Rapid Decompression Testing

Decompression Tests 2015

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ForeFlight
Intelligent Apps for Pilots™

ForeFlight LLC Rapid Decompression Test Report for Apple iPad Air and Apple iPad mini 3 Retina

CASCADE™ TEK

TEST REPORT

CTC C1504

March 19, 2015

A2LA ACCREDITED

Accredited by
American Association for
Laboratory Accreditation (A2LA)

ista CERTIFIED LABORATORY

Certified Commercial
Package Testing Laboratory
(ISTA)

DEPARTMENT OF DEFENSE · UNITED STATES OF AMERICA

MIL-STD Laboratory
Suitability Status by
Defence Logistics Agency (DLA)

LABORATORY LOCATIONS

OREGON
5245-A NE Elam Young Pkwy.
Hillsboro, OR, 97124 • Ph: 503-648-1818

COLORADO
1530 Vista View Drive
Longmont, CO, 80504 • Ph: 720-340-7810

www.cascadetek.com

Job Number: C1504

Rev.	Description of the Revision	Date
---	Initial Release of the Data Report.	March10, 2015
A	Amended the attention to and correct sample name	March19, 2015
B	Amended the sample name to include Serial Numbers	March19, 2015

Test Title	Test Summary
Rapid Decompression	The test was conducted per the required standard with no deviations.

Cascade Technical Sciences
www.cascadetek.com
1-888-835-9250

TESTING CERT #2582.02

March 19, 2015

Certification No: CTC C1504

Attention: Mr. C. Tvson Weihs

ForeFlight LLC
621 E 6th St, Suite 100
Austin, TX 78701

Reference:

a. Cascade Tek Job No.:	C1504
b. Cascade Tek Quote No.:	CTQ 16075A
c. Client Purchase Order No.:	1009
d. Technical Specification:	1. RTCA DO-160G

Cascade Technical Sciences hereby certifies that Two (2) Electronic Devices, P/N the iPad Air and the iPad mini 3, were subjected to the following test:

1. Rapid Decompression Test per Reference (b) Item 1, and (d1), samples were exposed to a pressure equivalent to 8,000 feet (565 TORR) of altitude to stabilize for a customer specified time and then exposed to a pressure equivalent of 51,000 feet (83 TORR) of altitude with a transition of less than 15 seconds. Samples were left to dwell for a minimum of 10 minutes and then returned to ambient altitude conditions (630 TORR).

Testing was done in accordance with the above references as evidenced and reported in the accompanying data. The testsamples were returned to the customer for evaluation.

The original of this report is on file at Cascade Technical Sciences, Inc. under the above referenced certification number forreview by authorized personnel. The results of the testing reported herein relate only to the actual itemstested.

Respectfully submitted,

David Bowles
Quality Administrator
Cascade Technical Sciences, Inc.

Total number of pages in this document is 14.

The objective of this test program was to subject customer provided test hardwaretoenvironmental simulation in compliance with customer stated specification, including any authorized modification, deviations or concessionstotheoriginal requirements. The hardware consisted of items identified in the appropriate sections of this report. In addition to test hardwareidentification, each section contains information that describes the associated test setup and performance and the resulting data. CascadeTEK,Inc.measuring instruments used in testing were calibrated according to the requirements of ANSI/NCSL Z540-1-1944 and ISO/IEC 17025,2ndEditionandare NIST traceable. Calibration records are on file and available for inspection by request. Because the test methods are wellestablishedand are qualitative or semi-quantitative in nature, Cascade TEK, Inc. does not apply measurement uncertainty unless obligatedbycontract. Measured value related to the corresponding tolerance requirement is used to decide whether a test meets the requirementsofthespecification. Any test hardware operational setups and resulting evaluations or inspections performed by the customer are not includedinthisreport,unless they were explicitly requested. While observations and/or specification compliance statements may be reported, no interpretationsoropinions regarding customer product performance are intended. Unless otherwise indicated in the appropriate report section, all contractobligationswere met and the test objective achieved.

Test Data Log

Job Number: C1504
Customer: ForeFlight LLC

Date Started: 3/4/2015
Date Completed: 3/4/2015

Reviewing Engineer: Meg Talbert
Signature: Meg Talbert

Responsible Technician: Keefe Hart

Type of Test: Decompression

Test Specification: RTCA DO-160G Section 4.6.2

Specimen Description: Electronic Devices

Specimen P/Nor Model No.	Specimen S/N
iPad Air Model No. MH322LL/A	DMPND07SG5YQ
iPad mini 3 Retina Model No. MH3N2LL/A	F4KND4DKG5YK

Laboratory Temperature: +71 ºF

Laboratory Humidity: 18% RH

Test Description:

Samples will be stabilized at a pressure equivalent to 8000 feet of altitude. Following a customer specified stabilization time, the samples will be exposed to a pressure equivalent of 51,000 feet of altitude with the transition occurring in less than 15 seconds. Upon achievement of the 51,000 foot level, the unit will dwell at that pressure for a minimum of 10 minutes and then be returned to ambient conditions. Customer will be onsite for the testing and has requested a short video of the test being conducted. Full operation of samples will be confirmed both pre and post testing.

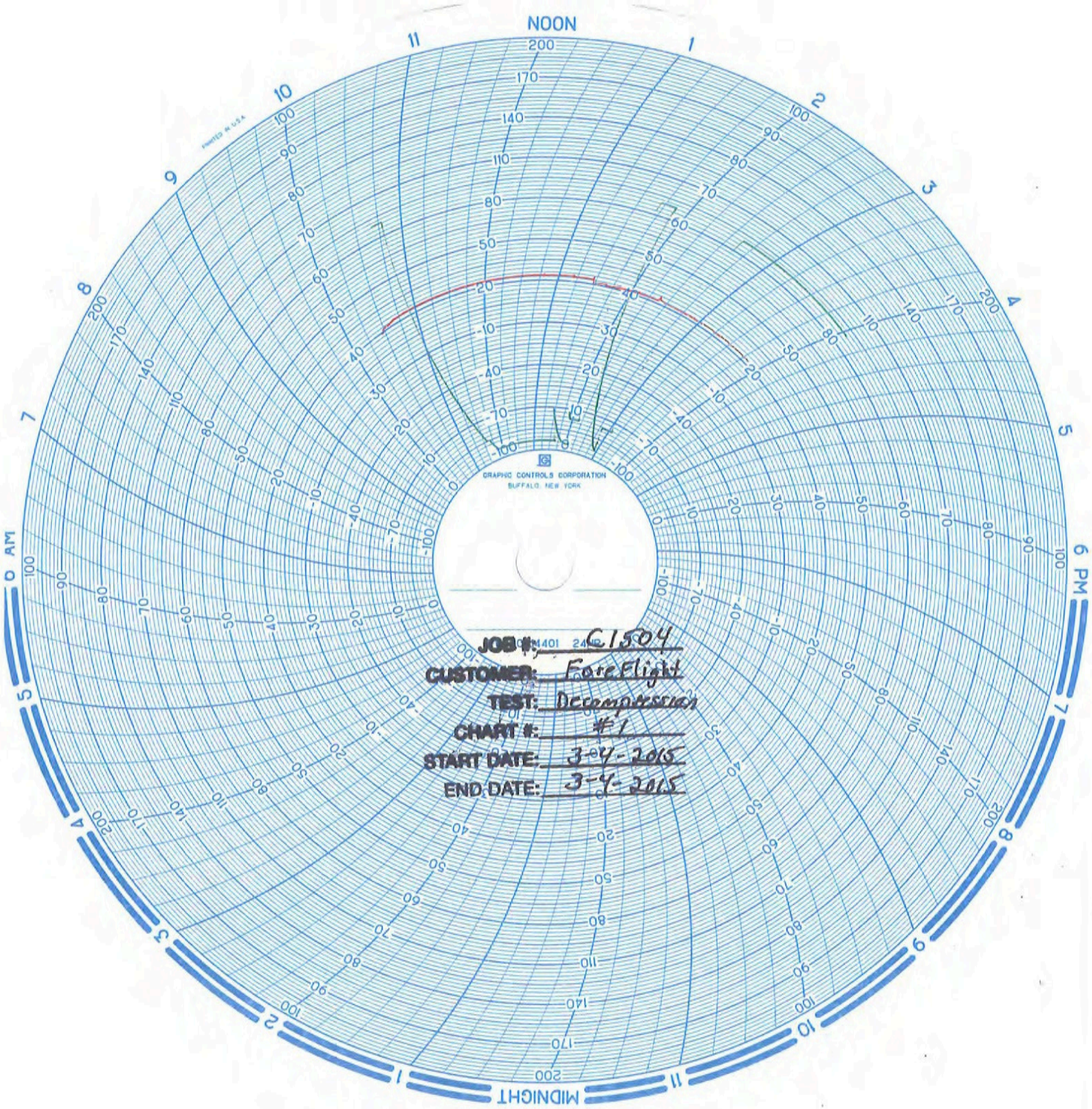
Initials	Date	Time	Notes	Photo
KH	3/4/2015	1000	All altitude readings will be registered in “TORR”. Critical values are: 8000 feet of altitude = 565 TORR 51,000 feet of altitude = 83 TORR 75,000 feet of altitude = 26 TORR 78,000 feet of altitude = 22 TORR Test site ambient altitude = 630 TORR	☐
KH	3/4/2015	1030	Customer is on site and advises that they will video the testing.	☐
KH	3/4/2015	1055	Correct operation of test samples is verified and samples are placed in chamber 1208.	☒
KH	3/4/2015	1055	Chamber 1208 is sealed and set for 8,000 feet altitude (565 TORR).	☒
KH	3/4/2015	1100	Chamber 1228 is sealed and set for 75,000 feet altitude (26 TORR); this chamber is equipped with a circular chart to verify altitude.	☐
KH	3/4/2015	1100	Both chamber are started. Data collection equipment is started under data file “A”.	☐
KH	3/4/2015	1240	Both chamber are at the prescribed set points.	☐
KH	3/4/2015	1245	The connecting valve between chamber 1208 and chamber 1228 is opened allowing the drawdown of pressure in chamber 1208.	☐

