# Test Report

| | |
|---|---|
| **Customer** | Strutt |
| **Vehicle / Part ID** | ev[1] / ev[1]c |
| **Test** | ISO7176-19:2022 Frontal Wheelchair Test |
| **UTAC Report Number** | 26/1387 |
| **UTAC Project Number** | PRJPG109004-1.01 |
| **Author** | Matthew Hodges<br>Test Engineer – Passive Safety |
| **Approved For Issue** | Philip Woskett<br>Senior Engineer – Passive Safety |
| **Date** | 06/11/2026 |

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

# Executive Summary

This report relates to a simulated frontal impact to the requirements laid out in BS ISO 7176-19:2022 to dynamically test a wheelchair loaded with an appropriately sized crash-test dummy using a 48km/h crash pulse.

- The wheelchair was subjected to a longitudinal acceleration pulse that exceeded 20g for at least 15ms, 15g for a continuous time period of 40ms and has a total duration of at least 75ms, with a total Δv of 48km/h (+2 -0).

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

## Distribution

| Organisation | Format | Recipient |
|---|---|---|
| Evolution One<br>Depleach Hall<br>Wimslow Road<br>Cheadle,<br>SK8 1DR | Electronic (PDF) | Shaun Wang |

## Revision History

| Rev. | Description | Date | Author | Approver | Page(s) |
|---|---|---|---|---|---|
| 0 | Initial release | 06/11/2026 | Matthew Hodges | Philip Woskett | All |

## Contents


Executive Summary ..... 2
Distribution ..... 3
Revision History ..... 3
Contents ..... 3
List of Figures ..... 4
List of Tables ..... 4
Abbreviations and Acronyms ..... 4
References ..... 4
Objectives ..... 5
Conclusions ..... 5
Test Parts / Vehicle Details ..... 6
Test Procedure ..... 7
Instrumentation ..... 7
Photographic ..... 8
Software Used in Testing ..... 8
Test Results – S19230 ..... 9
Test Setup Photos ..... 10
Acceleration Pulse Results ..... 13



**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

## List of Figures

Figure 1 - Pre-test Frontal View ..... 10
Figure 2 - Pre-test Side View ..... 10
Figure 3 - Pre-test Rear View ..... 11
Figure 4 - Post-test Front View ..... 11
Figure 5 - Post-test Side View ..... 12
Figure 6 - Post-test Rear View ..... 12
Figure 7 - Sled Acceleration Plot ..... 13
Figure 8 - Sled AVS Plots ..... 14

## List of Tables

Table 1 – Test Parts / Vehicle Details ..... 6
Table 2 – Wheelchair and WTORS Details ..... 7
Table 3 – ATD Occupancy ..... 7
Table 4 – Test Instrumentation ..... 7
Table 5 – Photographic Equipment ..... 8
Table 6 – Software Used in Testing ..... 8
Table 7 – Test Results Summary ..... 9

## Abbreviations and Acronyms

| | |
|---|---|
| ATD | Anthropomorphic Test Device |
| %ile | Percentile |
| Δv | Change in velocity |
| ms | millisecond |

## References

1. BS ISO 7176-19:2022 - Wheelchairs Part 19: Wheelchairs for use as seats in motor vehicles

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

## Objectives

1. To perform a sled test on the Strutt “ev¹” / “ev¹c” wheelchair that meet the requirements of BS ISO 7176-19:2022.
2. To perform a sled test on the Strutt “ev¹” / “ev¹c” wheelchair to check the dynamic response and structural soundness during and after a simulated frontal impact to ISO 7176-19:2022.
3. To meet the acceleration pulse requirements as outlined in ISO 7176-19:2022.

## Conclusions

1. The dynamic test requirements set out in ISO 7176-19:2022 were met.
2. The Strutt “ev¹” / “ev¹c” met the test conditions outlined in ISO 7176-19:2022.
3. The acceleration pulse requirements were met, however the upper limit for velocity was slightly exceeded – requirement: 48(+2/-0)kmh, actual: 50.12kmh.

High-speed films, pre and post-test stills and test results can be found in the electronic data pack.

All test results only relate to the items tested and are not necessarily indicative of type or batch. Unless otherwise stated, UTAC UK Ltd. shall make no pass or fail conclusions regarding this test. Any determinations shall be made solely by the customer.

