

HART Quality Assurance and Device Registration

Conformance Test Report

14 July 2014

For the:

**Regulateurs Georgin TiXo3
Device Type 0xE0DE**

Prepared for:

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By

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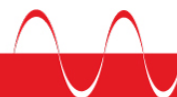
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Executive Summary

On 18 March 2014, the HCF received the Regulateurs Georgin TiXo3 Transmitter for registration as per the *HCF Quality Assurance and Device Registration Procedure*. (HCF_PROC-12). The HCF identified issues that prevented registration of the Regulateurs Georgin TiXo3 Transmitter. On 2 June 2014, Regulateurs Georgin submitted an updated device which covered all outstanding issues. This report summarizes testing and compliance assessment of the Regulateurs Georgin Transmitter (Expanded Device Type Code 0xE0DE; Device Revision 0x01; Software Revision 0x04, Hardware Revision 0x01).

The HCF performed 98 tests during the course of assessing the TiXo3 and analyzed the data produced.

Based on this testing and analysis, the TiXo3 complies with the HART Communication Protocol Requirements. The device is considered HART Registered and now authorized to use the "HART Registered" mark and terminology in literature, documentation, marketing materials, and markings of the device described on the HART Certificate of Registration.

The Regulateurs Georgin TiXo3 submitted for registration is a non-burst-mode 2-wire loop-powered field device that supports HART Protocol Revision 7.

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1. INTRODUCTION

1.1 Contact Information

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1.2 DUT Identification

Manufacturer Name: Regulateurs Georgin	Model Name(s): TiXo3
Manufacture ID Code(HEX): 0x6032	Expanded Device Type Code (HEX): 0xE0DE
Device ID (HEX): 0x02F68B	
Device Profile (HEX): 0x01	

HART Protocol Revision: 7	Device Revision: 0x01
Hardware Revision: 0x01	Software Revision: 0x04

Burst Mode Support: No

Physical Layers Supported: FSK
FSK Physical Device Category: 2-wire high-Impedance transmitter

1.3 Scope

This report summarizes the testing and compliance assessment of the Regulateurs Georgin TiXo3 Transmitter (Expanded Device Type Code 0xE0DE; Device Revision 0x01).

As per the requirements in the *HCF Quality Assurance and Device Registration Procedure* (HCF_PROC-12), the registration package supplied by Regulateurs Georgin was reviewed and audited (see Section 2).

The TiXo3 is a wired device and the following tests were performed:

- **Physical Layer** – wired FSK interface
- **Token-Passing Data-Link Layer** –slave tests (Data-Link Layer Services: non-burst mode)
- **Application Layer Universal Commands** – via wired FSK interface tests
- **Application Layer Common Practice Commands** – via wired FSK interface tests, both mandatory and optional commands

The test equipment used during testing is listed in Subsection 1.8. Upon completion of the testing the data and results were assessed for compliance. The results are discussed in Section 3 and Summarized in the Annexes.

Conclusions, based on the testing and assessments, are provided in Section 4.

1.4 Overview

The Device Under Test (DUT) is a Regulateurs Georgin model TiXo3 Transmitter (Expanded Device Type Code 0xE0DE; Device Revision 0x01). The DUT is a 2-wire high-impedance transmitter as per the *FSK Physical Layer Specification* (HCF_SPEC-54). As such, the DUT must be tested per the *HCF Quality Assurance and Device Registration Procedure* (HCF_PROC-12).

The DUT includes an FSK interface that supports current-loop (4-20mA) output as well as HART signaling. Access to the FSK interface is via a wiring terminal on the device.

On 18 March 2014, the HCF received the DUT at the HCF Austin offices and testing commenced shortly thereafter.). The HCF identified issues that prevented registration of the Regulateurs Georgin TiXo3 Transmitter. On 2 June 2014, Regulateurs Georgin submitted an updated device which covered all outstanding issues. This report refers to the DUT with Expanded Device Type Code 0xE0DE, Device Revision 0x01, Software Revision 0x04, and Hardware Revision 0x01.