Initials	Date	Time	Notes	Photo
KH	3/4/2015	1245	Upon conclusion of a 15 second period, chamber 1208 has not achieved the required pressure equivalent to 51,000 feet of altitude (83 TORR).	☐
KH	3/4/2015	1247	Chamber 1208 is returned to 8,000 feet of altitude pressure equivalent and held. Chamber 1228 is set for 78,000 feet altitude (22 TORR).	☐
KH	3/4/2015	1308	Chamber 1228 has reached 78,000 feet altitude (22 TORR).	☐
KH	3/4/2015	1310	The connecting valve between chamber 1208 and chamber 1228 is opened allowing the drawdown of pressure in chamber 1208.	☐
KH	3/4/2015	1312	Upon conclusion of a 15 second period, chamber 1208 has again not achieved the required pressure equivalent to 51,000 feet of altitude (83 TORR).	☐
KH	3/4/2015	1313	Customer is advised that test can be better achieved if samples are placed in test vessel 1151 due the smaller internal volume. Customer agrees to allow samples to be moved to 1151.	☐
KH	3/4/2015	1320	Samples have been relocated and are in vessel 1151. Full operation of samples is confirmed.	☒
KH	3/4/2015	1321	Chamber 1208 is connected to vessel to supply the 8,000 feet altitude (565 TORR) and vessel 1151 is drawn down to proper level.	☐
KH	3/4/2015	1321	Chamber 1228 is set for 75,000 feet (26 TORR) and allowed to achieve set point. Data collection equipment has been connected to CTEK vessel 1151 and disconnected from chamber 1208. Data collection is re-started under data file “B”.	☐
KH	3/4/2015	1355	Chamber 1228 is at prescribed set point.	☐
KH	3/4/2015	1405	Valve connecting 1228 and 1151 is opened allowing 1151 pressure to be drawn down below the 51,000 foot altitude equivalent pressure (83 TORR).	☐
KH	3/4/2015	1405	Decompression occurs in less than the prescribed 15 second period and vessel 1151 is held below the prescribed level for a period in excess of 10 minutes.	☐
KH	3/4/2015	1418	Chambers 1208 and 1228 are shut down and vessel 1151 is returned to ambient altitude conditions of 630 TORR.	☐
KH	3/4/2015	1430	Vessel is opened and full operation of both samples is verified by customer.	☒
KH	3/4/2015	1500	Testing is complete.	☐