## Test Facility and Dates

The test was performed on 16/10/2026 in the Sled facility at UTAC UK.

Address: UTAC UK
Station Lane
Millbrook
Bedford
MK45 2JQ

Contact: Philip Woskett – Senior Engineer
+447775825120
philip.woskett@utac.com

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

# Test Parts / Vehicle Details

The test vehicle was delivered on 24/09/2026.

| Manufacturer | Identification | Condition on Receipt |
|---|---|---|
| Strutt | ev[1] / ev[1]c | No defects noted |

**Table 1 – Test Parts / Vehicle Details**

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

# Test Procedure

The dynamic test was carried out to the customer requirements, using the UTAC Millbrook Proving Ground Sled.

The Sled, manufactured by Seattle Safety is a 1.4MN reverse acting linear shock tester. The sled system utilises a hydraulic servo brake acting directly on the sled carriage to control the acceleration of the sled. By this means the sled carriage, on which the test material is mounted, is accelerated in the manner required by the customer.

The rig and wheelchair loaded with an appropriately sized ATD were mounted on the sled carriage in a forward direction in order to simulate a frontal impact collision as outlined in ISO7176-19:2022.

The analogue transducer signal is digitised by the data acquisition system and acquired at a sampling rate of 10kHz over a period of 1100 milliseconds (100ms pre-test, 1000ms post-test).

The table below shows the wheelchair and restraints used on test:

| Test no. | Wheelchair | | Restraints | |
|---|---|---|---|---|
| | Manufacturer | Model | Tie-downs | Occupant |
| S19230 | Strutt | ev[1] / ev[1]c | Koller Nexxus 200 | |

**Table 2 – Wheelchair and WTORS Details**

The table below shows the ATD occupancy of the wheelchair:

| Test no. | Wheelchair | | Occupant | |
|---|---|---|---|---|
| | Name | Variant | ATD Type | ATD Mass (kg) |
| S19230 | Strutt | ev[1] / ev[1]c | HIII 50[th] %ile | 78.0 |

**Table 3 – ATD Occupancy**

# Instrumentation

| Chan No. | Channel Description | Transducer Make | Transducer Model | Trans. No. | CFC | CAC | Calibration Date | In Cal? |
|---|---|---|---|---|---|---|---|---|
| 1 | Primary Sled Accel X | Endevco | 2262C-200 | ZT71 | 1000 | 200 | 08/05/2026 | Y |

**Table 4 – Test Instrumentation**

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

## Photographic

Three high-speed cameras were positioned to provide overall coverage of the dynamic response of the wheelchairs and occupants. The high-speed cameras (nominal 1000 frames per second) used for the tests are as detailed below:

| Camera Position | Camera | Lens |
|---|---|---|
| Onboard LH Total | IDT NXA5-S2 | IDT 6mm |
| Onboard Rear View | IDT NXA5-S2 | IDT 6mm |
| Offboard Overhead | IDT NXA5-S2 | IDT 12.5mm |

**Table 5 – Photographic Equipment**

## Software Used in Testing

| Output Description | Software | Version |
|---|---|---|
| Sled acceleration data | DataPro | 3.3.680 |
| Data processing | NI DIADem | 21.0.0 |
| Data analysis | X-Crash | 8.3 |
| High-speed film capture and processing | MotionStudio | 2.16.06 |
| Film analysis | Orme TrackImage | 3.6.9 |

**Table 6 – Software Used in Testing**

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

# Test Results – S19230

Below is the test results summary of criteria for ISO 7176-19:2022:

| | |
|---|---|
| **Test No** | **S19230** |
| **Test Date** | **16/10/2026** |
| **Test Facility** | **ServoSled - UTAC UK** |
| **Manufacturer** | **Strutt** |
| **Model** | **ev[1] / ev[1]c** |
| **Mass (kg)** | **72.0kg** |
| **Occupant** | **HIII 50th %ile male (78.0kg)** |
| **Tie Down Restraint** | **Koller KFP0089/FRK** |
| **Occupant Restraint** | **Koller KFP0089/FRK** |

