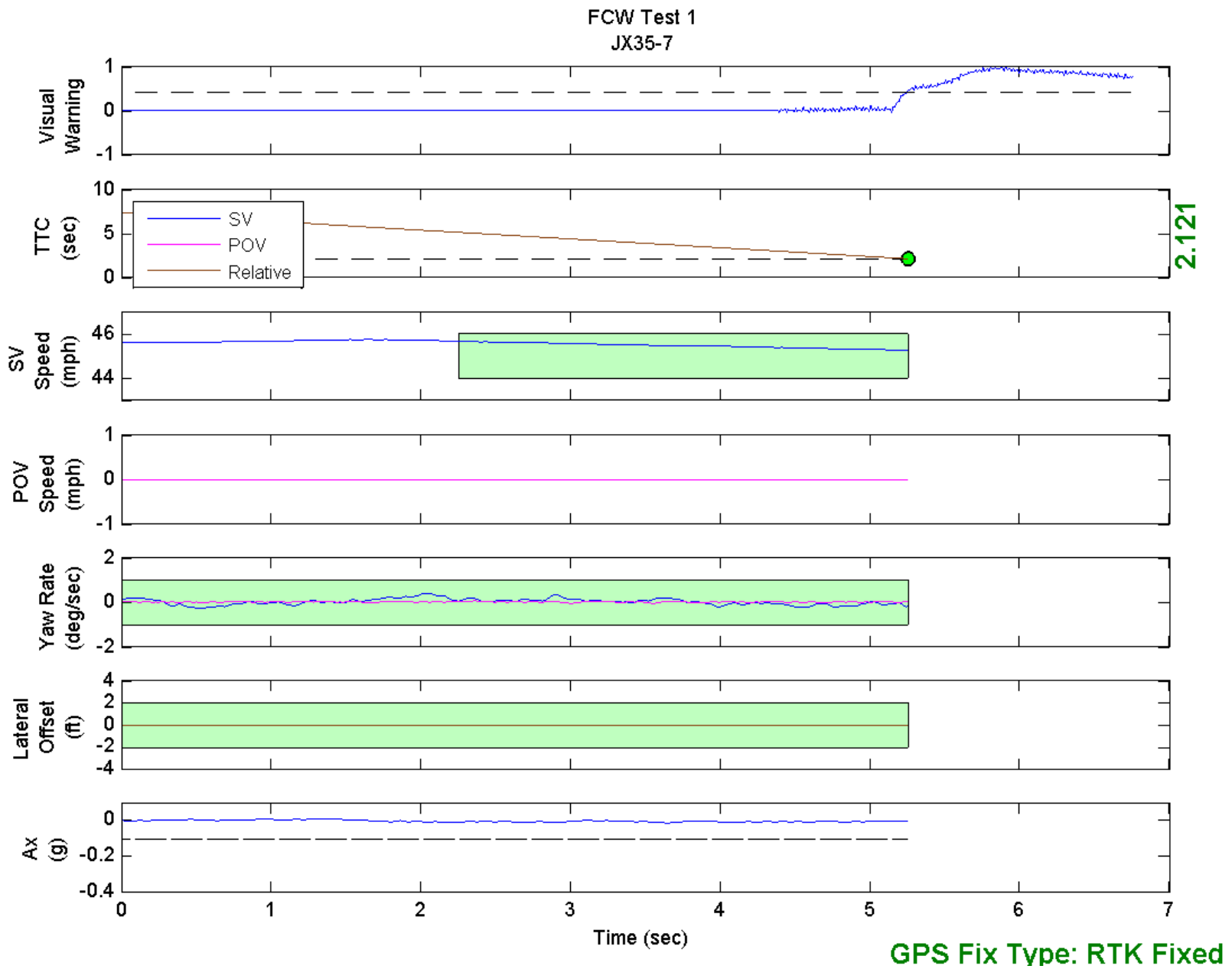


Figure D18. Time History for Run 07, FCW Test 1, Visual Warning

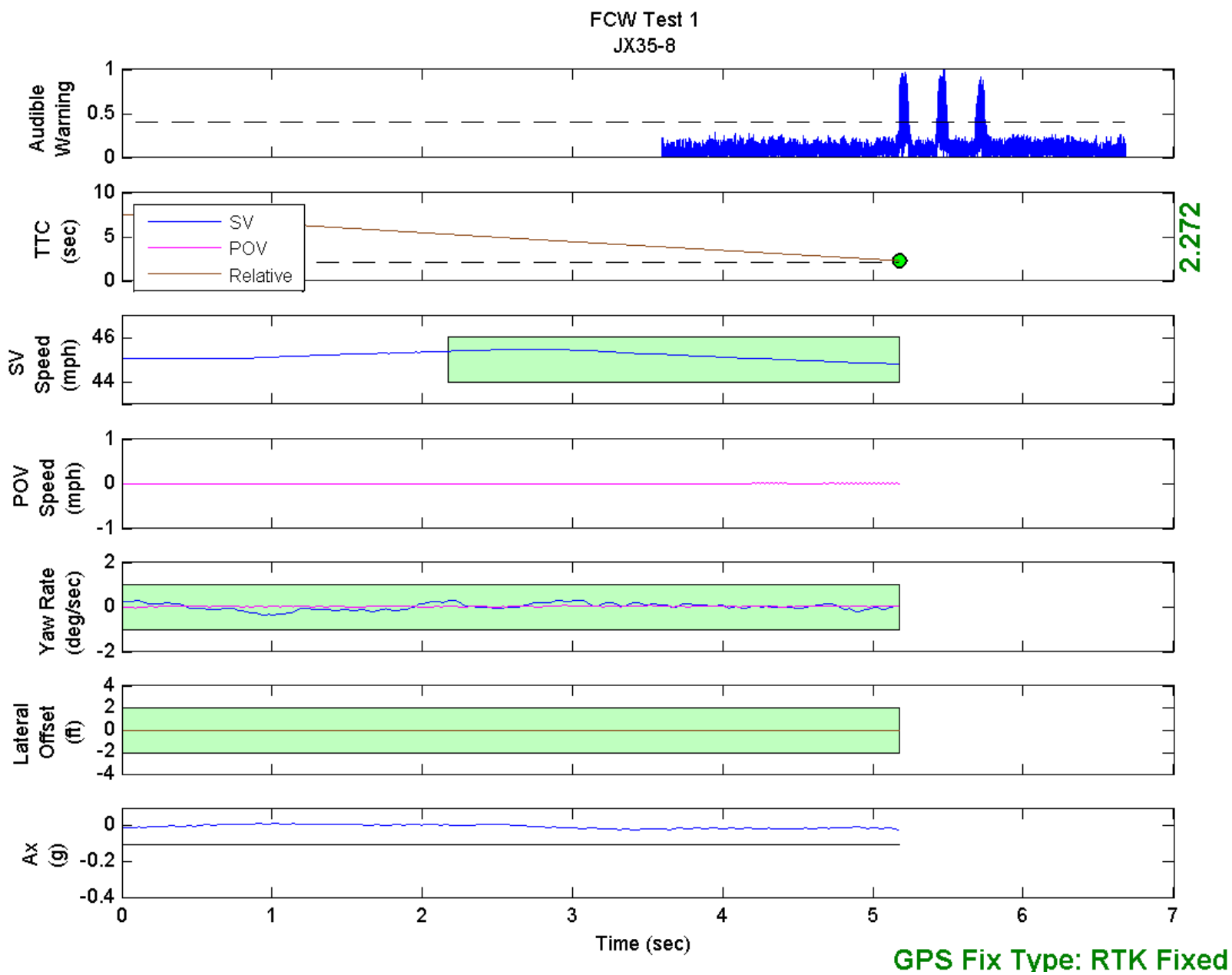


Figure D19. Time History for Run 08, FCW Test 1, Audible Warning

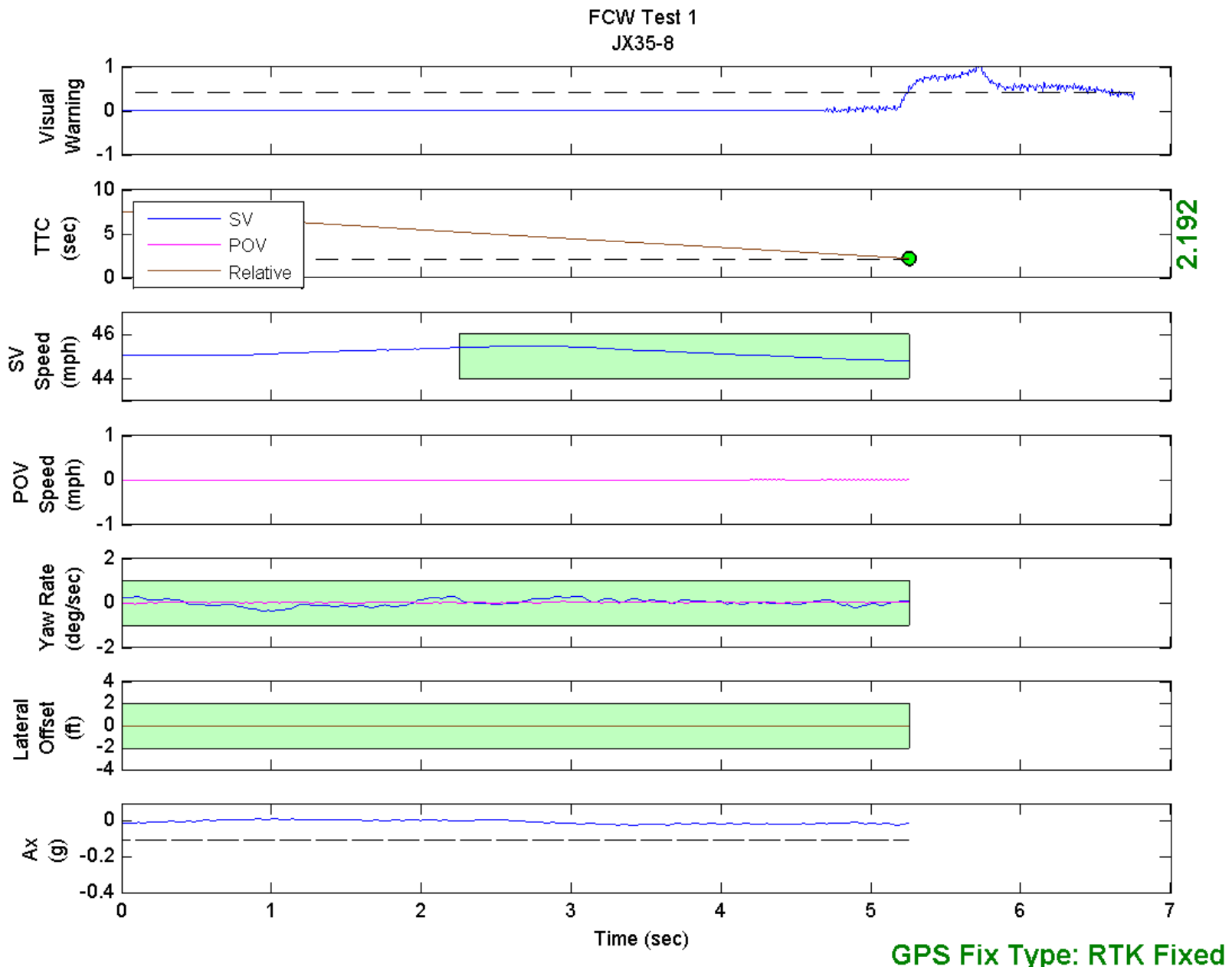


Figure D20. Time History for Run 08, FCW Test 1, Visual Warning