DS2- Test Equipment List

Test: Decompression **Job Number:** C1504 **Date:** 03/04/2015

Test Equipment List						
Equipment Description	**M anufacturer**	**Model**	**S/N**	**Cal No.**	**Calibrated Date (mm/dd/yy)**	**Calibration Due Date (mm/dd/yy)**
Altitude Chamber	Tenney	27ST-100400	8190	1208	04/29/14	04/30/15
Small Altitude Chamber	Tenney	8S	25720-02	1228	08/14/14	08/31/15
Digital Temp / RH Meter	Cole-Parmer	90080-03	130033077	FR417	03/27/13	03/31/15
Pressure Vessel	CTEK	NA	1	1151	Reference Only	
Pressure Transducer	Omega	PX303-100A5V	NA	FR332	12/17/14	12/31/15
Data Logger	Agilent	34970A	US37010202	FR411	03/20/14	03/31/15
Data Logger Input Module	Agilent	34901A	US37000277	FR412	03/20/14	03/31/15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MIDNIGHT
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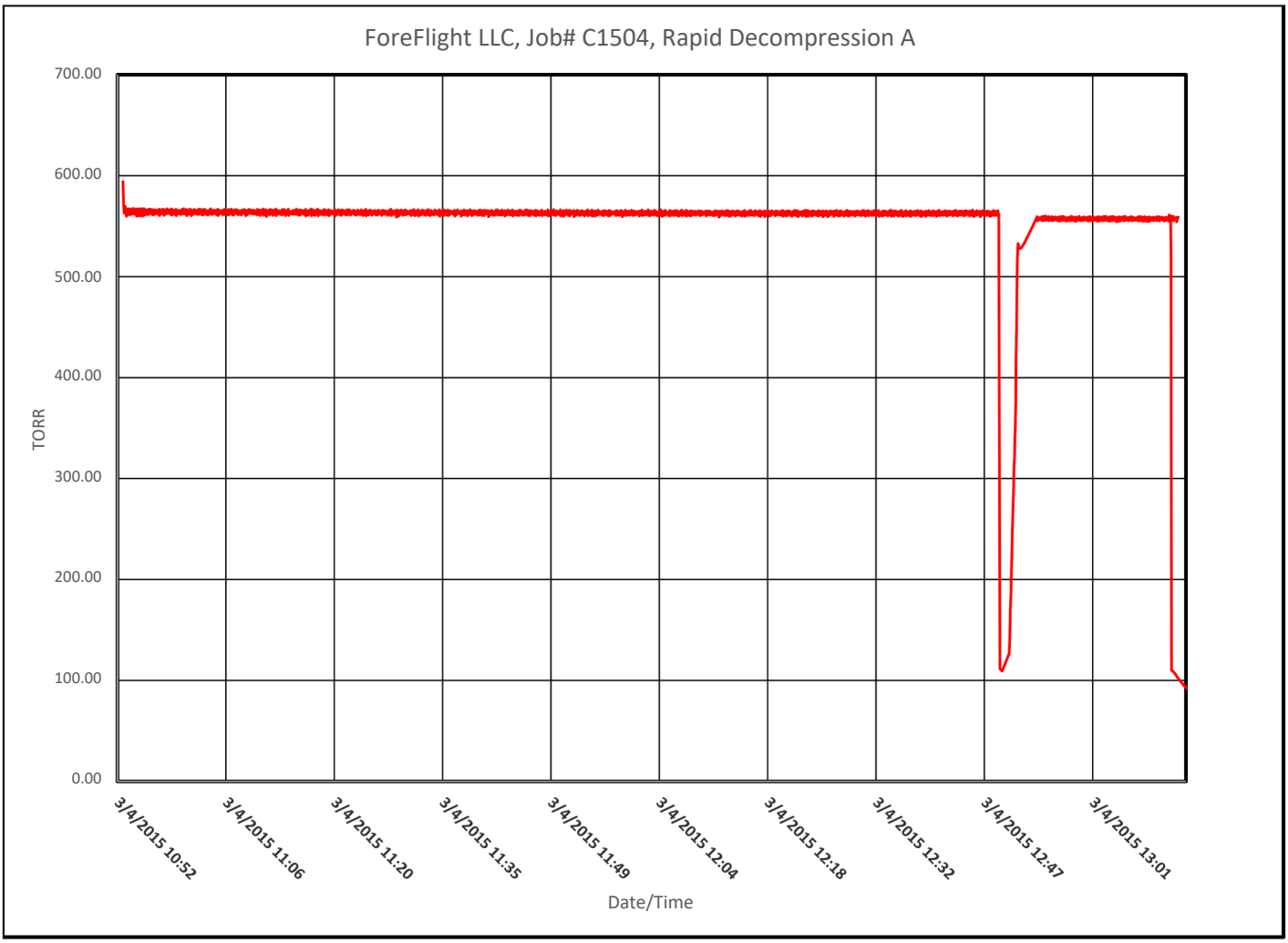
0 AM
GRAPHIC CONTROLS CORPORATION
BUFFALO, NEW YORK
JOB #: C1504
CUSTOMER: ForeFlight
TEST: Decompression
CHART #: #1
START DATE: 3-4-2015
END DATE: 3-4-2015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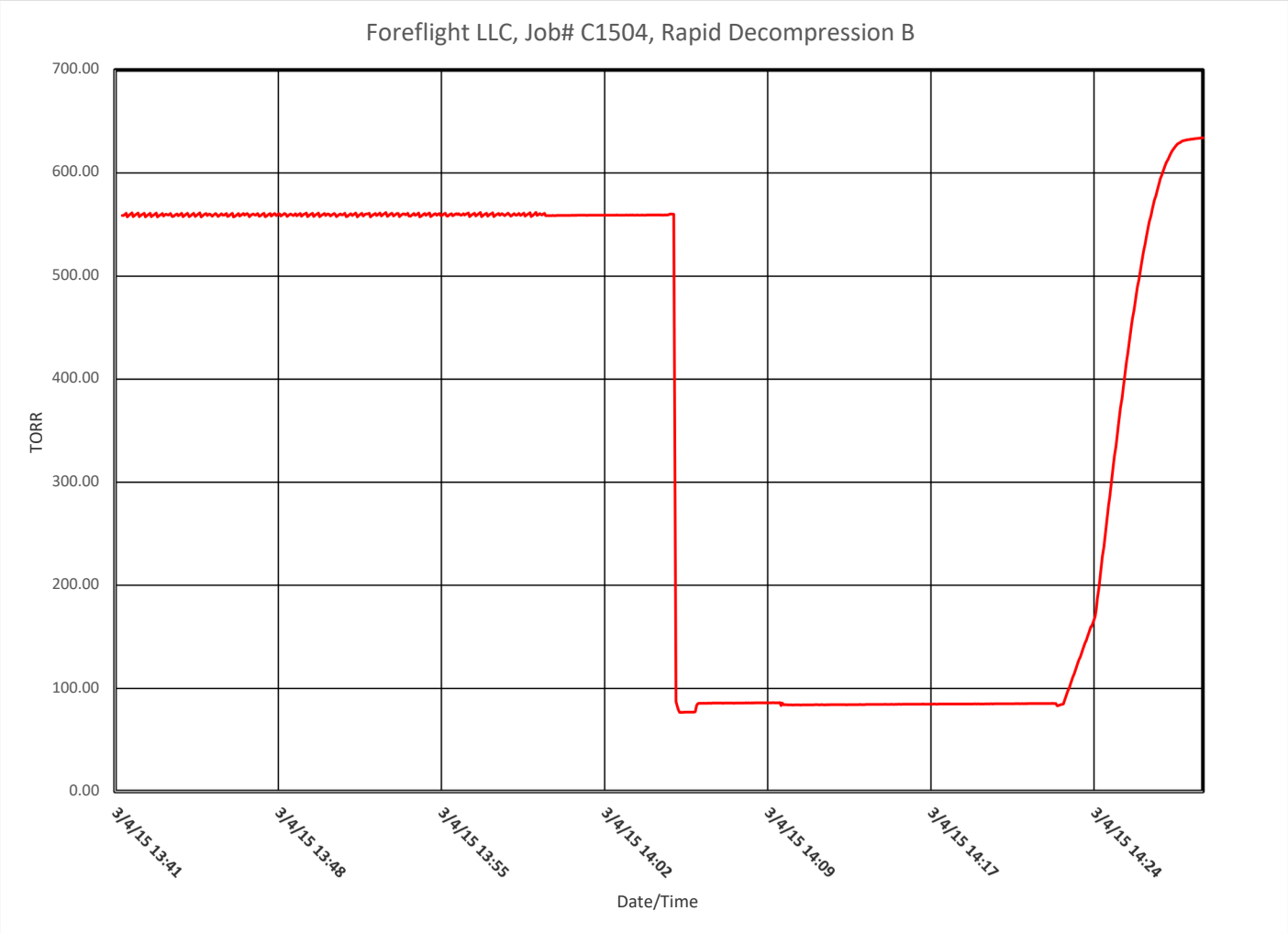
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3/4/15 14:17
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Date/Time

Rapid Decompression Testing

Decompression Tests 2016

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ForeFlight
Intelligent Apps for Pilots™

CASCADE™ TEK

TEST REPORT

CTC C1959

February 3, 2016

ACCREDITED

Accredited by
American Association for
Laboratory Accreditation (A2LA)
2582.01 & 2582.02

ista CERTIFIED LABORATORY

Certified Commercial
Package Testing Laboratory
(ISTA)

MIL-STD Laboratory
Suitability Status by
Defence Logistics Agency (DLA)

LABORATORY LOCATIONS

OREGON
5245-A NE Elam Young Pkwy.
Hillsboro, OR, 97124 • Ph: 503-648-1818

COLORADO
1530 Vista View Drive
Longmont, CO, 80504 • Ph: 720-340-7810

www.cascadetek.com

Job Number: C1959

Rev.	Description of the Revision	Date
---	Initial Release of the Data Report.	January26, 2016
A	Customer requested changes.	February3, 2016

Test Title	Test Summary
Rapid Decompression	The test was conducted per the required standard with no deviations.