| **5.2.3 During the test** | | |
|---|---|---|
| **Criteria** | **Description** | **Result** |
| a) | The horizontal excursions of the ATD and wheelchair shall not exceed the limits in 5.2.3 Table 1: | PASS |
| i | Was the horizontal movement of the test wheelchair P-Point ($X_{wc}$) less than 200mm (±5mm) | 80mm |
| ii | Was the horizontal movement of the dummy knee ($X_{knee}$) less than 375mm (±5mm) | 259mm |
| iii | Was the horizontal movement of the dummy head ($X_{headf}$) less than 650mm (±5mm) | 319mm |
| iv | Was the rear head excursion ($X_{headr}$) less than -450mm (±5mm) | n/a |
| b) | Was the ratio $X_{knee}/X_{wc}$ > 1.1 (peak knee excursion vs. peak wheelchair excursion) | 3.23 |
| c) | Batteries of powered wheelchairs or their surrogate replacement parts shall: | PASS |
| i | Not move completely outside the wheelchair footprint, and | PASS |
| ii | Not move into the wheelchair occupant's space (i.e. back of legs, etc.) | PASS |
| d) | No components of the securement system shall completely detach or disengage from a wheelchair securement point or adaptor | PASS |

| **5.2.4 After the test** | | |
|---|---|---|
| **Criteria** | **Description** | **Result** |
| a) | The wheelchair shall remain in an upright position on the test platform, and the ATD shall be retained in the wheelchair in a seated posture not more that 45° to the vertical in any direction | PASS |
| b) | The structural components of the wheelchair securement points shall not completely fail | PASS |
| c) | Rigid components, fragments or accessories of the wheelchair with a mass in excess of 150g shall not completely separate from the wheelchair | PASS |
| d) | Wheelchair components that can contact the occupant shall not fragment or separate in a manner that produces sharp edges | PASS |
| e) | Locking mechanisms of tilt seating adjusters shall not completely fail | PASS |
| f) | Removal of the ATD from the wheelchair shall not require the use of tools | PASS |
| g) | Release of the wheelchair from the securement system shall not require the use of tools | PASS |
| h) | The post-test height of the ATD H-point relative to the ground plane shall not have decreased by more than 20% from the pre-test height | PASS |
| i) | The wheelchair and its components shall not cause complete failure of the webbing of any of the WTORS assemblies during the test | PASS |
| j) | No components of the wheelchair securement shall completely detach from a wheelchair securement point or adaptor | PASS |

**ISO7176-19:2022**
**Test criteria fulfilled**

**Table 7 – Test Results Summary**

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

# Test Setup Photos

Pre-test:

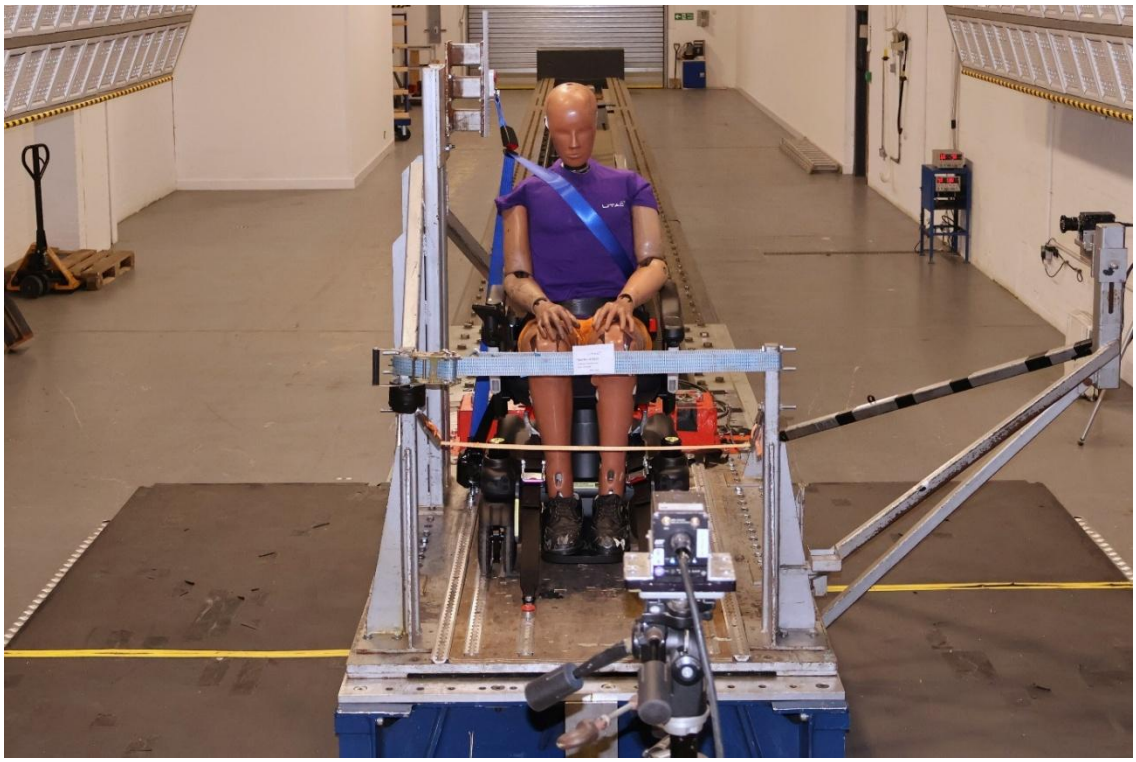


**Figure 1 - Pre-test Frontal View**

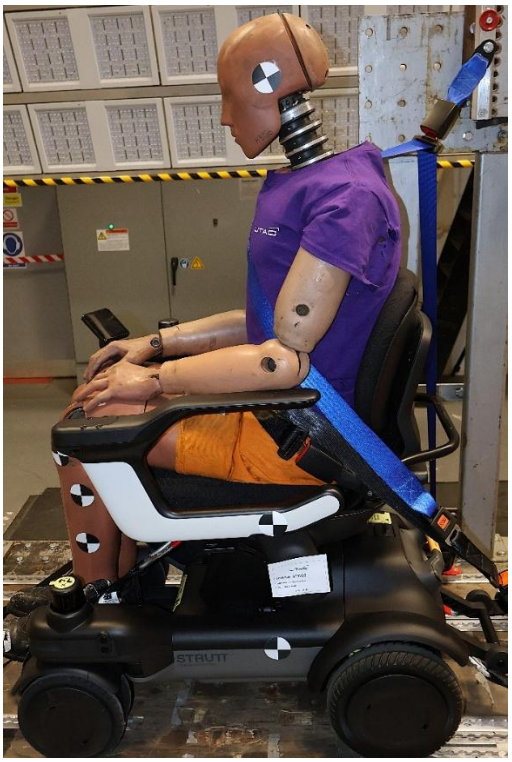


**Figure 2 - Pre-test Side