1.5 Limitation of Liability

This report summarizes the audits, testing and analysis used to assess the product's compliance with HART Communication Protocol requirements. The product's qualification for registration is solely based on (1) the applicable revision of the HART Communication Protocol Specifications; (2) the latest Standard Test Specifications and (3) the latest Standard Test Tools available from the HCF at the time of this report's release. THIS REPORT DOES NOT IMPLY THAT HCF PRODUCT REGISTRATION IS OR EVER HAS BEEN A CERTIFICATION PROGRAM. REGISTRATION DOES NOT CERTIFY THAT THE PRODUCT COMPLIES WITH ALL HART COMMUNICATION PROTOCOL REQUIREMENTS.

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THE FINDINGS DISCLOSED IN THIS REPORT ARE RELEVANT ONLY TO THE SAMPLE PROVIDED FOR TEST BY CLIENT.

1.6 Confidentiality

This report is provided for the exclusive use of the Product's Manufacturer. The Manufacturer is authorized to distribute this report only internally and only in its entirety. Any other distribution requires the express written permission of the HART Communications Foundation and the Product's Manufacturer.

1.7 References

The following HCF documents provided the basis for conformance testing.

The HART Communication Protocol Specifications

The following HART Communication Protocol Specification was the basis for conformance testing:

HART Communication Protocol Specification. HCF_SPEC-13. Revision 7.5

The HART Communication Protocol Test Specifications

The following HART Communication Protocol Test Specifications were used during conformance testing:

Slave Token-Passing Data Link Layer Test Specification, HCF_TEST-1. Revision 3.0

FSK Physical Layer Test Specification, HCF_TEST-2. Revision 2.2

Slave Universal Command Test Specification, HCF_TEST-3. Revision 4.0

Slave Common Practice Command Test Specification, HCF_TEST-4. Revision 4.0

Device Registration Procedures

The following registration procedure was used during conformance testing and registration:

HCF Quality Assurance and Device Registration Procedure. HCF_PROC-12. Revision 2.3

HCF Standard Forms

The following HCF forms were used to summarize test results:

Slave Token-Passing Data-Link Test Summary. HCF_FRM-156.1. Revision 3.0

FSK Physical Layer Test Data Sheets. HCF_FRM-156.2. Revision 2.0

Slave Universal Command Test Summary. HCF_FRM-156.3. Revision 3.0

Slave Common Practice Command Test Summary. HCF_FRM-156.4. Revision 3.0

1.8 Test Equipment

The following equipment was used to perform the Conformance Test:

Physical Layer Test Kit. HCF_KIT-116. Revision 1.0

HART Test System. HCF_KIT-192. Revision 2.1A

WaveTek Function Generator Model# FG3B. SN 707089

Kepco Model# BOP-50-2M SN 146556

Mactek RS-232 to HART Interface. SN 113138

Mactek RS-232 to HART Interface. SN 113136

National Instruments Scope Card Model# 5122. SN P10196230

IET Resistance Decade Box Model# RS-200. SN 02020914

IET Capacitance Decade Box Model# CS-300. SN 12089911

Fluke Multimeter Model# 77III. SN 77990287

HCF Analog Filter Model# HCF_TOOL-32. SN 0144

HCF Digital Filter Model# HCF_TOOL-31. SN 0184

1.9 Definitions, Acronyms and Symbols

1.9.1 Definitions

All terms and phrases unique to HART or critical to understanding this report are defined in this section.