CascadeTechnicalSciences
www.cascadetek.com
1-888-835-9250

TESTING CERT #2582.02

February 3, 2016

Certification No: CTC C1959

Attention: Ms. Anna Domning

ForeFlight LLC
621 E 6th St, Suite 100
Austin, TX 78701

Reference:

a. Cascade Tek Job No.:	C1959
b. Cascade Tek Quote No.:	CTQ 17964A
c. Client Purchase OrderNo.:	1018
d. Technical Specification:	1. RTCA DO-160G

Cascade Technical Sciences hereby certifiesthat Five (5) Electronic Devices, P/N: iPad Pro, iPad Air, iPad Mini, Stratus 1S, and Stratus 2S, S/N:aslisted in data, were subjected to the following test:

1. Rapid Decompression Test per Reference (b) Item 1 and (d1), Section 4.6.2, the operating samples were stabilized at a pressure of 10.92 psiA corresponding to an altitude of 8,000 feet and then subjected to a reduction in pressure to 1.69 psiA corresponding to an altitude of 50,000 feet within 15 seconds. This altitude of 50,000 feet was then maintained for at least ten minutes.

Testing was done in accordance with the above references as evidenced and reported in the accompanying data. The test samples were returned to the customer for evaluation.

The original of this reportis on file at Cascade Technical Sciences, Inc. under the above referenced certification number forreview by authorized personnel. The results of the testing reported herein relate only to the actual itemstested.

Respectfully submitted,

David Bowles
Quality Administrator
Cascade Technical Sciences, Inc.

Total number of pages in this document is 13.

The objective of this test program was to subject customer provided test hardware to environmental simulation in compliance with customer stated specification, including any authorized modification, deviations or concessions to the original requirements. The hardware consisted of items identified in the appropriate sections of this report. In addition to test hardware identification, each section contains information that describes the associated test setup and performance and the resulting data. Cascade TEK, Inc. measuring instruments used in testing were calibrated according to the requirements of ANSI/NCSL Z540-1-1944 and ISO/IEC 17025, 2nd Edition and are NIST traceable. Calibration records are on file and available for inspection by request. Because the test methods are well established and are qualitative or semi-quantitative in nature, Cascade TEK, Inc. does not apply measurement uncertainty unless obligated by contract. Measured value related to the corresponding tolerance requirement is used to decide whether a test meets the requirements of the specification. Any test hardware operational setups and resulting evaluations or inspections performed by the customer are not included in this report, unless they were explicitly requested. While observations and/or specification compliance statements may be reported, no interpretations or opinions regarding customer product performance are intended. Unless otherwise indicated in the appropriate report section, all contract obligations were met and the test objective achieved.

Test Data Log

Section 1 – Job Information

Job Number: C1959
Customer: ForeFlight LLC

Date Started: 1/20/2016
Date Completed: 1/20/2016

Responsible Technician: Keefe Hart
Quote Issued By: Michael Bosica

QA Reviewer: Meg Talbert
Signature: Meg Talbert

Customer Witness: No ☒ Yes ☐ Name: NA

Section 2 – Test Parameters

Test Title: Rapid Decompression

Test Specification: RTCA DO-160G Section 4.6.2

Test Description: Samples will be stabilized at a pressure equivalent to 8,000 feet of altitude (10.92 psiA) and then pulled down to a pressure equivalent to 50,000 feet of altitude (1.69 psiA) in less than 15 seconds. Pressure will be maintained at this level for 10 minutes and then returned to site pressure.

Section 3 – Test Sample Information

Sample Description	Sample P/N or Model No.	Sample S/N or Other Identifier	Qty.
Stratus 1S	153510-000007 SSID: Stratus 1S000882	1S0000882	1
Stratus 2S	SSID: Stratus2S000007 PN not listed on device	2S000007	1
iPad Pro	Pro ML3N2LL/A; Model A1652	DLXQM0VNGMW4 (602-00338-A)	1
iPad Mini	Mini 4 MK8A2LL/A; Model A1550	DLXQ701WGHML (602-00388-A)	1
iPad Air	Air 2 MH2N2LL/A; Model A1567	DMPQQ05VG5YM (602-00108-A)	1

Section 4 – Test Equipment

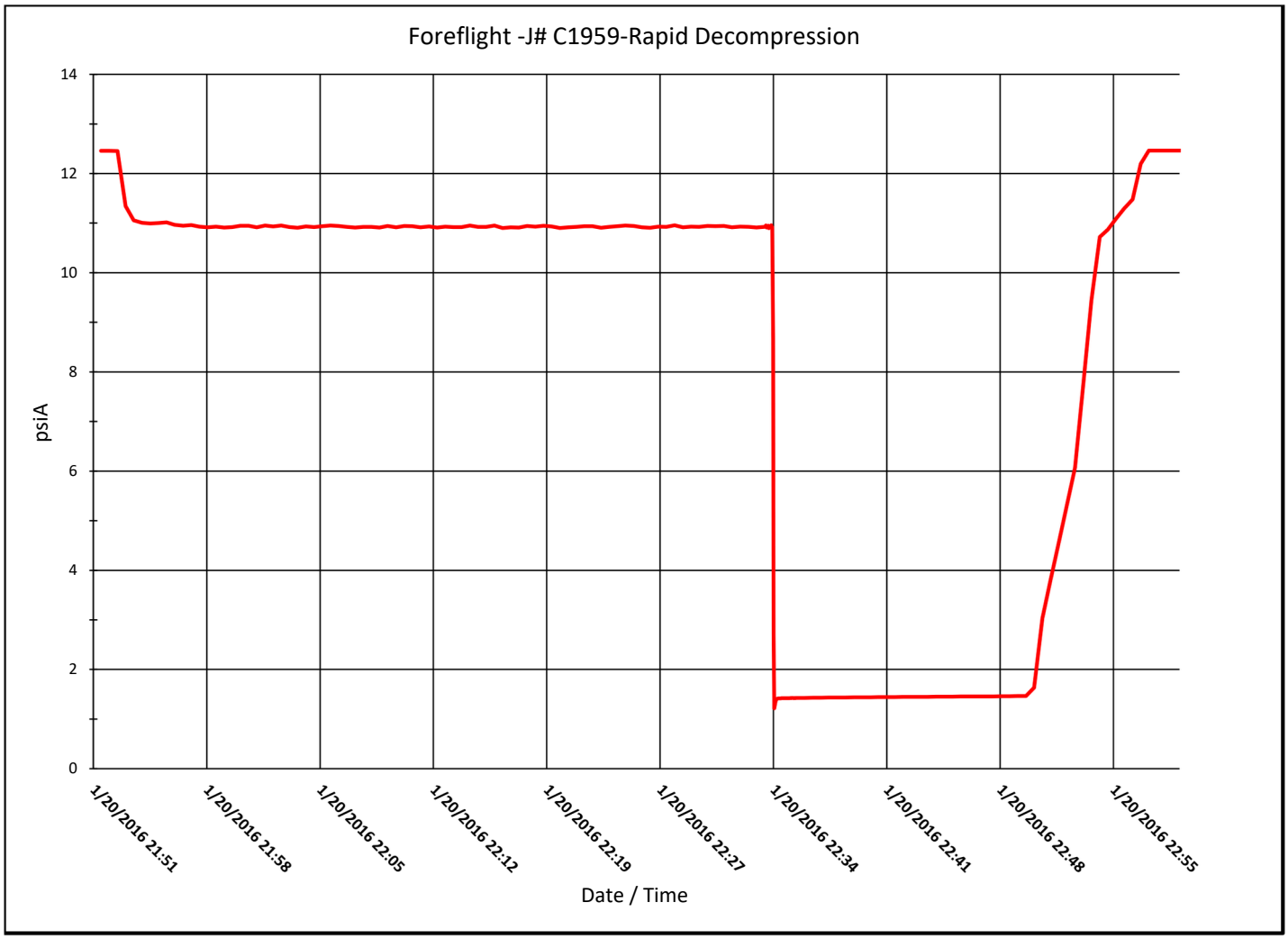
ID No.	Description	Manufacturer	Model No.	Serial No.	Last Cal	Next Cal
1208	Altitude Chamber	Tenney	27ST-100400	8190	04/17/15	04/30/16
1228	Altitude Chamber	Tenney	8S	25720-02	08/05/15	08/31/16
FR447	Temperature/Relative Humidity Meter	Cole-Parmer	90080-03	130743104	03/07/14	03/31/16
FR411	Data Logger	Agilent	34970A	US37010202	03/30/15	03/31/16
FR412	Data Logger Input Module	Agilent	34901A	US37000277	04/10/15	04/30/16
403	Transducer	Omega	PX303-100A5V	NA	12/21/15	12/31/16
1151	Pressure Vessel	CTEK	---	1	Reference Only	
FR446	Stop Watch	Control Company	94460-28	130699687	01/22/14	01/31/16