View**

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

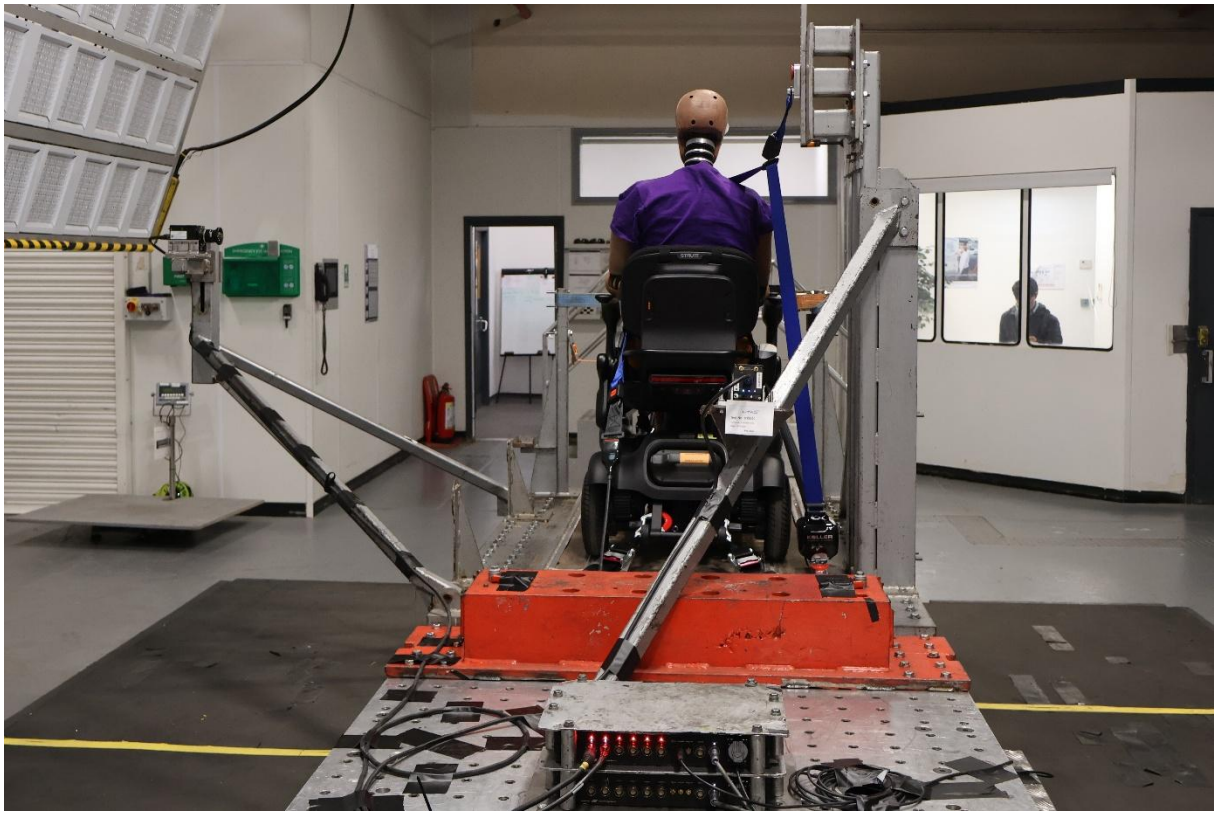


**Figure 3 - Pre-test Rear View**

Post-test:



**Figure 4 - Post-test Front View**

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

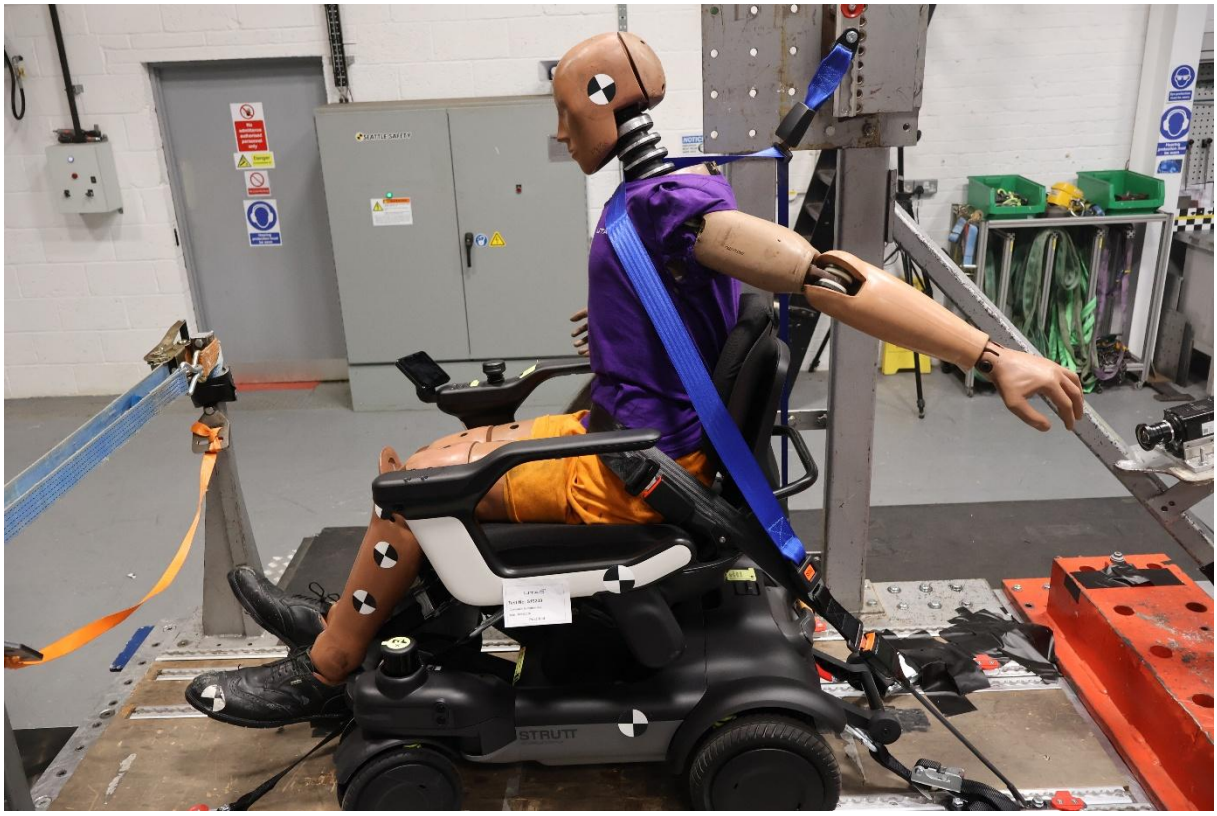


**Figure 5 - Post-test Side View**



**Figure 6 - Post-test Rear View**

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

## Acceleration Pulse Results

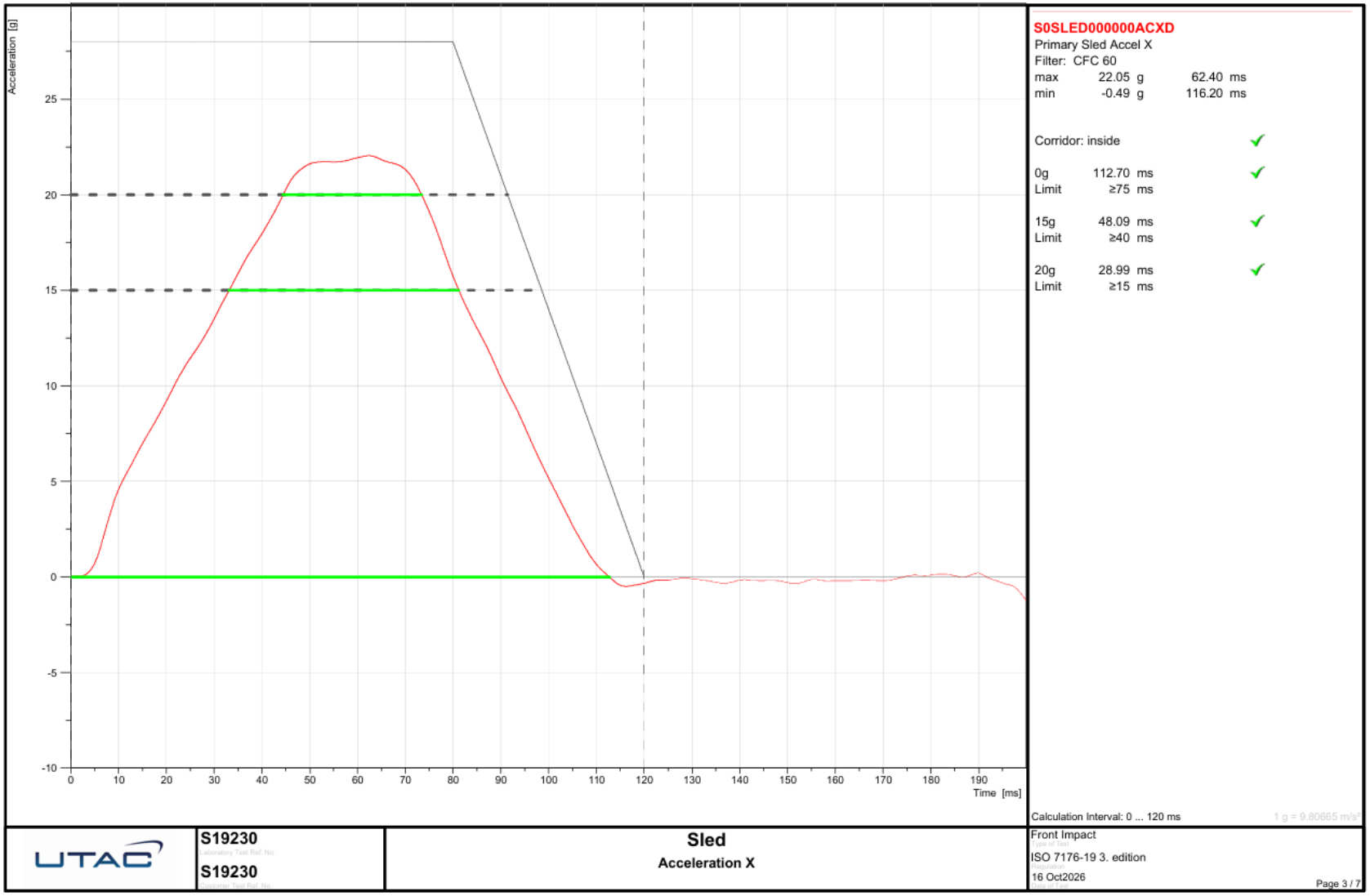