Application Layer	Topmost layer in the Open System Interconnect (OSI) model. In the HART Protocol this layer includes: the definitions of data types; revision rules; application procedures; and the HART Commands.
Byte	8-bits, sometimes called an Octet.
Data Link Layer	Layer 2 in the OSI model. This layer is responsible for the error-free communication of data. The Data Link Layer defines the message structure, error detection strategy and bus arbitration rules.
Device Variable	A uniquely defined data item within a Field Device that is always associated with cyclical process information. A Device Variable's value varies in response to changes and variations in the process.
Dynamic Variable	The connection between the process and an analog channel. All HART field devices may contain Primary, Secondary, Tertiary, and Quaternary Variables that are mapped to the first 4 analog channels in a field device.
Field Device	Field Devices are connected to the Process and their Device Variables vary as process conditions change.
Interoperability	Interoperability is the ability for like devices from different manufacturers to work together in a system and be substituted one for another without loss of functionality at the host system level.
Logical Link Control	Logical Link Control (LLC) is the higher of the two data link layer sub-layers defined in the OSI Model. The LLC sub-layer handles error control, flow control, framing, and addressing.
Long Tag	A 32 character ISO Latin-1 string used to identify the field device. See Tag.
Medium Access Control	A sub-layer found with the OSI Data-Link Layer (OSI Layer 2) used for arbitrating access to the communication channel.
Packet	A generic reference to the set of data communicated across a network
Physical Layer	Layer 1 in the OSI model. The Physical Layer is responsible for transmission of the raw bit stream and defines the mechanical and electrical connections and signaling parameters for devices.
Request Data Bytes	The sub-field returned in the Data field that contains the Application Layer message data being transmitted from the Master to the Slave.
Response Data Bytes	The sub-field returned in the Data field that contains the Application Layer message data being transmitted from the Slave to the Master. The first byte in the HART Data Field that is not a Response Code, Communication Status, Device Status or Extended Command Number.
Transaction	A complete, atomic cycle of Data-Link activity. A transaction consists of (a) a single DLPDU transmission from a source device, or (b) two DLPDUs: one from the Data-Link source followed by a second, link-level acknowledgement DLPDU from the destination.
Unique Identifier	The concatenation of the Device Type and Device ID used in constructing the long frame address (see the Data Link Layer Specification). These data, when combined, uniquely identify a specific field device. No two devices ever manufactured may have the same combination of these data.

1.9.2 Acronyms and Symbols

All Symbols and Abbreviations used in this report are listed in this section.

APDU	A pplication P rotocol D ata U nit
DPDU	D ata-link P rotocol D ata U nit
DUT	D evice U nder T est
HCF	HART C ommunication F oundation
STO	S lave T ime- O ut
SOM	S tart O f M essage

2. REVIEW OF REGISTRATION PACKAGE

2.1 Registration Package Contents

The manufacturer supplied registration package was reviewed. A summary of the supplied versus required materials is shown in Table 1.

Table 1. Summary of Materials Supplied with Registration Package.

Contents	Included	Comments
Product Registration. HCF_FRM-110	Yes	
Properly completed	Yes	
<i>Token-Passing Data-Link Test Summary.</i> HCF_FRM-156.1	Yes	
<i>FSK Physical Layer Test Data Sheets.</i> HCF_FRM-156.2	Yes	
<i>Slave Universal Command Test Summary.</i> HCF_FRM-156.3	Yes	
<i>Slave Common Practice Command Test Summary.</i> HCF_FRM-156.4	Yes	
The product specification including device specific details as per <i>Field Device Specification Guide</i> (HCF_LIT-18)	Yes	Document: LIT-18_TiXo3.pdf
TP BA*.OUT (Token-Passing Data-Link) files	Yes	
TP DLL039a.qa.log and DLL039b.qa.log files	Yes	
TP UAL*.qa.log (Universal Command) files	Yes	
TP CAL*.qa.log (Common Practice Command) files	Yes	
Sample of device	Yes	
Purchase order for testing and registration fee	Yes	
Other supplied by manufacturer	Yes	Document: GEORGIN - TiXo3 - Instruction manual.pdf

2.2 Audit of manufacturer's test reports and data

2.2.1 FSK Physical Layer

The Regulateurs Georgin submittal of the FSK Physical Layer Test data (HCF_FRM-156.2) indicates the device passed all tests as a 2-wire high-impedance loop-powered transmitter. The scope captures and measurement data are presented as required. The submitted results were consistent with the HCF results.