Section 5 – Test Log

Customer Name: ForeFlight LLC
Job Number: C1959

Laboratory Temperature: +72°F
Laboratory Humidity: 22% RH

Initials	Date	Time	Notes	Photo
KH	1/20/2016	2130	Samples are placed in pressure vessel 1151 and vessel is sealed.	☒
KH	1/20/2016	2200	Internal pressure in vessel is brought to an equivalent to 8,000 feet of altitude using chamber 1228 as a vacuum source.	☐
KH	1/20/2016	2230	Vessel is maintained at 8,000 feet allowing samples time to stabilize. During this period of stabilization, chamber 1208 is brought to a pressure equivalent to 60,000 feet of altitude.	☐
KH	1/20/2016	2232	Vacuum source from 1228 is closed off and vacuum source from 1208 is opened bringing the internal vessel pressure down to an equivalent to 50,000 feet of altitude. Pressure change occurs in about 7 seconds.	☐
KH	1/20/2016	2245	Vessel pressure is maintained for a period greater than 10 minutes.	☐
KH	1/20/2016	2250	Vessel internal conditions are returned to site conditions.	☐
KH	1/20/2016	2300	Samples are removed from chamber.	☐
KH	1/20/2016	2315	Samples are verified operational.	☒
KH	1/20/2016	2315	Samples will be returned to customer.	☐
KH	1/20/2016	2330	Testing is complete.	☐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Date / Time

Rapid Decompression Testing

Decompression Tests 2017

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ForeFlight
Intelligent Apps for Pilots™

Element Materials Technology

Portland/Denver/Seattle

Report ETC D2801

January 12, 2017

For: ForeFlight, LLC

Prepared By:	Meg Talbert Digitally signed by Meg Talbert DN: cn=Meg Talbert, o=Element Materials Technology, ou=Quality, email=meg.talbert@element.com, c=US Date: 2017.01.12 17:19:39 -07'00'	January 10, 2017	
	Element Denver Quality Administrator	Date	
Reviewed By:	Michael Bosica Digitally signed by Michael Bosica DN: cn=Michael Bosica, o=Element Materials Technology, ou=Management - Denver, email=michael.bosica@element.com, c=US Date: 2017.01.12 16:03:26 -07'00'	January 10, 2017	
	For Element Denver Laboratory Manager	Date	

Administrative Data

Prepared for: ForeFlight, LLC
2323 S Shepherd Dr, Suite 1002
Houston, TX 77019

Test Facility: Element Denver
1530 Vista View Dr
Longmont, CO 80504
(720) 340-7810

Test(s) Performed	Test Specification (Paragraph/Section)
Decompression	ForeFlight SOW Per e-mailREF:RTCADO-160G

Item(s) Tested (Description)	Part Number(s)	Serial Number(s)
Apple iPad	Pro 9.7	DMPRL1HFGXQ5
Apple iPad	Air 2	DMPQV6TBG5YM

Rev.	Reason For Revision	Date	Approval
---	Report Issued.	January10,2017	MJT

Date Test Items Received: 12/28/2016

Testing Initiated Date: 12/29/2016

Testing Completed Date: 12/29/2016

Element – Portland/Denver/Seattle

January 12, 2017 Certification No: ETC D2801

Attention: Mr. Anna Domning
ForeFlight, LLC
2323 S Shepherd Dr, Suite 1002
Houston, TX 77019

Reference:
a. Element Job No.: D2801
b. Element Quote No.: EPO0001909Q
c. Customer Purchase Order No.:161213A
d. Technical Specification: 1.ForeFlight SOW Per E-mail

Element Materials Technology – Portland herebycertifies that the following test sample(s) were subjected to the following test(s).

Quantity	Description	Model/Part Number	Serial Number(s)
1	Apple iPad	Pro 9.7	DMPRL1HFGXQ5
1	Apple iPad	Air 2	DMPQV6TBG5YM

1. Decompression per Reference (b) and (d1), the operating samples were subjected to an altitude exposure at a pressure of 10.91psiAcorresponding to an altitude of 8,000 feet followed by reduction in pressure to 1.32 psiA correspondingto an altitude of 55,000 feet, within 15 seconds. This pressure was then be maintained for at least10minutes.

Testing was done in accordancewith the above references as evidenced and reported in the accompanying data. The test samples were returnedtothe customer for evaluation.

The original of this report is on file at Element Materials Technology, Inc. under the above referenced certification number for review by authorized personnel. The results of the testing reported herein relate only to the actual items tested.

Respectfully submitted,

Meg Talbert

Quality Administrator
Element – Portland/Denver/Seattle

The objective of this test program was to subject customer provided test hardware to environmental simulation in compliance with customer stated specification, including any authorized modification, deviations or concessions to the original requirements. The hardware consisted of items identified in the appropriate sections of this report. In addition to test hardware identification, each section contains information that describes the associated test setup and performance and the resulting data. Element Materials Technology, Inc. measuring instruments used in testing were calibrated according to the requirements of ANSI/NCSL Z540-1 and ISO/IEC 17025, and are traceable NIST or NMI. Calibration records are on file and available for inspection by request. Because the test methods are well established and are qualitative or semi-quantitative in nature, Element Materials Technology, Inc., Inc. does not apply measurement uncertainty unless obligated by contract. Any test hardware operational setups and resulting evaluations or inspections performed by the customer are not included in this report, unless they were explicitly requested. While observations and/or specification compliance statements may be reported, no interpretations or opinions regarding customer product performance are intended. Unless otherwise indicated in the appropriate report section, all contract obligations were met and the test objective achieved.

Section 1 – Job Information

Job Number: D2801
Customer: ForeFlight

Date Started: 12/29/2016
Date Completed: 12/29/2016

Responsible Technician: Steve Milton / Michael Bosica
Customer Witness: No ☒ Yes ☐ Name: N/A

Section 2 – Test Parameters

Test Title: Decompression

Test Specification: ForeFlight SOW : per e-mail, REF:RTCA DO-160G Section 4.6.2 CAT A1

Test Description: The operating samples will be exposed to an altitude of 8,000 feet or 10.91 psiA allowing the samples to stabilize (2 hours), then reduce the pressure to 55,000 or 1.32 psiA- this transition shall take place within 15 seconds, then this pressure is to be held for a least 10 minutes. The samples will then be checked for functionality at site level pressure.