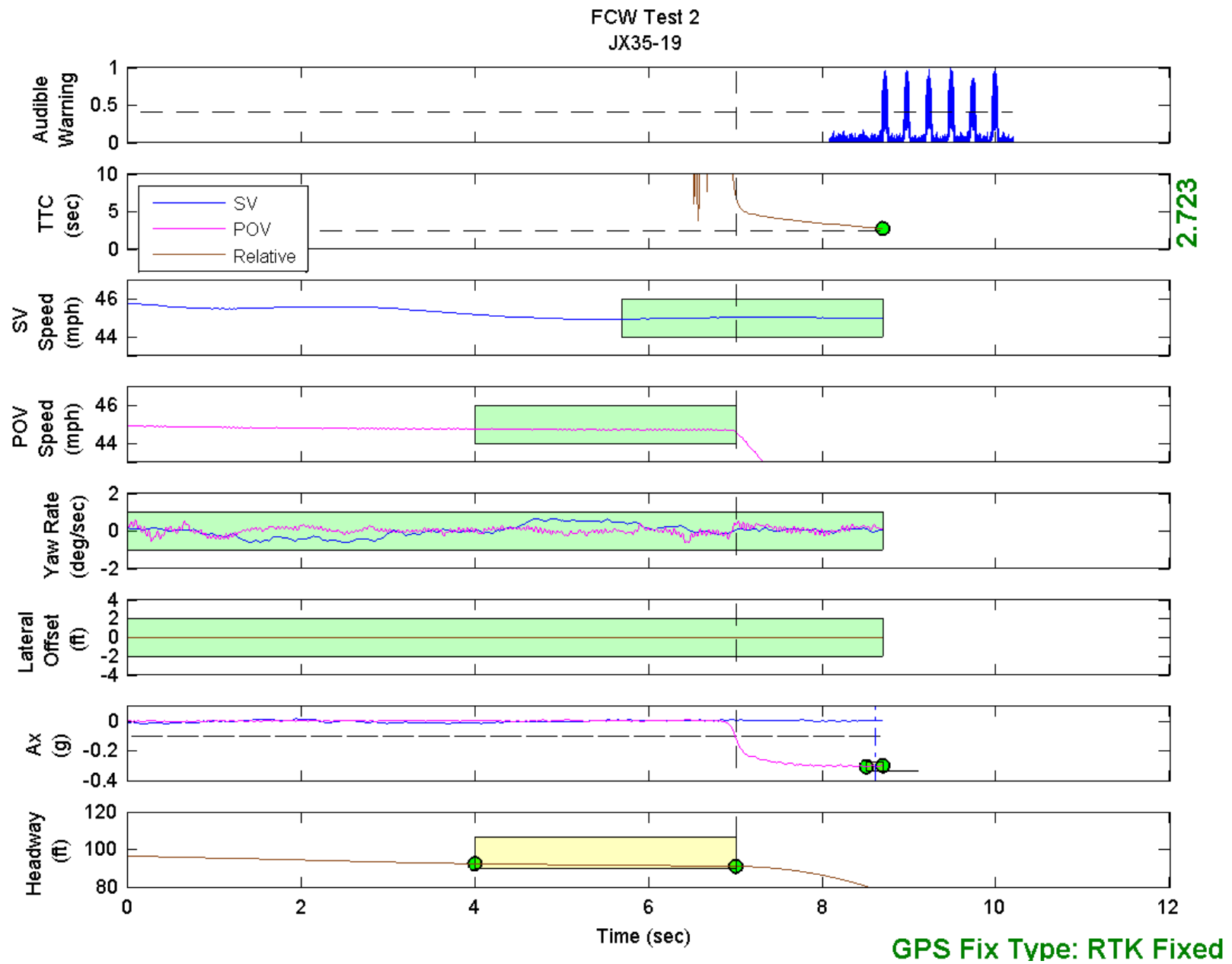


Figure D21. Time History for Run 19, FCW Test 2, Audible Warning

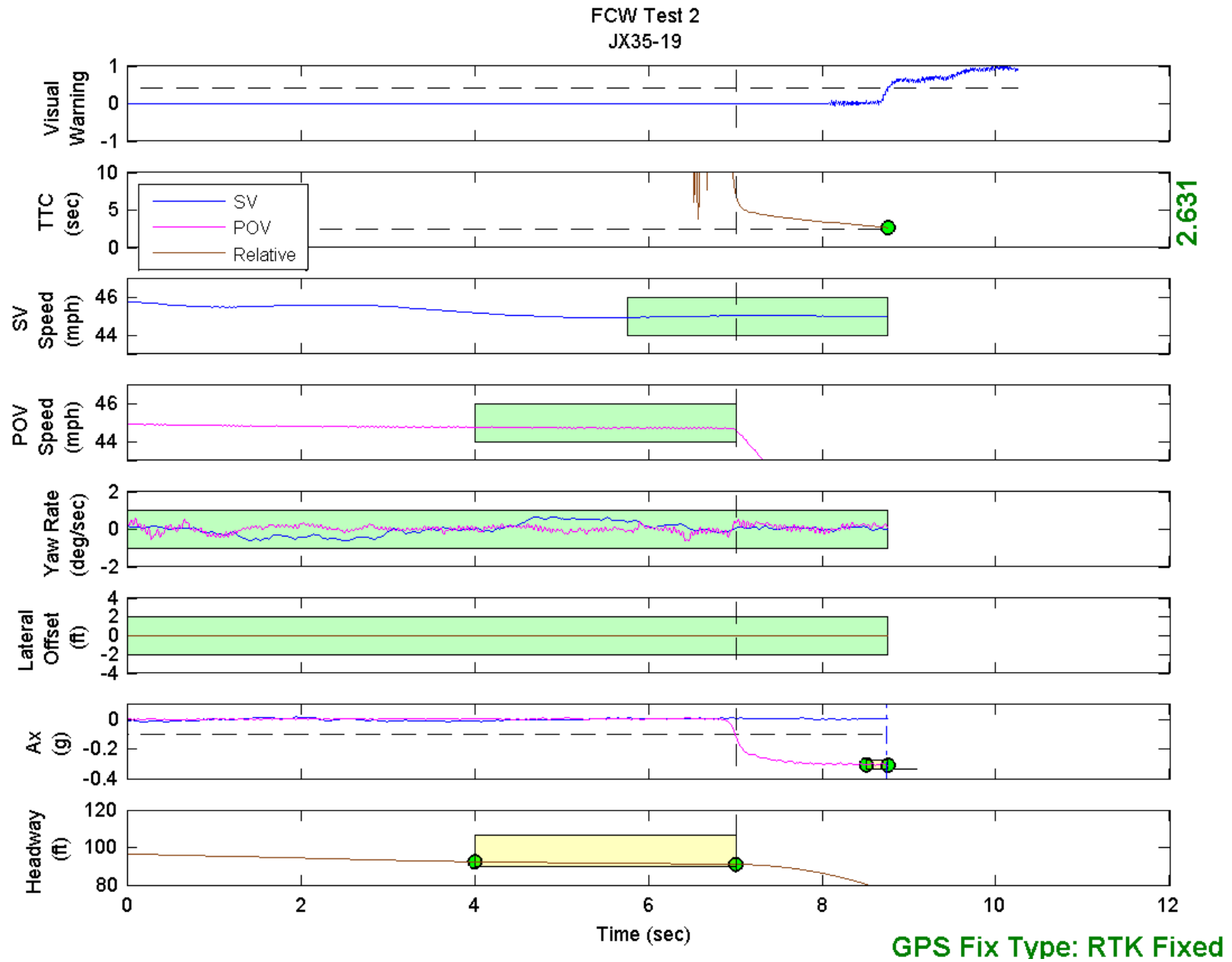


Figure D22. Time History for Run 19, FCW Test 2, Visual Warning

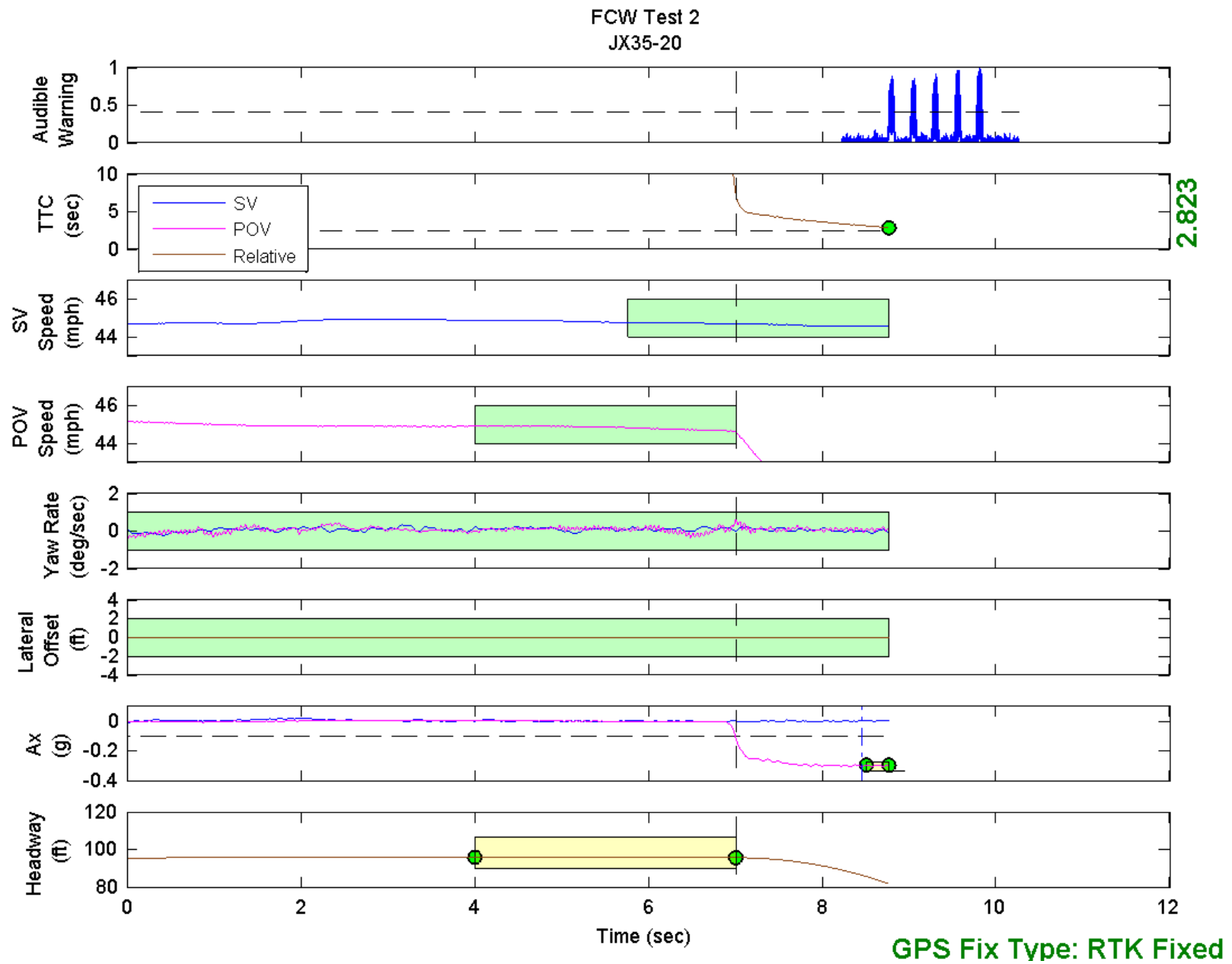


Figure D23. Time History for Run 20, FCW Test 2, Audible Warning