2.2.2 Token-Passing Data-Link

The submitted results from Regulateurs Georgin indicated the device passed all Token-Passing Data Link Layer tests as a non-bursting slave field device (non-burst mode transmitter).

2.2.3 Universal Command Application Layer

The submitted FSK results from Regulateurs Georgin indicated the device passed all Universal tests as a transmitter.

2.2.4 Common Practice Command Application Layer

The Regulateurs Georgin device completed all Common Practice Application Layer (CAL) test cases. The transmitter does not support all Common Practice Commands.

3. INDEPENDENT TESTING BY HCF

As per *HCF Quality Assurance and Device Registration Procedure* (HCF_PROC-12), all devices submitted for registration shall be independently tested by the HCF. This Section summarizes the testing performed by the HCF and the resulting findings.

3.1 FSK Physical Layer

The HCF conducted the FSK Physical Layer tests on the FSK-based interface port of the Regulateurs Georgin TiXo3 Transmitter. The testing followed the procedures specified in the *FSK Physical Layer Test Specification* (HCF_TEST-2) to assess compliance with the *FSK Physical Layer Specification* (HCF_SPEC-54). The TiXo3 was tested as a 2-wire loop-powered high-impedance transmitter.

The DUT includes a temperature sensor.

The HCF conducted all 10 specified FSK Physical Layer tests. The DUT passed all tests

3.2 Token-Passing Data-Link

Token-Passing Data-Link Layer tests were performed using the FSK interface of the DUT using HART Registered RS-232 to HART adapters (modems). The HCF performed 46 Token-Passing Data Link Layer tests using HART Test System (HCF_KIT-192). All communications were recorded using ANALYS (HCF_TOOL-004) thus producing the binary .OUT files. These were, in turn analyzed using the Standard Token-Passing Data-Link Layer Compliance Assessors (post-processing HCF_TOOL-086).

The TiXo3 is a non-burst-mode transmitter.

The results are summarized in Annex A2 and the DUT passed all applicable tests.

3.3 Universal Command Application Layer

The HCF executed all 16 Universal Command Application Layer tests using the HART Test System (HCF_KIT-192) via the DUT's FSK Interface. All test message traffic was recorded in the .qa.log files associated with each test. The .qa.log files also contain descriptive information about the test and the device, as well as a pass-fail test disposition.

All tests were performed on the Token-Passing Data Link Layer using a HART Registered RS-232 to HART interface (modem) via a serial port. ANALYS was used in conjunction with the tests to visually monitor the message traffic. The results of the Universal Command Application Layer testing are summarized in Annex A3.

The DUT supports Universal Commands 0, 1, 2, 3, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 38, and 48.

The DUT passed all applicable Universal Command Application Layer tests.

3.4 Common Practice Command Application Layer

HCF Common Practice Command testing indicates that the DUT supports Common Practice Commands. The *Slave Common Practice Command Test Specification* (HCF_TEST-004) provides standard test specifications for many common practice commands.

The HCF executed all of the test automation available for the Common Practice Application Layer tests using the HART Test System (HCF_KIT-192) via the DUT's FSK interface. All test message traffic was recorded in the .qa.log files associated with each test. The .qa.log files also contain descriptive information about the test and the device, as well as a pass-fail test disposition.

All tests were performed on the DUT's FSK interface using a HART Registered RS-232 to HART interface (modem) via a serial port. Analys was used in conjunction with the tests to visually monitor the message traffic. The results of the Common Practice Command Application Layer testing are summarized in Annex A4.

The DUT supports Common Practice Commands 35, 40, 41, 42, 44, 54, 71, and 76.

The DUT supports Temperature Device Family Commands 1024, 1025, 1026, 1152, and 1155.

The DUT supports Device Specific Commands 128, 129, 131, 133, and 134.

All Common Practice Command Application Layer tests were run and concluded in a Pass result.