Section 3 – Test Sample Information

Sample Description	Sample P/N or Model No.	SampleS/NorOther Identifier	Qty.
Apple iPad	Pro 9.7	DMPRL1HFGXQ5	1
Apple iPad	Air 2	DMPQV6TBG5YM	1

Section 4 – Test Equipment

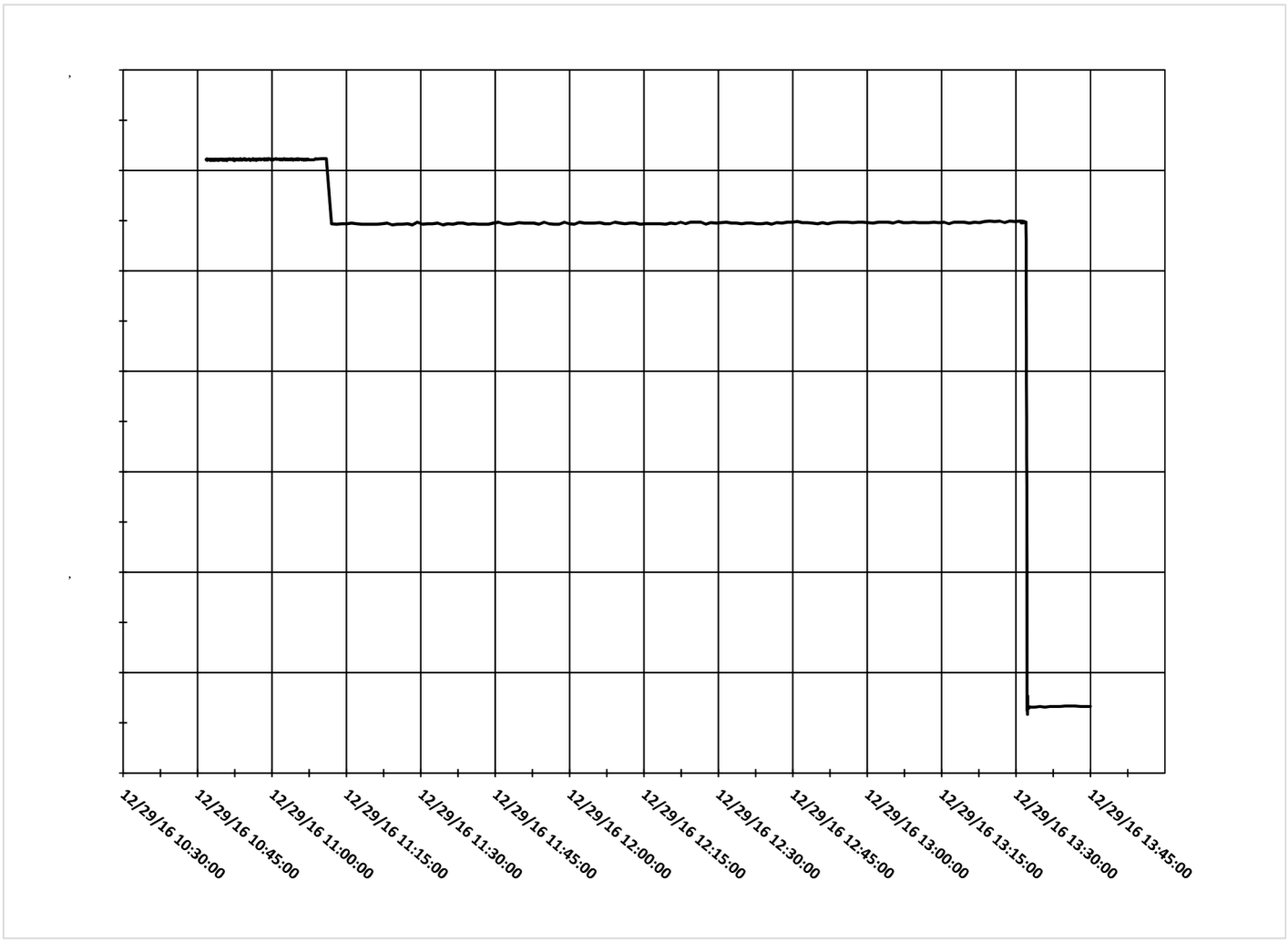
ID No.	Description	Manufacturer	Model No.	Serial No.	Last Cal	Next Cal
FR513	Temperature/Relative Humidity Meter	Cole-Parmer	90080-03	160173038	03/05/16	03/05/18
FR332	Presser Transducer	Omega	PX303-100A5V	N/A	01/19/16	01/19/17
1151	Pressure Vessel	N/A	N/A	N/A	Reference Only	
FR411	Data Acquisition/Switch Unit	Hewlett Packard	34970A	US37010202	04/28/16	04/28/17
FR412	Data acquisition Plug In Module	Hewlett Packard	34901A	US37000277	04/28/16	04/28/17
1228	Pressure Chamber	Tenney	8S	25720-02	Reference Only	
1208	Pressure Chamber	Tenney	27ST-100-400	8190	Reference Only	

Section 5 – Test Log

Laboratory Temperature: +71°F

Laboratory Humidity: 20%RH

Initials	Date	Time	Notes	Photo
SM	12/29/2016	936	Begin setting up in pressure vessel #1151.	☐
SM	12/29/2016	1108	Take photos of the samples.	☒
SM	12/29/2016	1110	Seal the vessel and begin the ramp to 8,000 feet 10.91 psiA.	☐
SM	12/29/2016	1115	The vessel pressure is at 8,000 feet. Begin the two hour soak.	☐
SM	12/29/2016	1332	Reduce the pressure to 1.32 PSiA. The transition occurred within 15 seconds.	☐ ☐
SM	12/29/2016	1333	Hold for at least 10 minutes then return the vessel to site level pressure.	☐
SM	12/29/2016	1345	The exposure is complete.	
SM	12/29/2016	1349	Remove the samples from the vessel. Take post exposure photos.	
SM	12/29/2016	1400	The testing is complete the samples will be returned to the customer.	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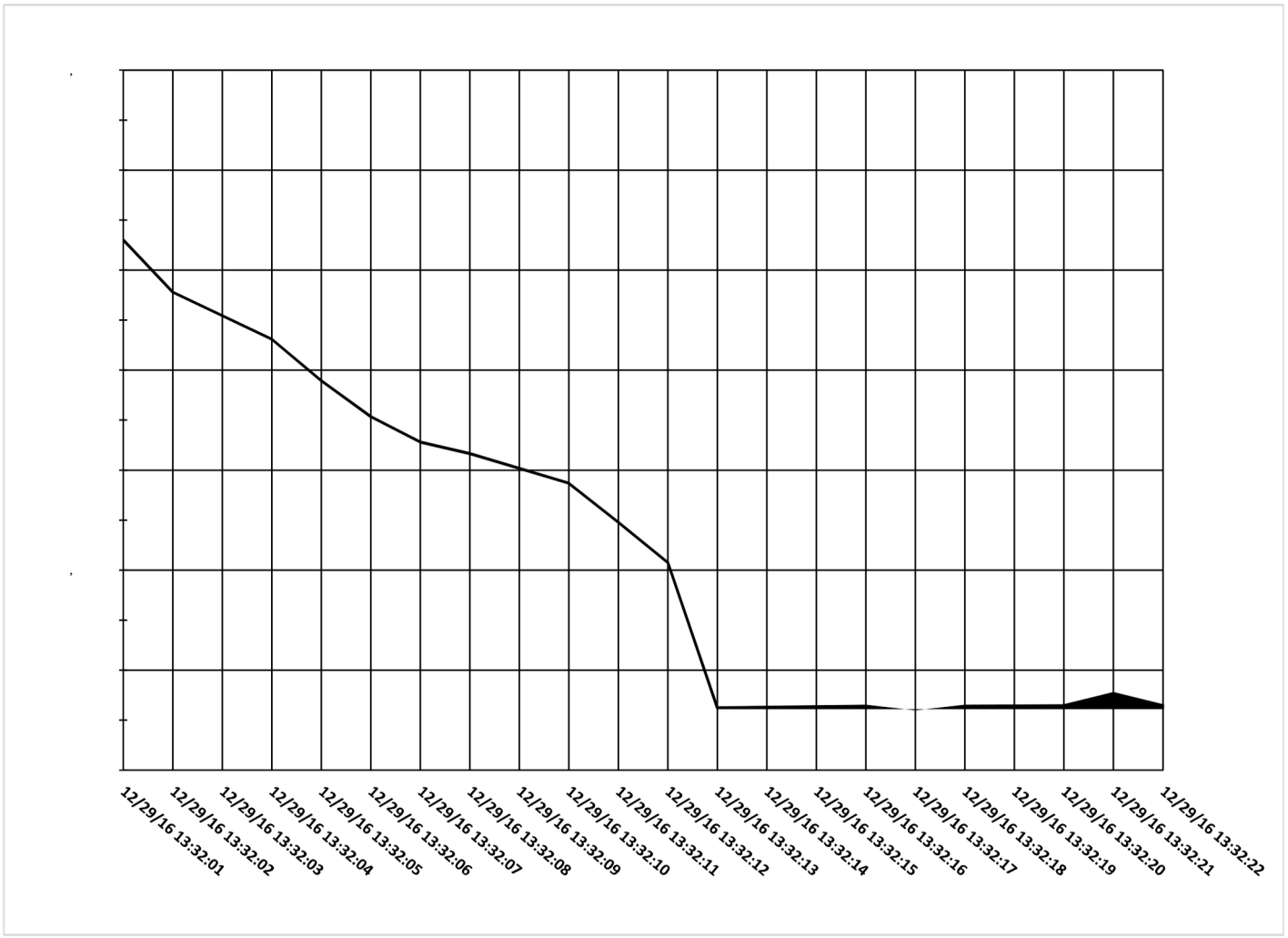
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12/29/16 13:32:20
12/29/16 13:32:21
12/29/16 13:32:22