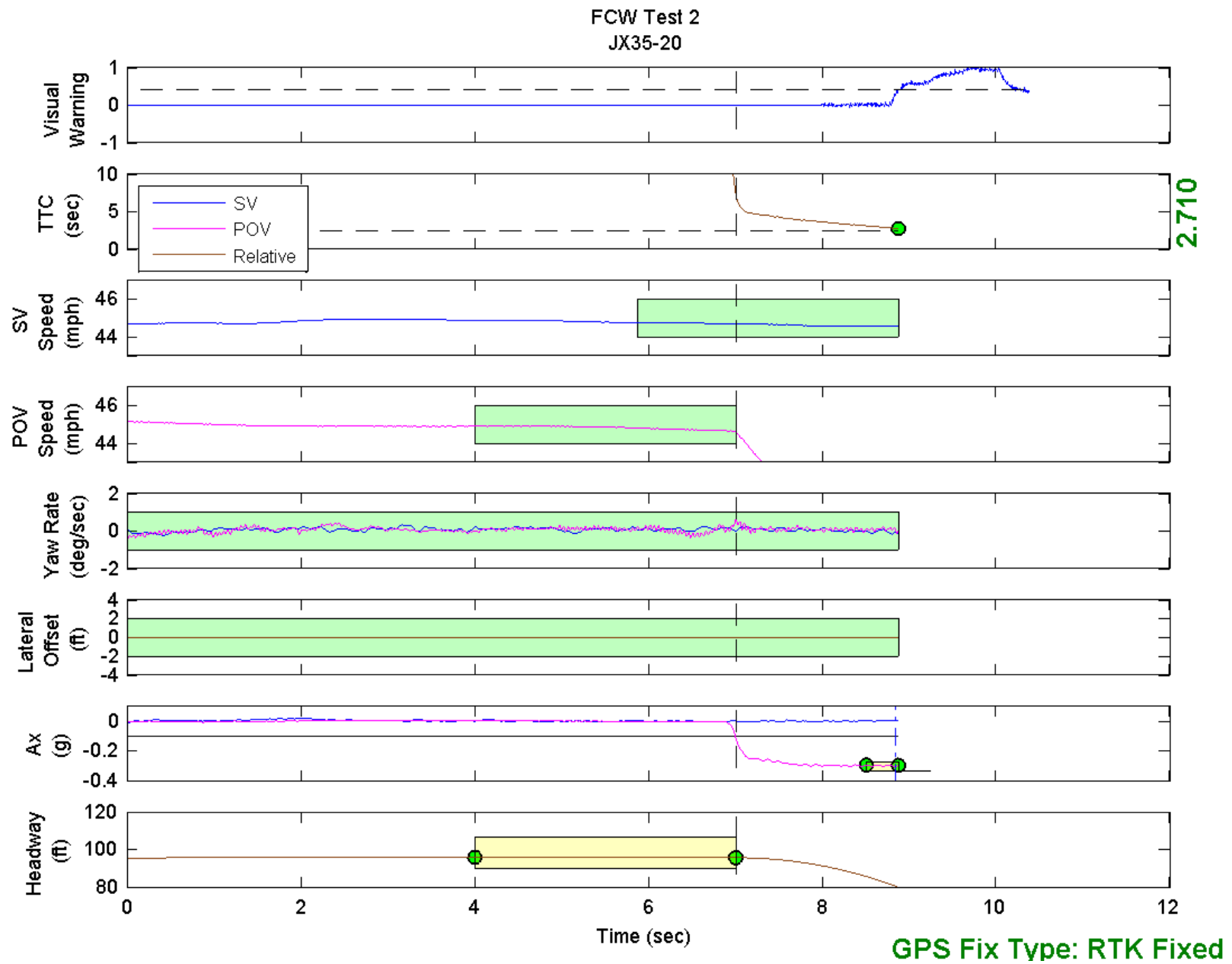


Figure D24. Time History for Run 20, FCW Test 2, Visual Warning

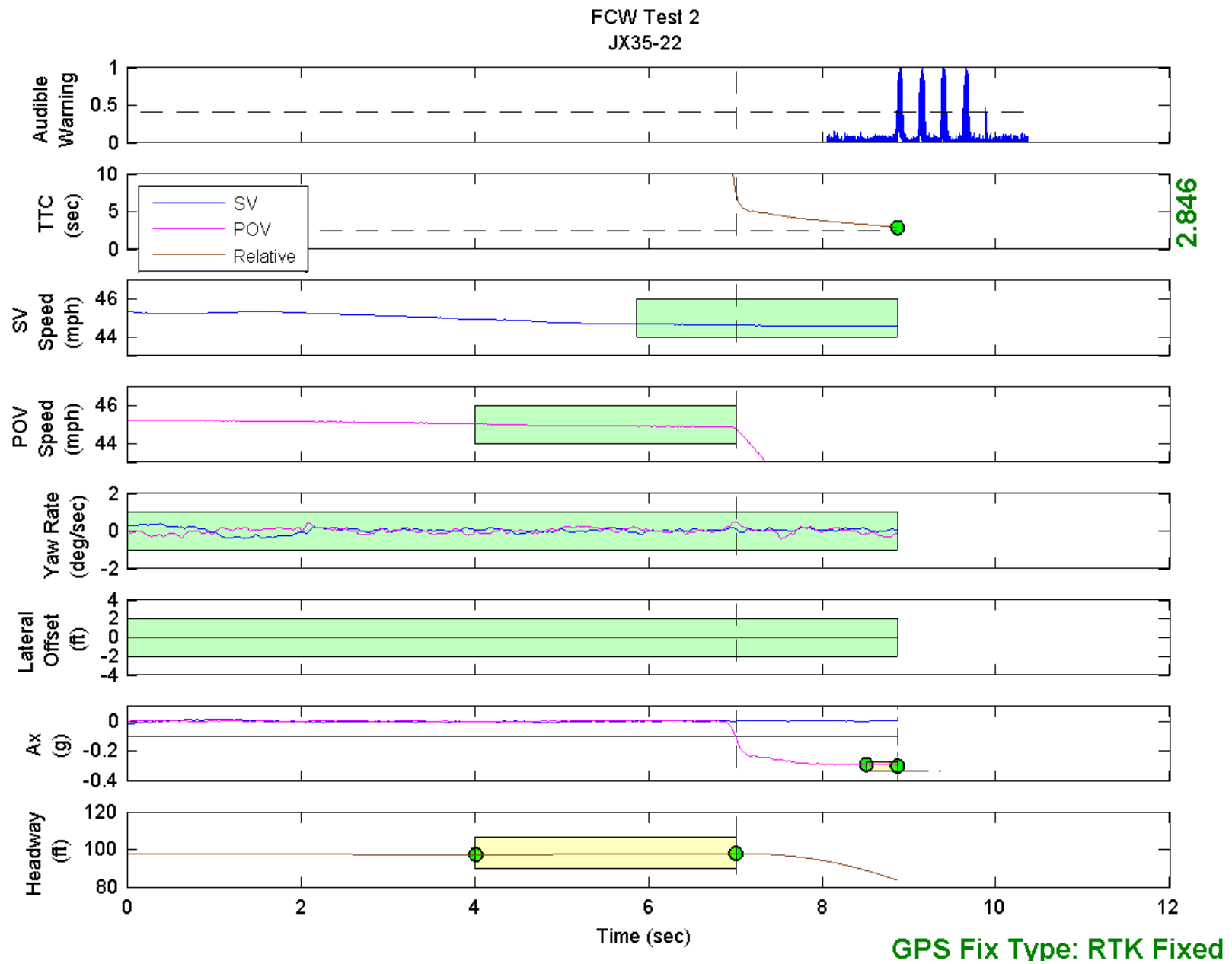


Figure D25. Time History for Run 22, FCW Test 2, Audible Warning

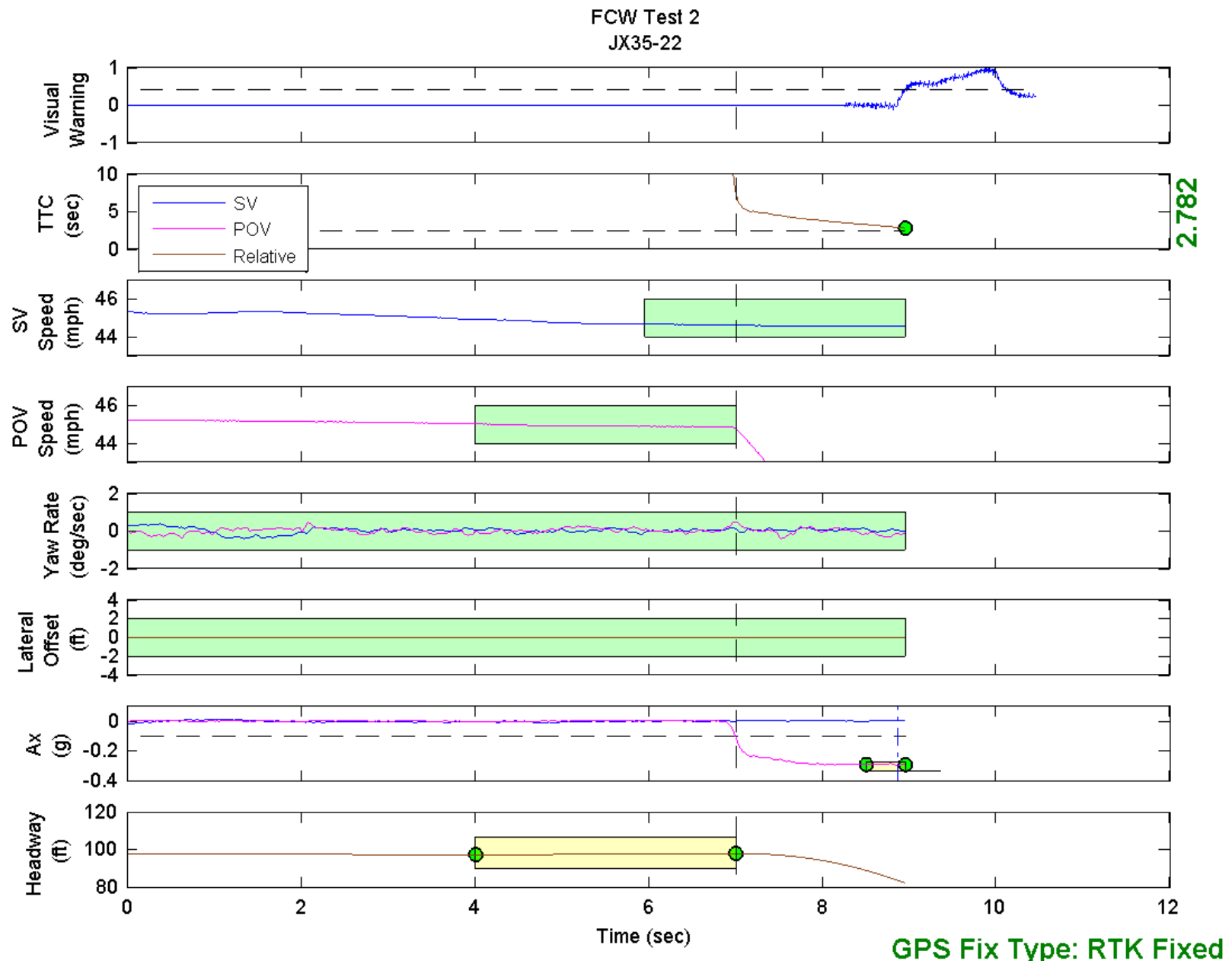
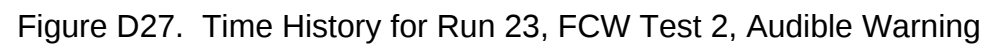
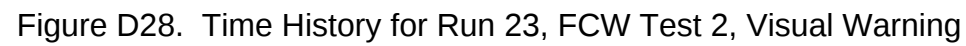