4. CONCLUSIONS

The Regulateurs Georgin TiXo3 Transmitter (Expanded Device Type Code 0xE0DE, Device Revision 0x01) meets all the requirements for registration based on the *HCF Quality Assurance and Device Registration Procedure* (HCF_PROC-12). Testing and analysis of the TiXo3 demonstrated the product compliance with the HART Communication Protocol Requirements. The device is considered HART Registered and now authorized to use the "HART Registered" mark and terminology in literature, documentation, marketing materials, and markings of the device described on the HART Certificate of Registration.

The Regulateurs Georgin TiXo3 Transmitter submitted for registration supports HART Protocol Revision 7 as a non-burst-mode 2-wire loop-powered transmitter.

HCF TEST SUMMARIES

A1. FSK Physical Layer

The following table summarizes the FSK Physical Layer test results of the FSK port of the DUT. The device was tested as 2-wire loop-powered transmitter.

DUT Identification

Manufacturer Name: Regulateurs Georgin

Model Name(s): TiXo3

Manufacture ID Code(HEX): 0x6032

Expanded Device 0xE0DE

Device ID (HEX): 0x02F68B

Type Code (HEX):

Test Result Summary

Test	Description	Result
13.1	Waveshape	Pass
13.2	Carrier Start / Stop	Pass
	Carrier Decay Timing	Pass
13.3	Carrier Start / Stop Transient	Pass
13.4	Output Noise During Silence	Pass
13.5	Analog Rate of Change	Pass
13.6	Receive Impedance Measurement (Type = High Impedance Transmitter) RX = 220kOhms CX= 1000pF	Pass
13.7	Send Impedance	Pass Not Applicable ¹
13.8	Noise Sensitivity	Pass
13.9	Carrier Detect Level	Pass
	Carrier Detect Start / Stop	Pass

¹ DUT is a transmitter therefore the test is "Not Applicable". By specification, the test is recorded as "Pass".

A2. Token-Passing Data-Link Layer

The Token-Passing Data-Link Layer tests were performed via the FSK interface.

DUT Identification

Manufacturer Name: Regulateurs Georgin

Model Name(s): TiXo3

Manufacture ID Code(HEX): 0x6032

Expanded Device 0xE0DE

Device ID (HEX): 0x02F68B

Type Code (HEX):

Test Result Summary

Test	Result
DLL001 FSK Preamble Check	
A. More Preamble Bytes Than Requested	Pass
B. From 5 up to Number Requested Preamble Bytes	Pass
C. 0 or 1 Preamble Bytes	Pass
D. Non 0xFF in Last Two Preamble Bytes	Pass
E. Non 0xFF Followed By Two 0xFF Bytes	Pass
F. Preamble Sequences with Non 0xFF Values	Pass
DLL002 Delimiter Check	Pass
DLL003 Frame Expansion Check	Pass
DLL004 Short Frame Check	Pass
DLL005 Master Address Bit Check	Pass
DLL006 Burst Mode Bit Check	Pass
DLL007 Long Frame Address Check	Pass
DLL009 Incorrect Byte Count Check	Pass
DLL010 Vertical Parity Check	Pass
DLL011 Framing Error Check	Pass
DLL012 Check Byte Test	Pass
DLL013 FSK Gap Receive Timeout Test	Pass
DLL014 Long Message Test	Pass
DLL015 Start Of Message In Data Field Check	Pass
DLL016 Preamble Check For BACK Frames	Pass Not Applicable ²
DLL017 Preamble Check For ACK Frames	Pass
DLL018 Gap Errors in ACK Frames Check	Pass
DLL019 Gap Check For BACK Frames	Pass Not Applicable
DLL020 Dribble Byte Check For ACK Frames	Pass
DLL021 Dribble Byte Test For BACK Frames	Pass Not Applicable
DLL022 Test Host Address Bit For BACK Frames	Pass Not Applicable
DLL023 Test Burst Mode Bit Of Burst-Mode Slave Frames	Pass Not Applicable

² The DUT does not support Burst Mode therefore these tests are "Not Applicable". By specification, these tests are recorded as "Pass".