**Figure 7 - Sled Acceleration Plot**

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**

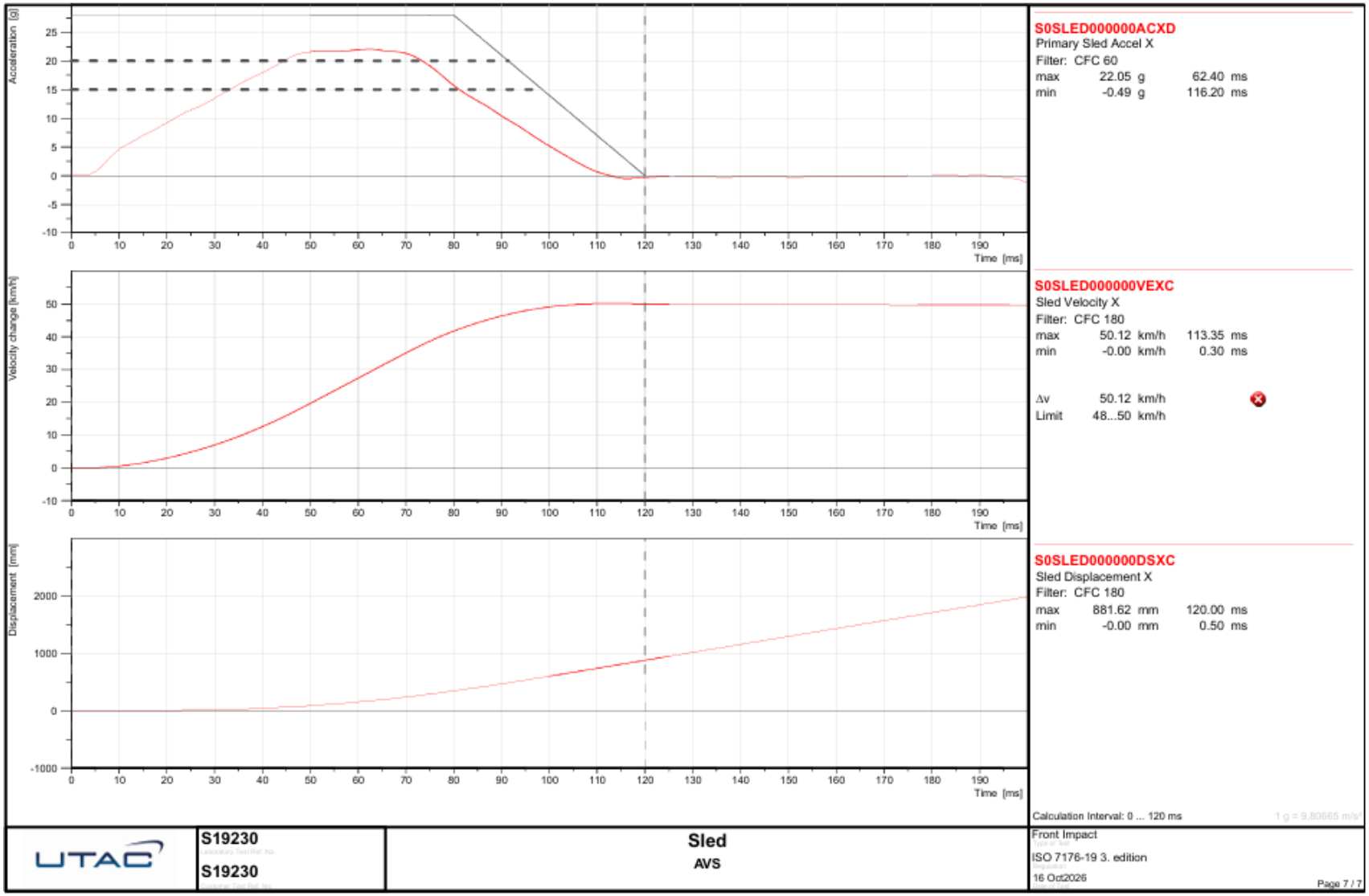



**Figure 8 - Sled AVS Plots**

**--- End of report ---**

**This test report shall not be altered or amended and shall not be reproduced, except in full, without the prior written approval of UTAC UK Limited**