Rapid Decompression Testing

Decompression Tests 2018

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ForeFlight
Intelligent Apps for Pilots™

Element Materials Technology Denver
1530 Vista View Drive
Longmont, CO 80504
P 720-340-7810

Decompression Test Report

Date: July13, 2018
Report Number: R6716

ForeFlight LLC
233 S Wacker Drive, WHQKT, 5th Floor, Cube 586-A
Chicago, IL 60606
United States

Prepared By:	Meg Talbert Element Denver Quality Administrator	07/13/2018 Date
Reviewed By:	Michael Bosica Element Denver LabManager	07/13/2018 Date
Concurred By:	JacquelineBooher EPO Deputy Quality Manager	07/16/2018 Date

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ADMINISTRATIVE DATA

Prepared For:	Anna Domning ForeFlight LLC 233 S Wacker Drive, WHQKT, 5th Floor, Cube 586-A Chicago, IL 60606 United States
Test(s) Performed:	Decompression testing per Table 1 on page 5
Test Facility:	Element Materials Technology Denver 1530 Vista View Drive Longmont, CO 80504 720-340-7810
Test Unit Description(s):	Apple iPad
Part Number(s):	A1822
Serial Number(s):	GG7W4X99HLFD
Primary Test Specification(s):	ForeFlight SOW per email dated 6-4-18
Purchase Order Number(s):	PO 180614A
Element Job Number:	6716P
Element Quote Number(s):	EPO006716Q-1
Project Begin Date:	06/28/2018
Project Completion Date:	06/28/2018
Test Report CompletionDate:	July 13, 2018

REVISIONS

Revision	Description	Date	Approval
N/A	OriginalRelease	July13,2018	MJT

1.0 INTRODUCTION

1.1 Scope

This document describes procedures and performance of the Decompression Tests performed in accordance with specification: ForeFlight SOW per email dated 6-4-18. The results described in this report relate only to the specific items tested.

1.2 Purpose

Thepurpose of this test was to demonstrate that the test specimens met or exceeded the design specification requirements during or upon completion of exposure to the stresses detailed herein.

1.3 Test Sequence

Thefollowingtests were conducted during the course of Environmental Testing:

Table 1 – Environmental Test Sequence

Test	Start Date	End Date
Decompression	06/28/2018	06/28/2018

2.0 APPLICABLE DOCUMENTS

2.1 Specification

ForeFlight SOWper email dated 6-4-18, received from Anna Domning, REF: RTCA DO-160G, reference older Quote EPO0001909Q.

3.0 GENERAL INFORMATION

3.1 Test Equipment

All testinstrumentation was calibratedinaccordance with ANSI/NCSL Z540.3 or ISO 10012, as applicable, and is traceableto a recognized National Metrology Institute (NMI). The following table liststhe equipmentused during the testing:

Table 2 – DecompressionEquipment

Test Dates: 06/28/2018 to06/28/2018

ID#	Description	Mfg.	Model#	Serial#	Last Cal	Next Cal
FR616	Temperature/Relative Humidity Meter	Digi-Sense	90080 -03	170855567	12/06/17	12/06/19
FR411	Data Acquisition/Switch Unit	HP	34970A	US37010202	04/13/18	04/13/19
1151	Small Pressure Vessel	N/A	N/A	N/A	Reference Only	
FR332	Presser Transducer	Omega	PX303 - 100A5V	N/A	01/11/18	01/11/19
1228	Small Altitude Chamber	Tenney	8S	25720-02	Reference Only	
1208	Large Altitude	Tenney	27ST-100-400	8190	Reference Only	
FR569	Stopwatch	Digi-Sense	94460-28	170093811	04/10/17	04/10/19

3.0 GENERAL INFORMATION (continued)

3.2 Test Conditions

Unlessspecifiedherein, all tests and measurements were performed at the room ambient conditions existing at the laboratory during testing:

Temperature:	10°C to 40°C
Relative Humidity:	Ambient to 90%

3.3 Test Witnessing/Monitoring

Alltesting wasconductedbyaqualified Element Environmental Test Technician under the direction and cognizance of the Lab Manager and Quality Assurance.

3.4 Test Recording

Chronological logs of all significant events are maintained by test lab personnel and indicate date, times and descriptions of conditions. These logs, as listed in Appendix C, are used as reference, retained at Element and available upon request. Test setup photographs are provided in Appendix A, with any additional charts, plots, or graphs provided in Appendix B.

4.0 Decompression Procedures

4.1 Setup

4.1.1 One (1) Apple iPad P/N: A1822 with S/N: GG7W4X99HLFD was visually inspected with no signs of deformation, discoloration, or any other anomalies noted.

4.1.2 Operating sample was prepared and placed into Vessel 1151.

4.1.3 A secondary chamber, 1208, was prepared for the decompression event.

4.2 Steps

4.2.1 Began pressure stabilization at 8,000 feet (10.91psiA) and stabilized sample for 2 hours.

4.2.2 Valve was opened between the two chambers to subject the sample to a reduction in pressure to 50,000 feet (1.32psiA) within 15 seconds.

4.2.3 Exposed sample to 10 minutes at 50,000 feet.

4.2.4 Vessel pressure was returned to site level and sample was removed.

4.2.4.1 Post exposure showed sample operational.

4.2.5 Upon test completion, at ambient conditions, the sample was visually inspected, then returned to customer for final analysis.