Figure D26. Time History for Run 22, FCW Test 2, Visual Warning





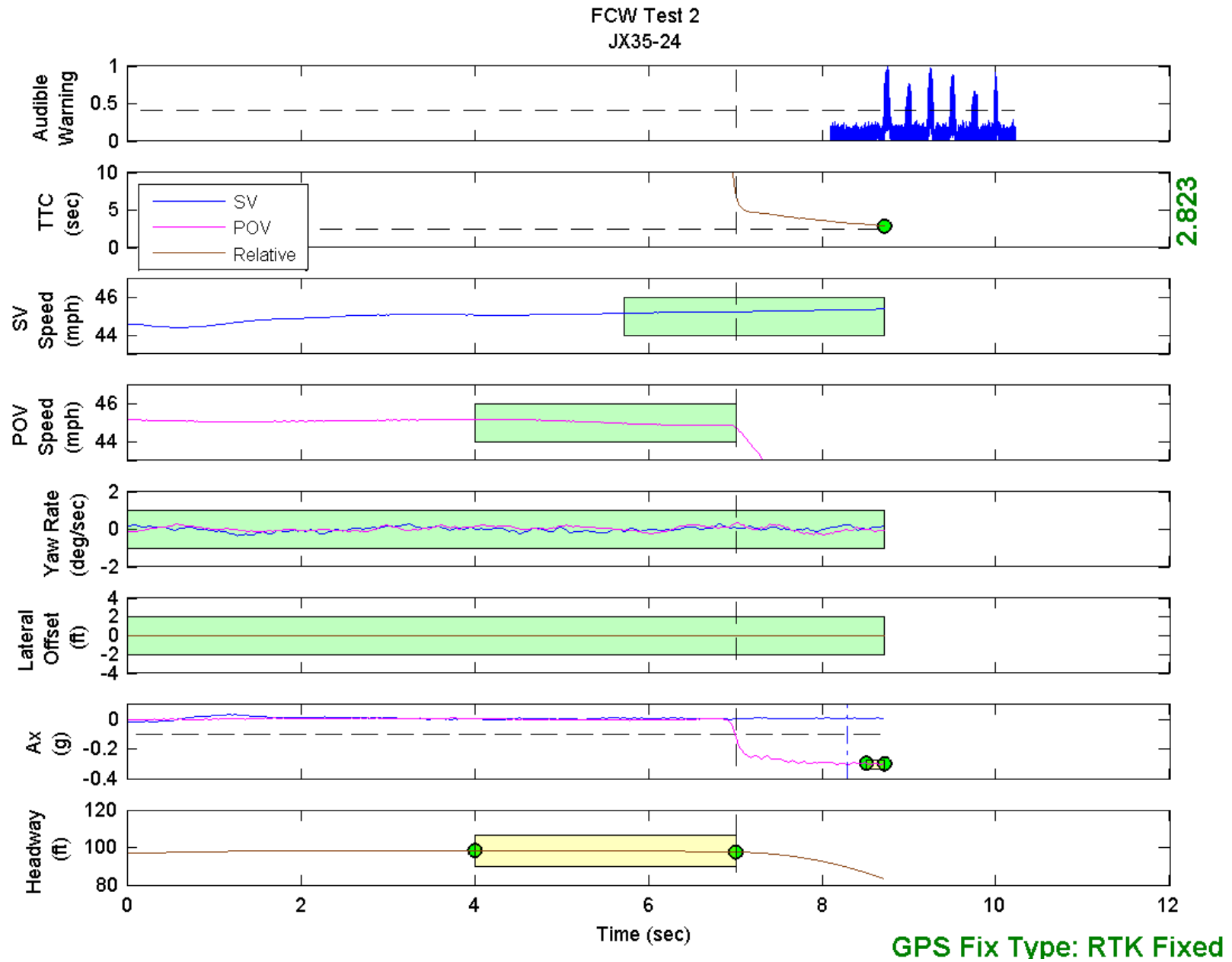


Figure D29. Time History for Run 24, FCW Test 2, Audible Warning

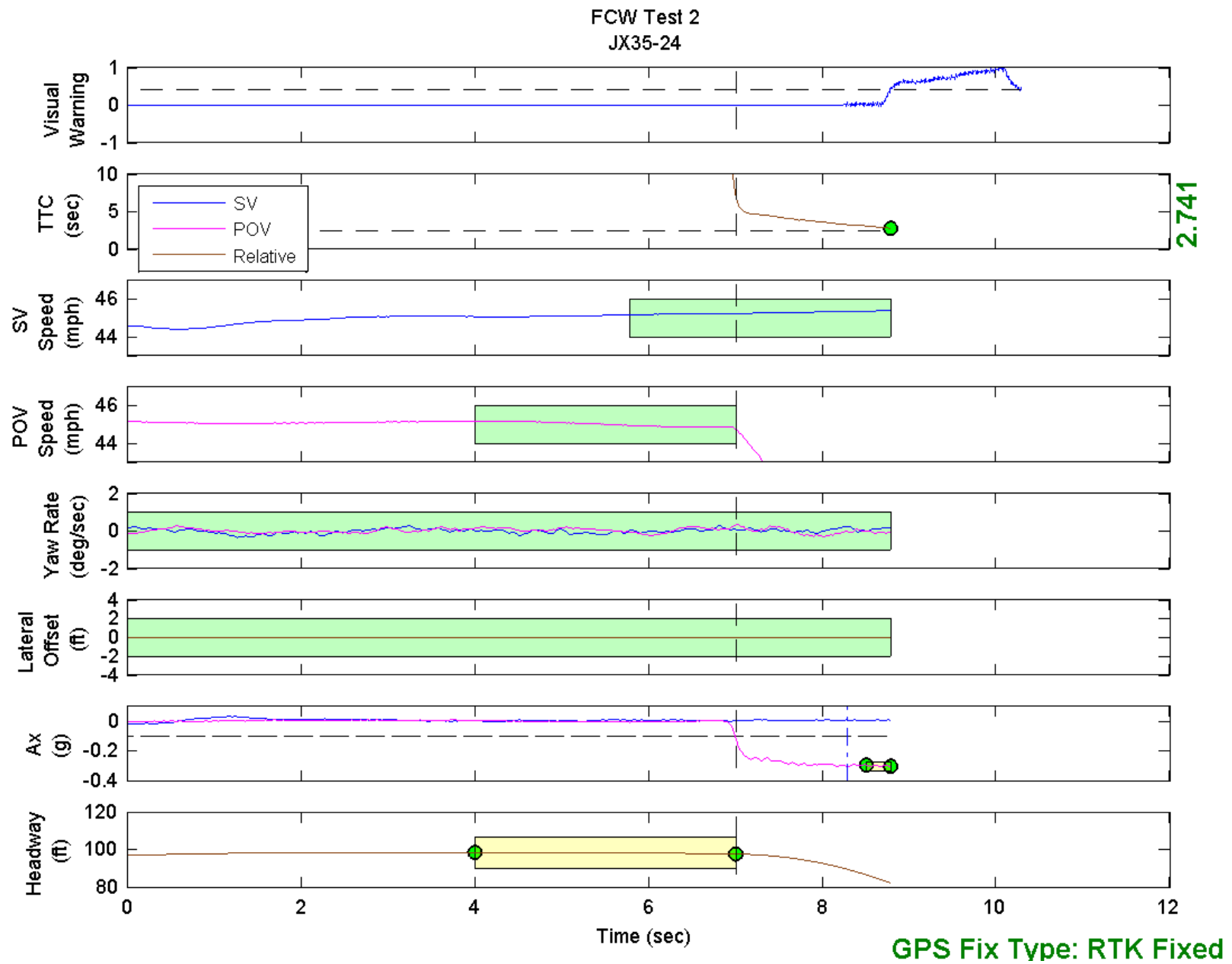


Figure D30. Time History for Run 24, FCW Test 2, Visual Warning

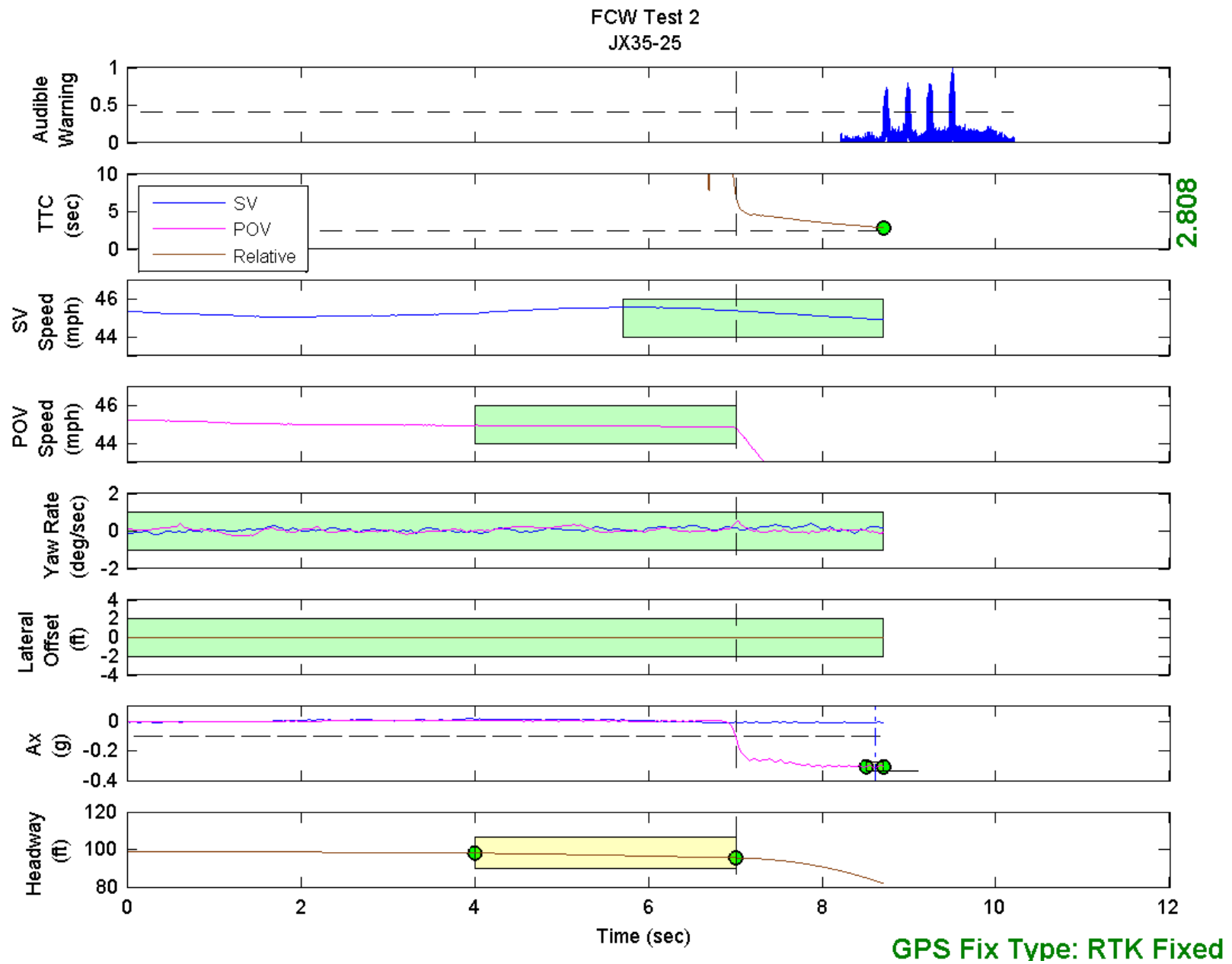


Figure D31. Time History for Run 25, FCW Test 2, Audible Warning

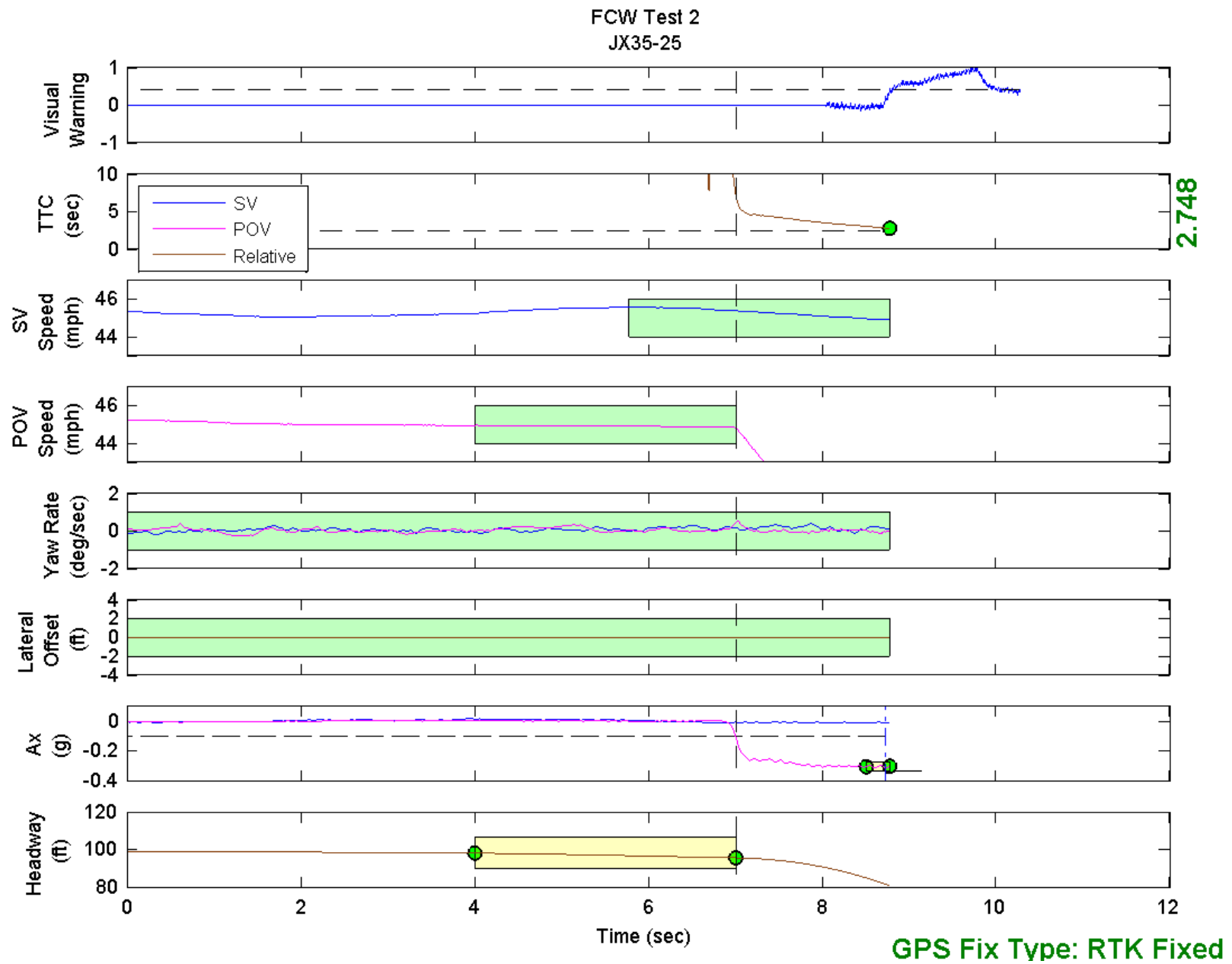
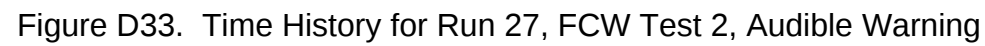