Test	Result
DLL024 Test Slave Responds Within STO A. Verify STO for Selected Universal Commands B. Verify STO for All Commands C. Verify STO for Extended Command Numbers	Pass Pass Pass
DLL025 Burst Hold During Master Preamble	Pass Not Applicable ³
DLL026 Test Burst Response Time After a DUT ACK	Pass Not Applicable
DLL027 Test Response Time Between Consecutive Bursts	Pass Not Applicable
DLL028 BACK Timing with STXs Errors	Pass Not Applicable
DLL029 Burst Mode Timeout On Other Slave	Pass Not Applicable
DLL030 Burst After Response From Other Slave	Pass Not Applicable
DLL032 Read Unique Identifier (Command 0)	Pass
DLL033 Write Polling Address (Command 6) A. Test All Polling Addresses B. Test Invalid Data Fields C. Test Loop Current Signaling	Pass Pass Pass
DLL034 Read Unique Identifier with Tag (Command 11)	Pass
DLL035 Write Number Of Response Preambles (Command 59)	Pass
DLL036 Write Burst Mode Command Number (Command 108) A. Verify Mandatory Burst Commands B. BACK Changes Command Response In Burst Mode C. Support for 16-Bit Burst Command Numbers D. Support for Multiple Burst Messages	Pass Not Applicable Pass Not Applicable Pass Not Applicable Pass Not Applicable
DLL037 Burst Mode Control (Command 109) A. Enable/Disable Burst Mode B. Verify Burst mode through power cycles, self-test, reset C. Verify Supported Burst Mode Control Codes D. Support for Multiple Burst Messages	Pass Not Applicable Pass Not Applicable Pass Not Applicable Pass Not Applicable
DLL038 Read Unique Identifier With Long Tag (Command 21)	Pass
DLL039 Slave Time-Out Stress Test A. Verify Cyclical Data Access B. Verify Write Commands	Pass Pass
DLL040 Unique Address Test	Pass
DLL041 Framing Successive Messages	Pass
DLL042 Command Number Expansion	Pass
DLL043 Write Burst Device Variables A. Basic Command 107 Support B. Command 107 Support Across Burst Messages	Pass Not Applicable Pass Not Applicable
DLL044 Support for Multiple Burst Messages A. Verify support for at least 3 Burst Messages B.. Verify on-the-fly burst configuration changes	Pass Not Applicable Pass Not Applicable
DLL045 Smart Data Publishing	Pass Not Applicable

³ The DUT does not support Burst Mode therefore these tests are "Not Applicable". By specification, these tests are recorded as "Pass".

A3. Universal Command Application Layer

The Universal Command Application Layer tests were performed via the FSK interface. The following tables summarize the test results from performing the Universal Command Application Layer tests.

DUT Identification

Manufacturer Name: Regulateurs Georgin

Model Name(s): TiXo3

Manufacture ID Code(HEX): 0x6032

Expanded Device Type Code (HEX): 0xE0DE

Device ID (HEX): 0x02F68B

Test Result Summary

Test	Result
UAL000 Confirm All Universal Commands Supported	Pass
UAL001 Read Dynamic Variables (Commands 1, 2, and 3)	Pass Number of Dynamic Variables = 1
UAL005 Write Message	Pass
UAL006 Write Tag Descriptor and Date	Pass
UAL007 Verify Command 14 and 15 Response	Pass
UAL008 Write Final Assembly Number	Pass
UAL009 Verify Write Protect	Pass Not Applicable⁴
UAL010 Verify Cold Start Bit	Pass
UAL011 Read Device Variables (Command 9)	
Test Case A: Checking for Supported Device Variables	Pass
Test Case B: Checking Required Device Variables	Pass
UAL012 Read Dynamic Variable Classification	Pass
UAL013 Write Long Tag	Pass
UAL038 Reset Configuration Changed Flag	
Test Case A: Without Configuration Changed Counter	Pass
Test Case B: With Configuration Changed Counter	Pass
UAL048 Read Additional Device Status	
Test Case A: Basic checking of Command 48	Pass
Test Case B: Clearing the "More Status Available" bit	Pass

⁴ The DUT does not support write protect therefore this test is "Not Applicable". By specification, this test is recorded as "Pass".