4.3 Results

4.3.1 No signs of damage, deformation, discoloration, corrosion or any other anomalies noted.

4.3.2 Test photographs provided in Appendix A.

4.3.3 Applicable graphs, charts, and/or plots provided in Appendix B.

APPENDIX A – TEST PHOTOGRAPHS

Decompression

Photo 1 – *Example of setup within pressure vessel, functional*

Photo 2 – *Post-Exposure, functional*

APPENDIX B – TEST PLOTS, CHARTS, GRAPHS

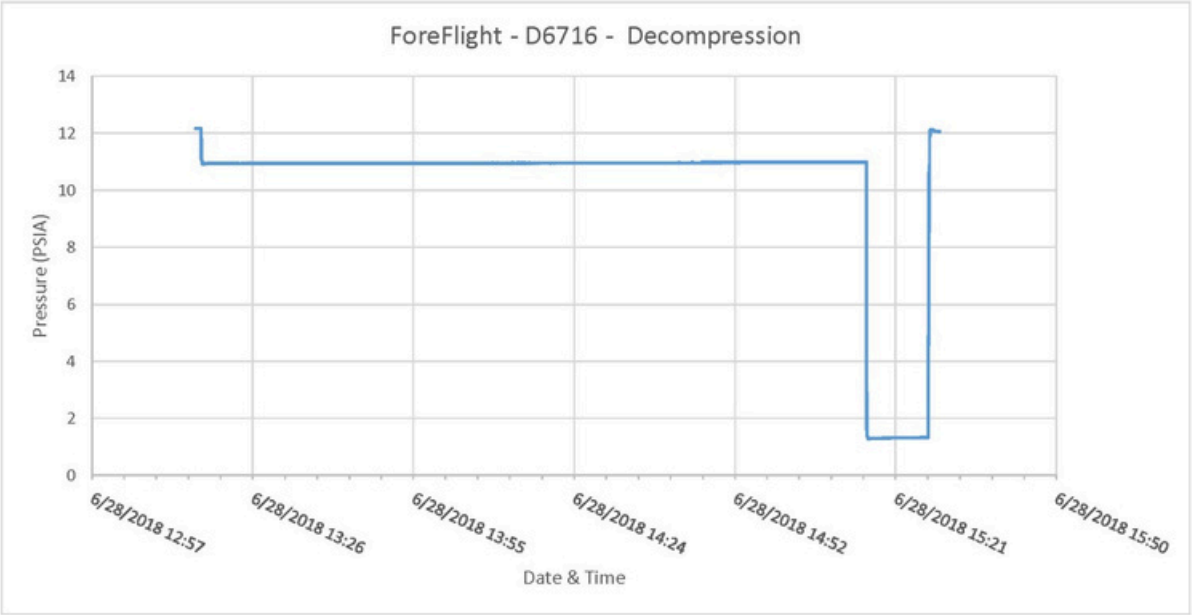

Figure 1 – Decompression (Soak) Chart 1 of 2

APPENDIX B (continued)

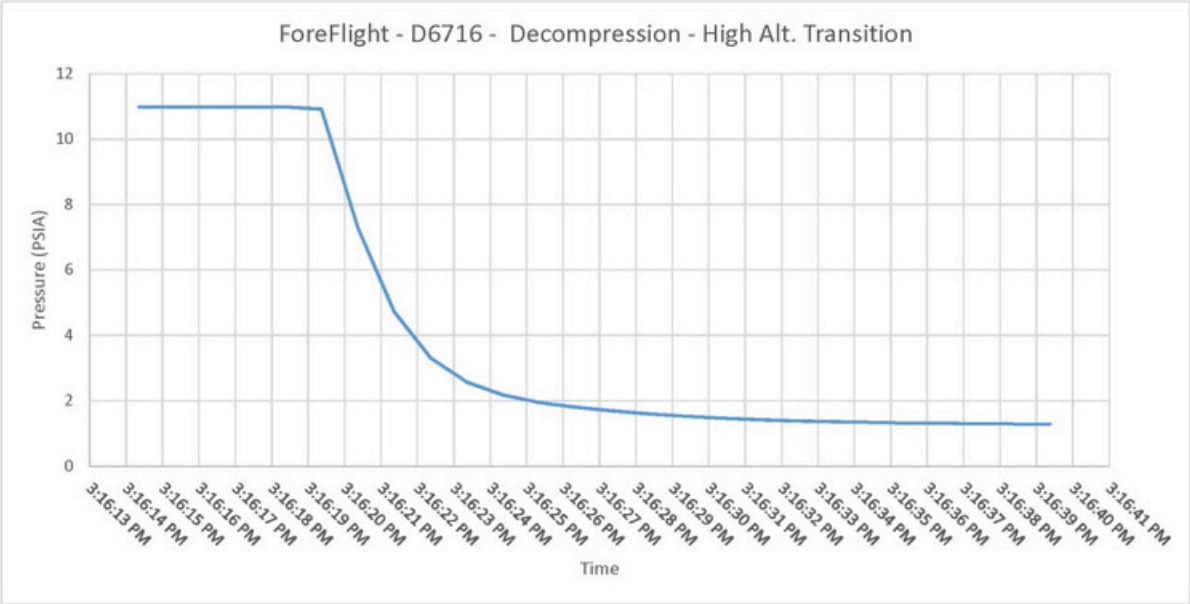

Figure 2 – Decompression (Transition) Chart 2 of 2

APPENDIX C – REFERENCES

1. rev a ForeFlight - D6716 - Decompression.docx

element™

Element – Portland/Denver/Seattle
Test Data Log

Section 1 – Job Information

Job Number: D6716
Customer: ForeFlight LLC

Date Started: 6/28/2018
Date Completed: 6/28/2018

Responsible Technician: E. Geneva/M. Bosica
Customer Witness: No ☒ Yes ☐ Name: N/A

Section 2 – Test Parameters

Test Title: Decompression

Test Specification: ForeFlight SOW : per e-mail, REF:RTCA DO-160G Section 4.6.2 CAT A1

Test Description: The operating sample will be exposed to an altitude of 8,000 feet or 10.91 psiA allowing the sample to stabilize (2 hours), then reduce the pressure to 55,000 feet or 1.32 psiA- this transition shall take place within 15 seconds, then this pressure is to be held for a least 10 minutes. The sample will then be checked for functionality at site level pressure.

Section 3 – Test Sample Information

Sample Description	Sample P/N or Model No.	Sample S/N or Other Identifier	Qty.
Apple iPad	A1822	GG7W4X99HLFD	1

Section 4 – Test Equipment

ID No.	Description	Manufacturer	Model No.	Serial No.	Last Cal	Next Cal
FR616	Temperature/Relative Humidity Meter	Digi-Sense	90080-03	170855567	12/06/17	12/06/19
FR411	Data Acquisition/Switch Unit	HP	34970A	US37010202	04/13/18	04/13/19
1151	Small Pressure Vessel	N/A	N/A	N/A	Reference Only	
FR332	Presser Transducer	Omega	PX303-100A5V	N/A	01/11/18	01/11/19
1228	Small Altitude Chamber	Tenney	8S	25720-02	Reference Only	
1208	Large Altitude	Tenney	27ST-100-400	8190	Reference Only	
FR569	Stopwatch	Digi-Sense	94460-28	170093811	04/10/17	04/10/19

SP 708-3 Test Data Log Form

2nd Edition, Rev. 0, Issue Date June 1, 2016

Section 5 – Test Log

Laboratory Temperature: +80°F Laboratory Humidity: 28%RH

Initials	Date	Time	Notes	Photo
EG	6/28/2018	1200	Begin setting up in pressure vessel #1151.	☐
EG	6/28/2018	1210	Perform several test runs with sealed empty pressure vessel to dial in the required 15 second transfer time. [Photo 4607]	☒
EG	6/28/2018	1315	Setup the sample and seal the vessel. Begin the ramp to 8,000 feet 10.91 psiA.	☐
EG	6/28/2018	1318	The vessel pressure is at 8,000 feet. Begin the two hour soak.	☐
EG	6/28/2018	1519	Reduce the pressure to 1.32 psiA. The transition occurred within 15 seconds.	☐
EG	6/28/2018	1519	Begin 10 minute soak.	☐
EG	6/28/2018	1529	The exposure is complete.	☐
EG	6/28/2018	1530	Remove the sample from the vessel. [Photo 4616]	☒
EG	6/28/2018	1540	The testing is complete the samples will be returned to the customer.	☐

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End of Report.

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