Figure D32. Time History for Run 25, FCW Test 2, Visual Warning



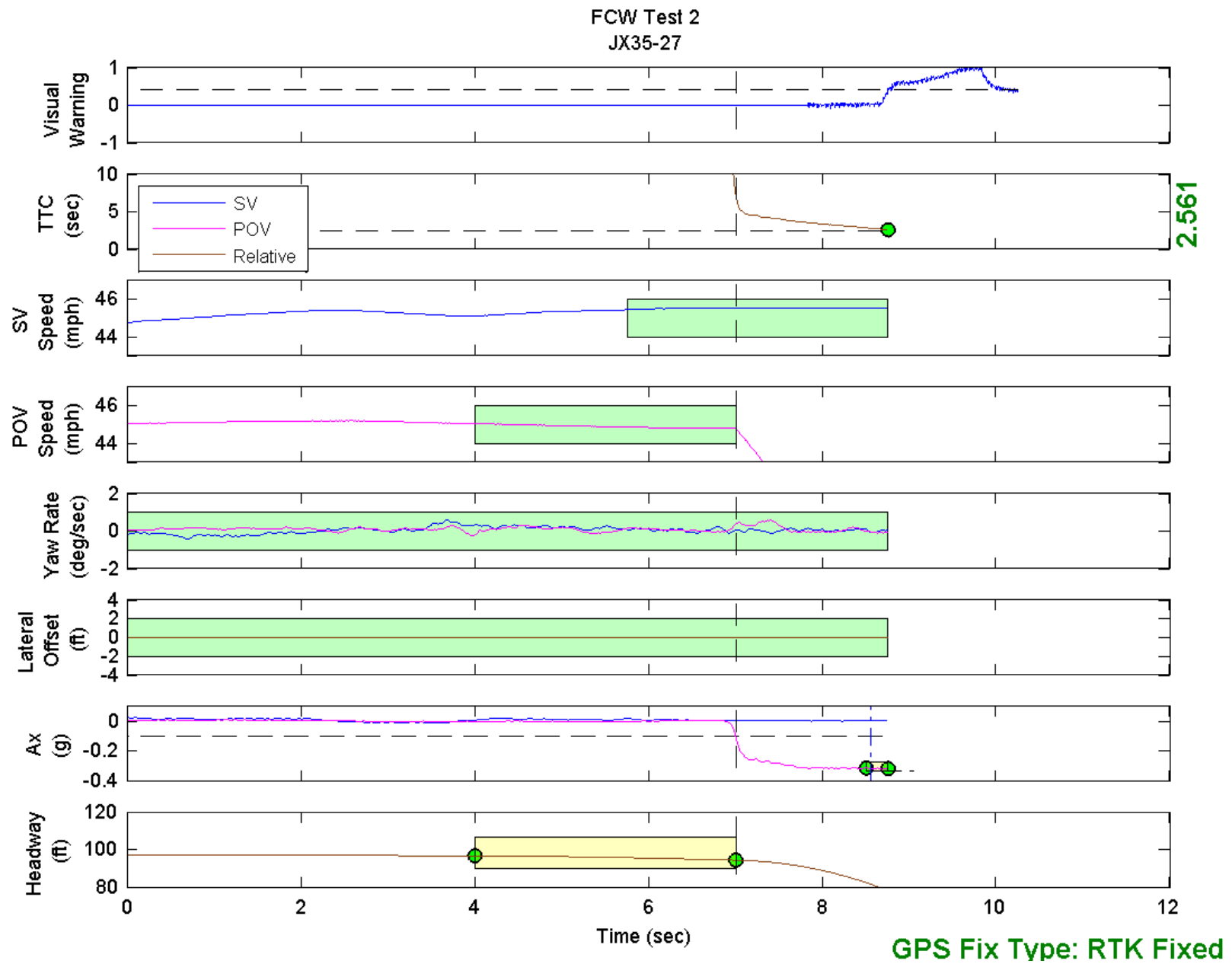


Figure D34. Time History for Run 27, FCW Test 2, Visual Warning

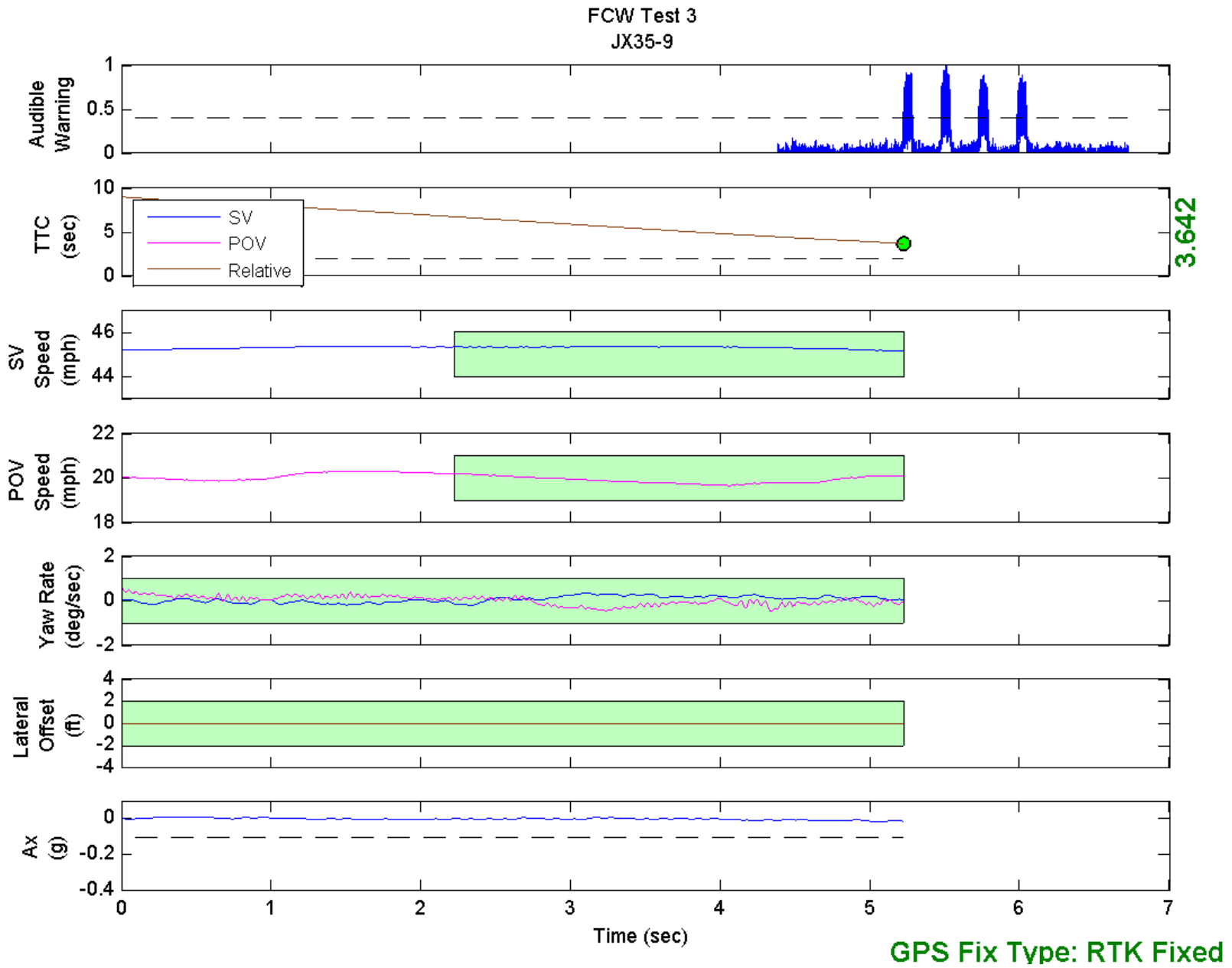


Figure D35. Time History for Run 09, FCW Test 3, Audible Warning

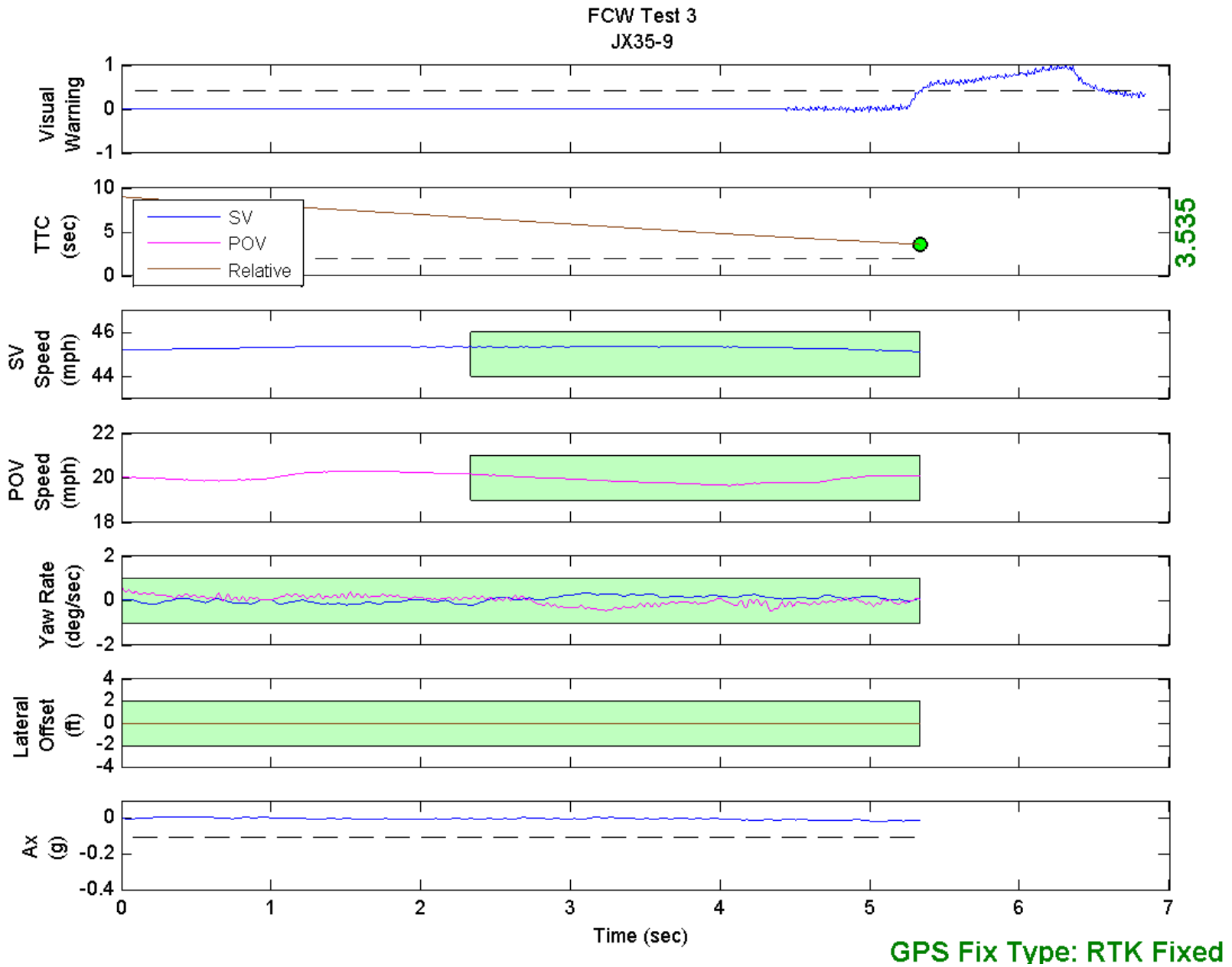


Figure D36. Time History for Run 09, FCW Test 3, Visual Warning

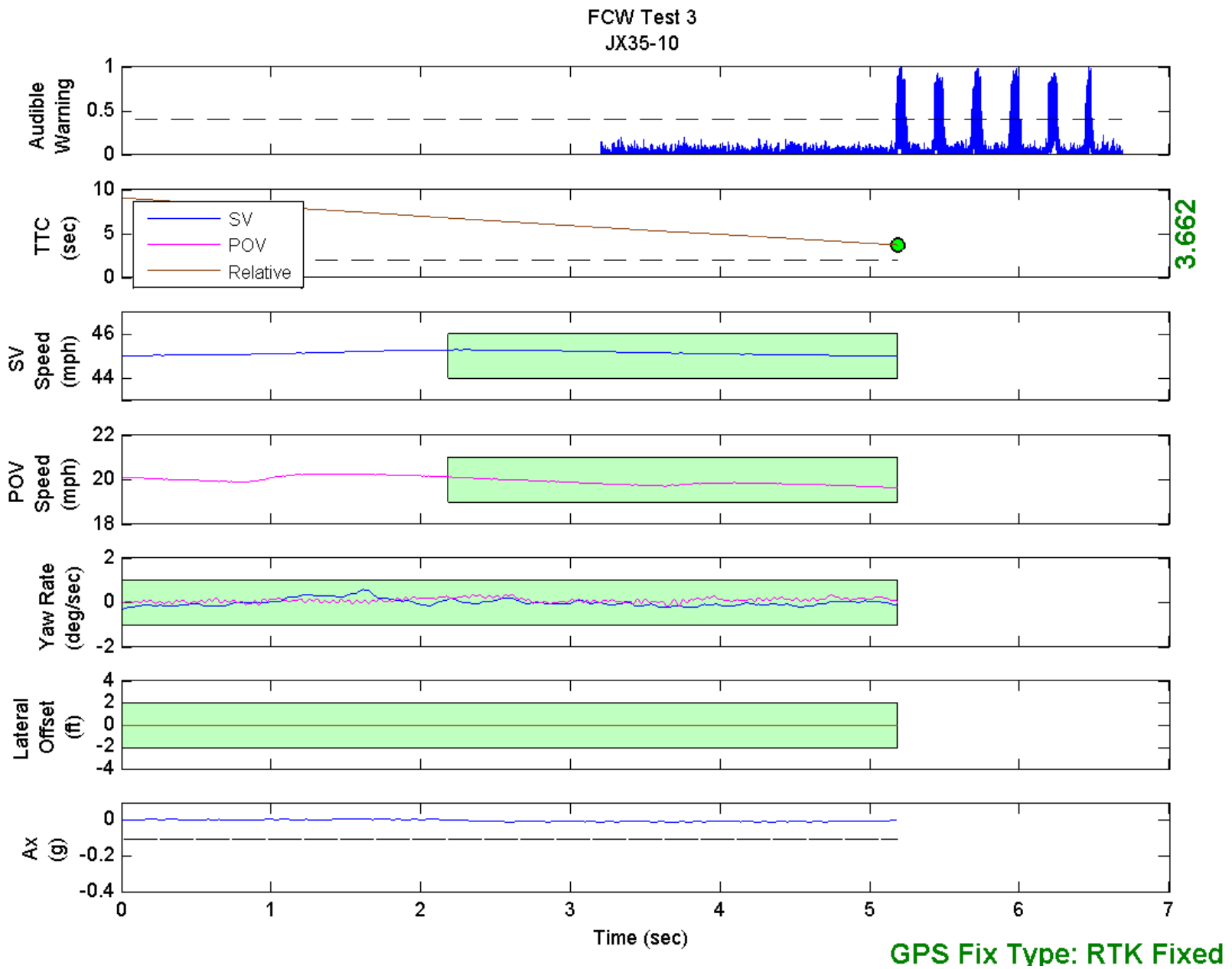