A4. Common Practice Command Application Layer

The Common Practice Command Application Layer tests were performed via the FSK interface. The following tables summarize the test results from performing the Common Practice Command Application Layer tests.

DUT Identification

Manufacturer Name: Regulateurs Georgin

Model Name(s): TiXo3

Manufacture ID Code(HEX): 0x6032

Expanded Device 0xE0DE

Device ID (HEX): 0x02F68B

Type Code (HEX):

Test Result Summary

Test	Result
CAL000 Checks for Common Practice Commands	Pass
CAL001 Write Protect Test	Pass Not Applicable ⁵
CAL033 Read Device Variables	Pass Not Applicable
CAL034 Write Primary Variable Damping Value	Pass Not Applicable
CAL035 Write Primary Variable Range Values	Pass
CAL036 Set Primary Variable Upper Range Value	Pass Not Applicable
CAL037 Set Primary Variable Lower Range Value	Pass Not Applicable
CAL040 Enter/Exit Fixed Current Mode	Pass
CAL041 Perform Self-Test	Pass
CAL042 Perform Device Reset	Pass
CAL043 Set Primary Variable Zero	Pass Not Applicable
CAL044 Write Primary Variable Units	Pass
CAL045 Trim Loop Current Zero	Pass Not Applicable
CAL046 Trim Loop Current Gain	Pass Not Applicable
CAL047 Write Primary Variable Transfer Function	Pass Not Applicable
CAL049 Write Primary Variable Transducer Serial Number	Pass Not Applicable
CAL050 Read Dynamic Variable Assignments	Pass ⁶ Not Applicable
CAL051 Write Dynamic Variable Assignments	Pass Not Applicable
CAL052 Set Device Variable Zero	Pass Not Applicable
CAL053 Write Device Variable Units	Pass Not Applicable
CAL054 Read Device Variable Information	Pass Not Applicable
CAL055 Write Device Variable Damping Value	Pass Not Applicable
CAL071 Lock Device	
Test Case A: Basic Lock Testing	Pass
Test Case B: Write Lock on TDMA Products	Pass Not Applicable
CAL072 Squawk	Pass Not Applicable
CAL073 Find Device	Pass Not Applicable

⁵ The DUT does not support these common practice commands therefore these tests are "Not Applicable". By specification, these tests are recorded as "Pass".

⁶ HCF does not have standard test automation for CAL050, CAL053-CAL056, CAL079-CAL080, CAL091, CAL115, and CAL512. Consequently HCF used the Generic Device Description of the DD-IDE and manually monitored DUT Communication to confirm compliance with these test requirements

Test	Result	
CAL074 Verify I/O System Commands		
Test Case A: Basic I/O and Sub-device Tests	Pass	Not Applicable⁷
Test Case B: HART 7 I/O and Sub-device Testing	Pass	Not Applicable
Test Case C: Command 87 and 88 Testing	Pass	Not Applicable
Test Case D: I/O System and Sub-device Statistics	Pass	Not Applicable
CAL091 Trending		
Test Case A: Basic Trending Operation	Pass	Not Applicable
Test Case B: Basic Command 92 Testing	Pass	Not Applicable
Test Case C: Support for multiple trends	Pass	Not Applicable
CAL101 Subsystem Burst Mode	Pass	Not Applicable
CAL115 Event Notification		
Test Case A: Basic Tests for all HART devices	Pass	Not Applicable
Test Case B: Queuing of multiple events	Pass	Not Applicable
Test Case C: Events and sub-devices	Pass	Not Applicable
CAL512 Country Code	Pass	Not Applicable

⁷ The DUT does not support these common practice commands therefore these tests are "Not Applicable". By specification, these tests are recorded as "Pass".