Figure D37. Time History for Run 10, FCW Test 3, Audible Warning

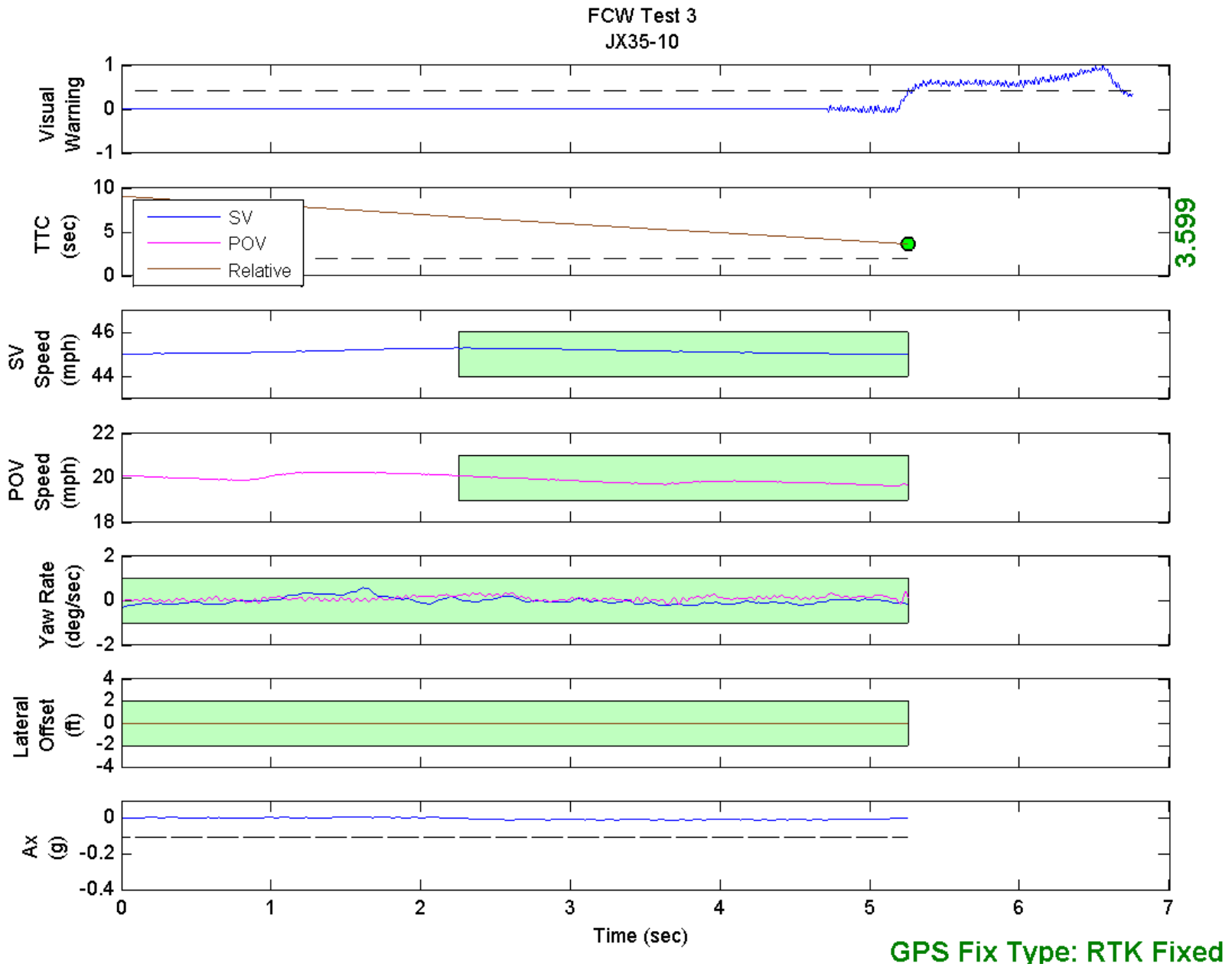


Figure D38. Time History for Run 10, FCW Test 3, Visual Warning

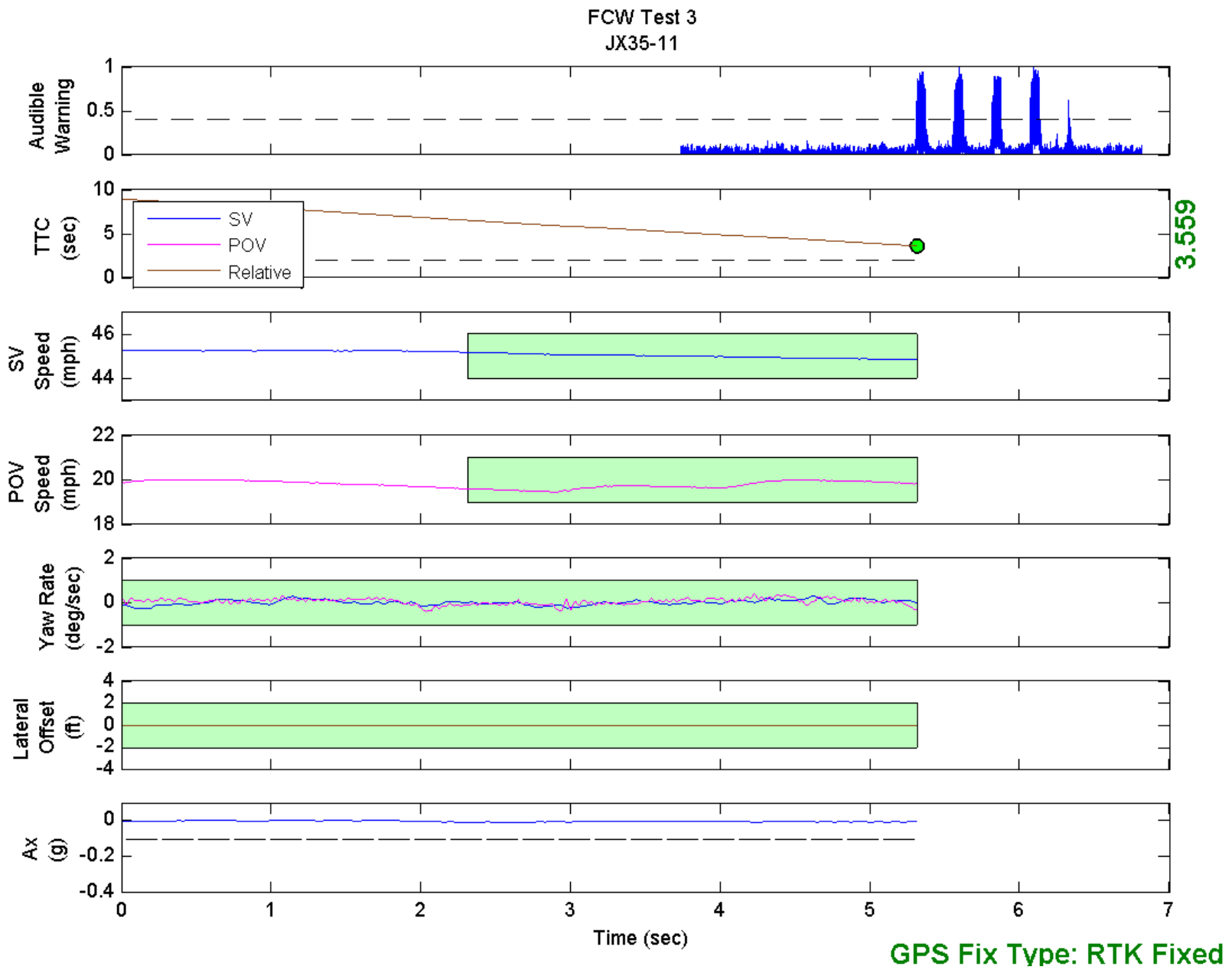


Figure D39. Time History for Run 11, FCW Test 3, Audible Warning

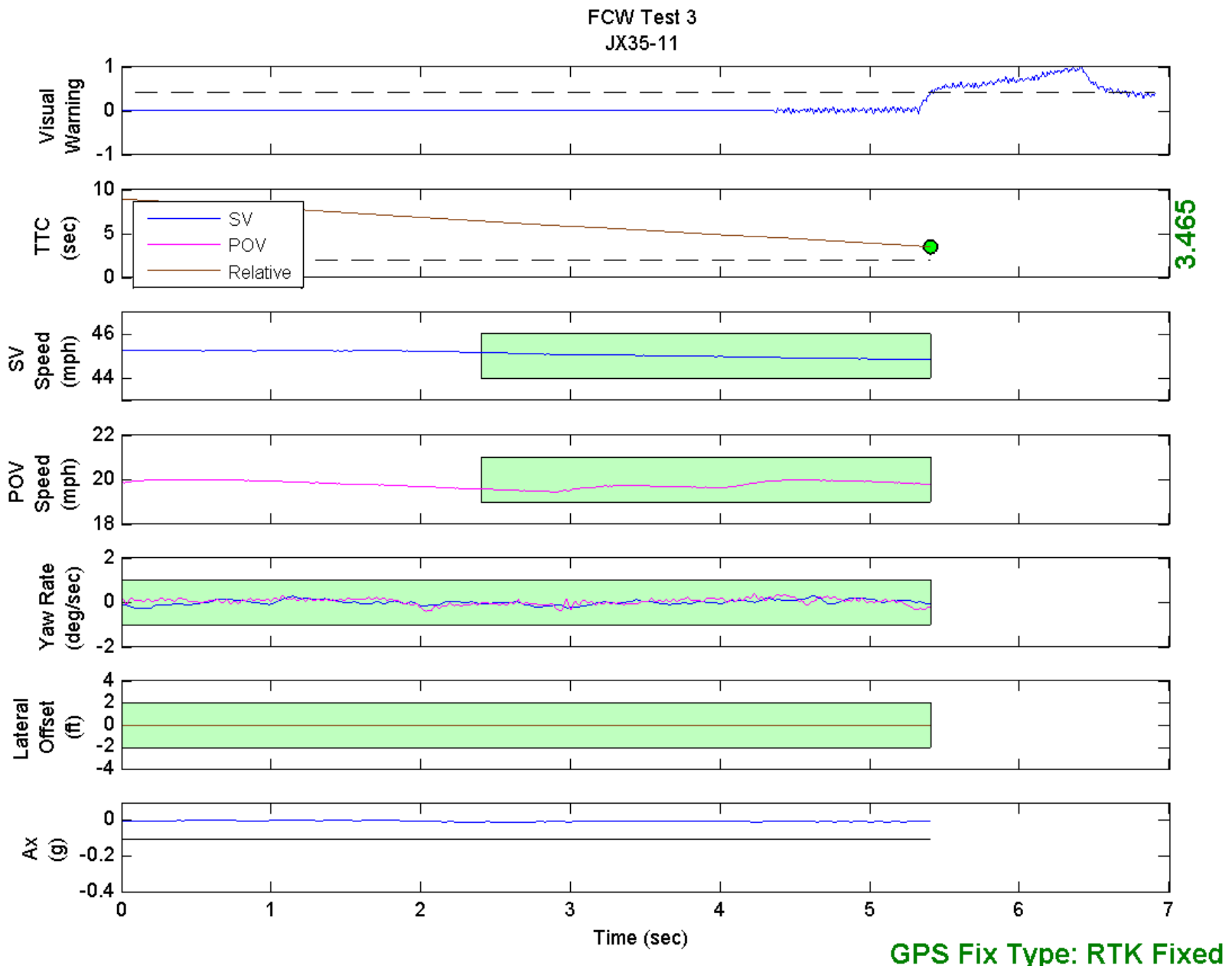


Figure D40. Time History for Run 11, FCW Test 3, Visual Warning

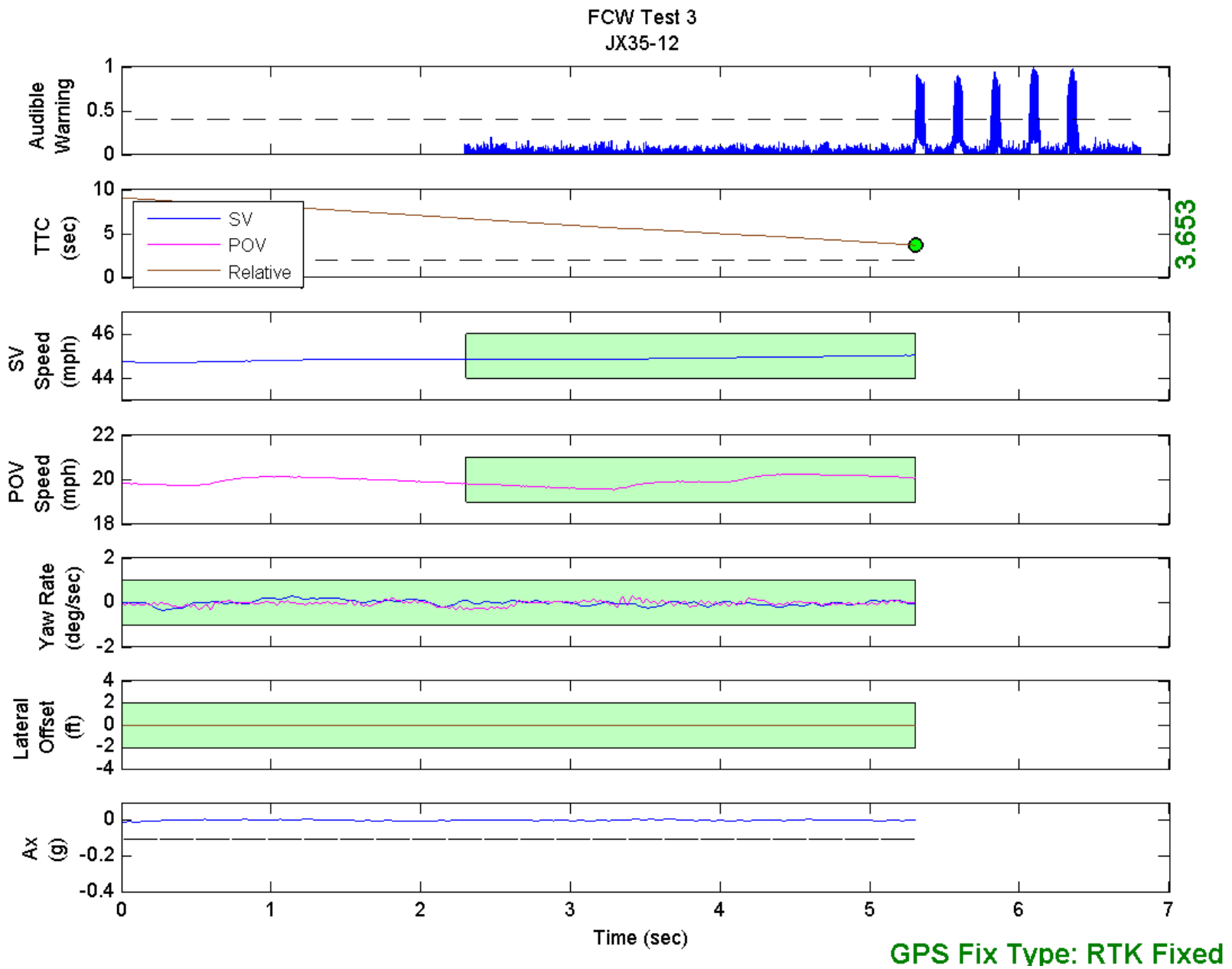


Figure D41. Time History for Run 12, FCW Test 3, Audible Warning

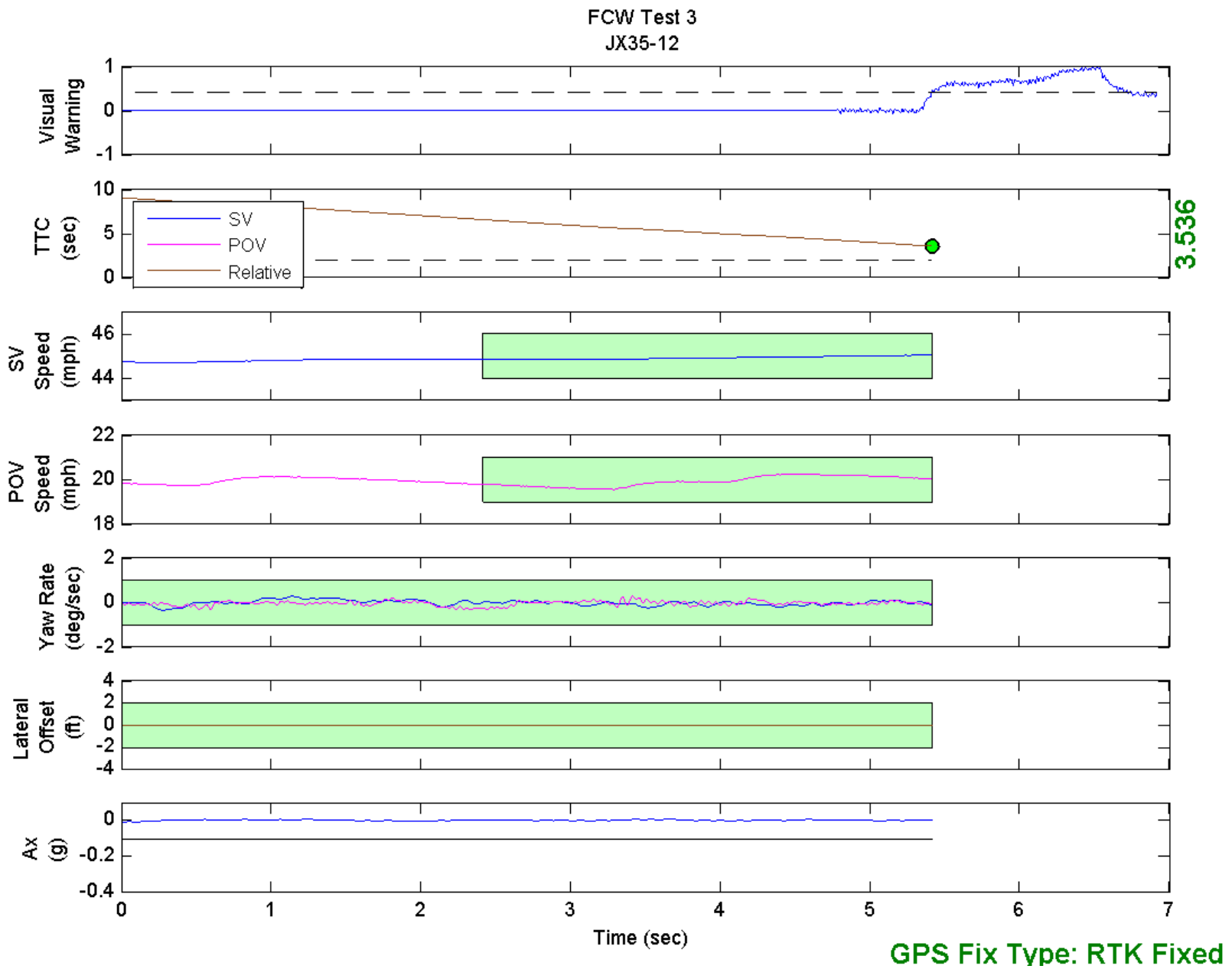


Figure D42. Time History for Run 12, FCW Test 3, Visual Warning

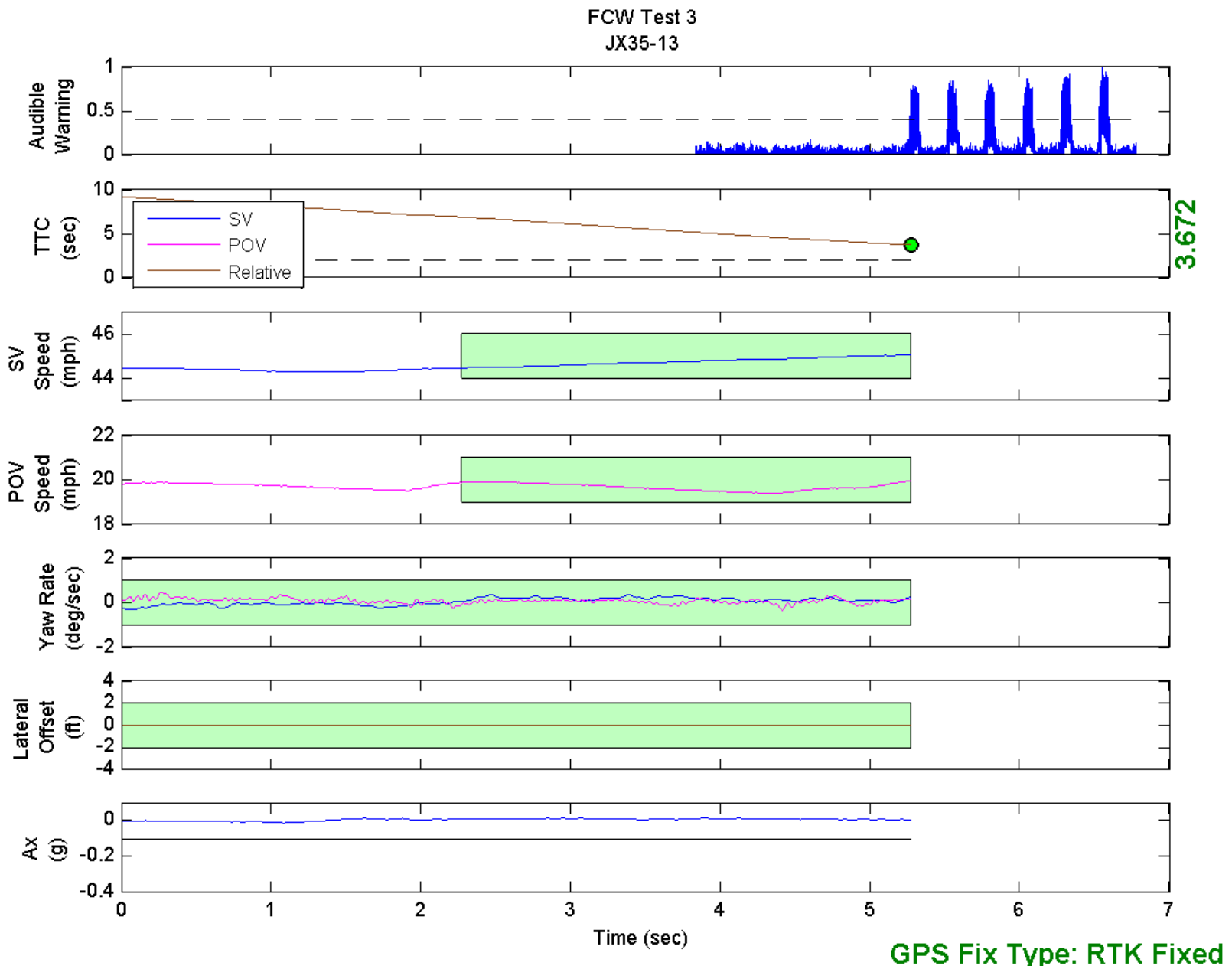


Figure D43. Time History for Run 13, FCW Test 3, Audible Warning

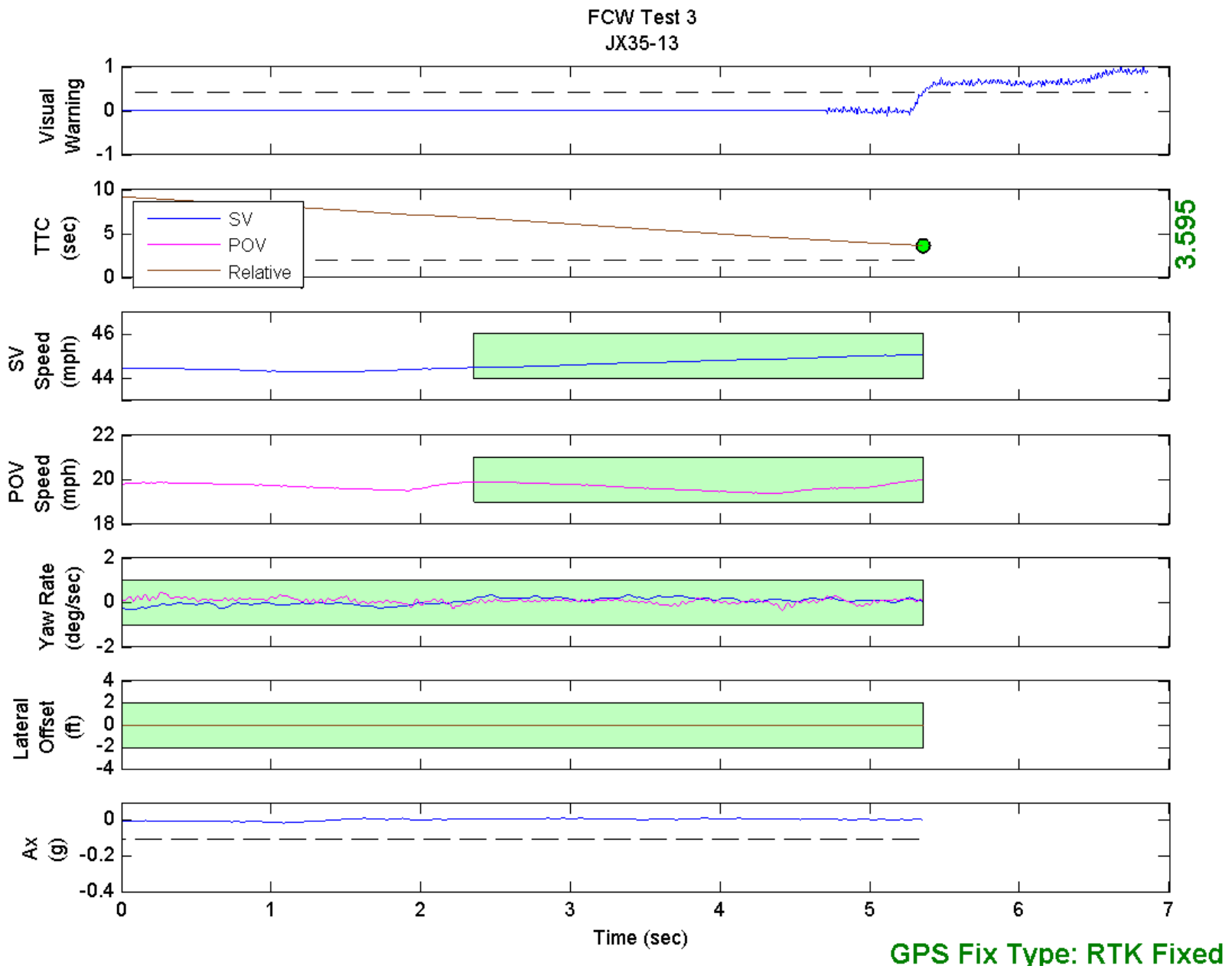


Figure D44. Time History for Run 13, FCW Test 3, Visual Warning

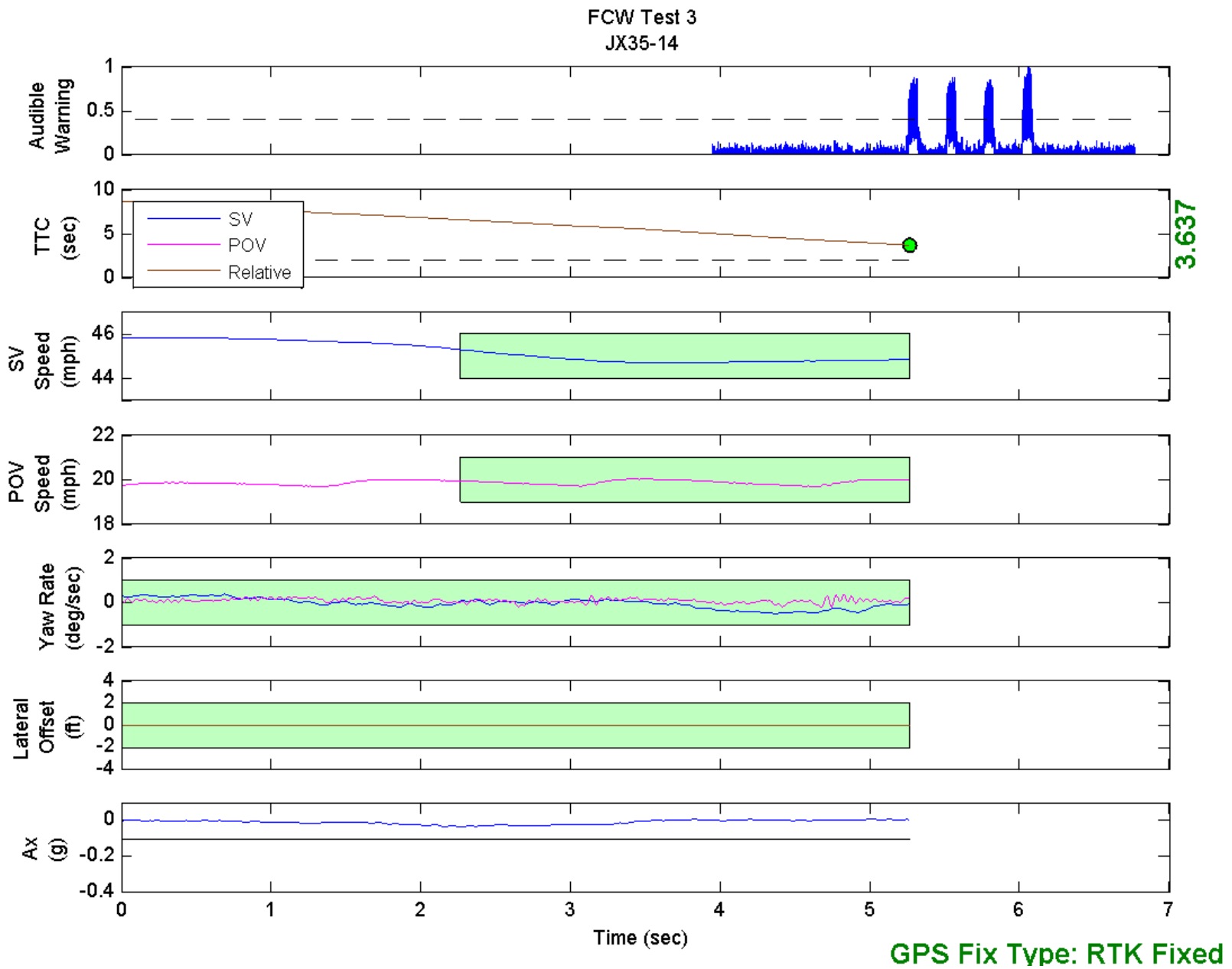


Figure D45. Time History for Run 14, FCW Test 3, Audible Warning

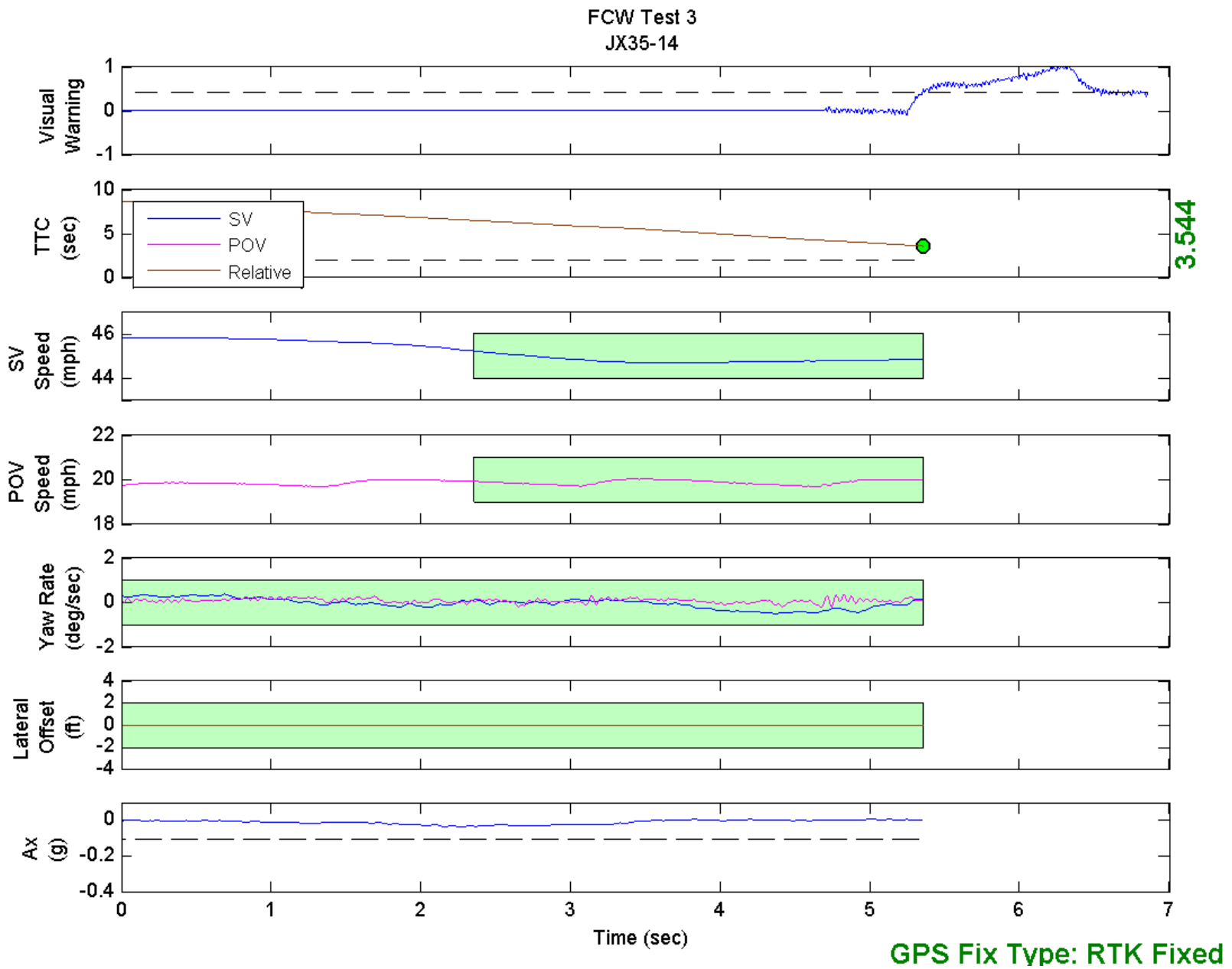


Figure D46. Time History for Run 14, FCW Test 3, Visual Warning

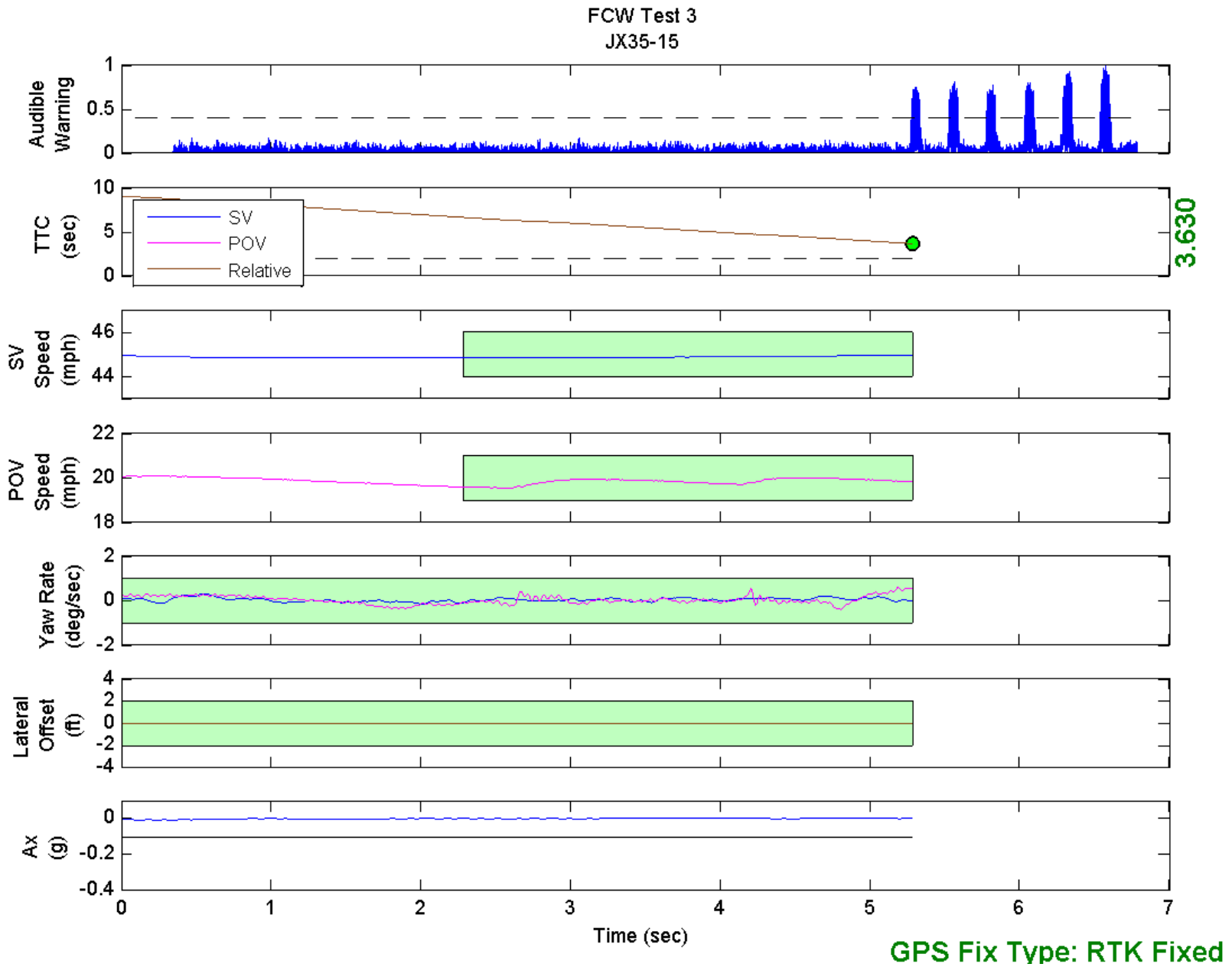


Figure D47. Time History for Run 15, FCW Test 3, Audible Warning

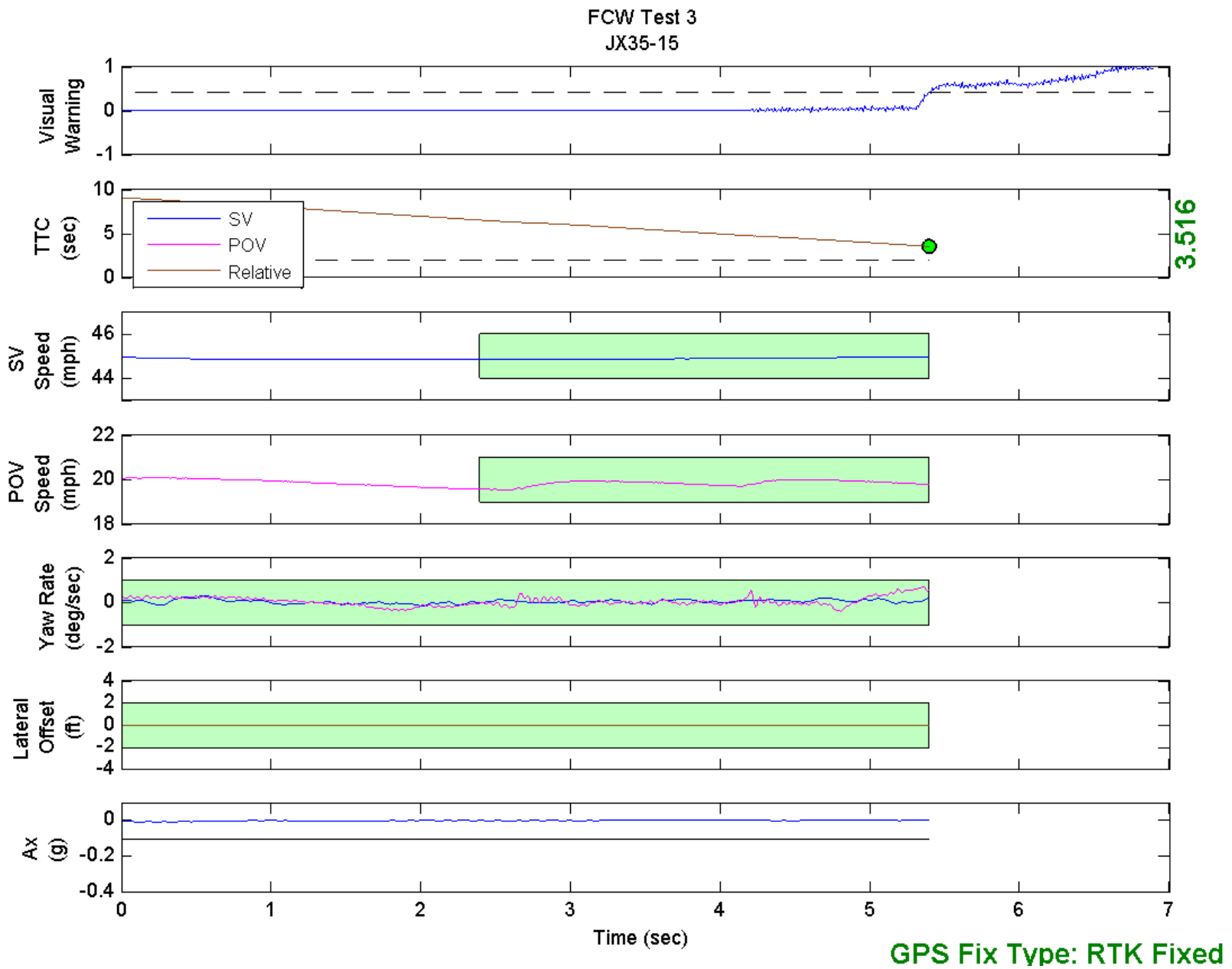


Figure D48. Time History for Run 15, FCW Test 3, Visual Warning