U.S. Department of Transportation
Federal Motor Carrier Safety Administration

ELECTRONIC LOGGING DEVICE

Interface Control Document and ELD Web Services Development Handbook

Version 1.3

Prepared by:

Federal Motor Carrier Safety Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

June, 2020

Revision History

Revision Number	Document ID	Description of Change	Revision Date
1	V 1.0	Initial draft	August, 2017
2	V 1.1	Updates to tables and bullet item in Appendix A	August, 16 2017
3	V 1.2	Updates: • New allowed certificate hashing algorithms and associated key lengths • Addition of several new possible error values to Table 4-2. Validation Messages—Descriptions. • Revision to the requirements—including length—of the ELD Authentication Value	September 15, 2017
4	V 1.3	Updates: • Section 2.0 – Updated ELD web site URL • Section 2.1 – Updated ELD web site URL • Section 2.2.2 – Updated File Validator URL • Section 2.3 – Updated ELD web site URL • Section 2.3.2 – Updated ELD web site URL • Section 3.1.1 – Updated ELD web site URL • Section 3.2 – Updated ELD web site URL • Added Section 3.2.4 - FMCSA Public Certificate Expiration • Corrected a typo in table 4-4 • Appendix A – Updated ELD web site URL • Appendix B – Removed outdated links	June, 2020

List of Definitions

Term	Definition
<CR>	Used to represent a carriage return character (ASCII code 13) in text
<LF>	Used to represent a line feed character (ASCII code 10) in text
ASCII	American National Standard Code for Information Interchange as defined by ANSI INCITS 4-1986 is the standard for character encoding which should be used in the ELD Output File
Blank/Empty Field	When generating the ELD output file, a blank or empty field would be specified by leaving the space between the two comma values into which the field would go completely blank. No space, tab, or other whitespace characters need to be inserted to signify that the intention is for the field to be empty.
Field	Fields are the individual values contained in an ELD file line. A field is defined as the text between two commas, before the first comma and after the last comma in a file line. When two commas are encountered without any text between this is considered a blank/empty field and is valid for optional fields. A line with no commas will be considered to have a single field consisting of the entire contents of the line.
File Line	Text between two <CR> characters, the text before the first <CR> character found in the file and the text after the final <CR> character found in the file
Public/Private Key Pairs	Also known as Asymmetric keys, public/private key pairs are used for encrypting and decrypting data, as well as signing and verifying electronic signatures. Public keys can be distributed to anyone who requests them, while private keys must be kept private and secure.
FMCSA ELD Public Key	FMCSA's ELD public key will be used by providers to encrypt emails submitting ELD data using the S/MIME standard. FMCSA's public key will be available to providers by means of a digital certificate after device registration.
Manufacturer Public Key	Manufacturers' public keys, corresponding with their private keys, will be submitted to FMCSA during device registration by means of a digital certificate. FMCSA will verify manufacturers' electronic signatures using the public key on file when ELD data submission emails are received.
Manufacturer Private Key	Manufacturers' private keys, corresponding to their public keys, will be used by providers for the following purposes: • Electronically signing emails when submitting ELD data to FMCSA via email. • Connecting to FMCSA ELD web services to submit ELD data. • Calculating ELD Authentication Values when generating ELD files.
Section Header	The section header consists of a line and the value contained in that line which define the various sections of the ELD file. A complaint ELD CSV file will contain each section header exactly one time. Section header lines do not contain line data check values and do not contribute to the file data check value.

List of Abbreviations

Acronym	Definition
AOBRD	automatic on-board recording device
CMV	commercial motor vehicle
DOT	Department of Transportation
ECM	Electronic Control Module
ELD	electronic logging device
EOBR	Electronic On-Board Recorder
eRODS	electronic records of duty status software
FMCSA	Federal Motor Carrier Safety Administration
HOS	Hours-of-service
MAP-21	Moving Ahead for Progress in the 21st Century Act
RODS	records of duty status
SOAP	Simple Object Access Protocol
USB	Universal Serial Bus
VIN	Vehicle Identification Number

Table of Contents

Revision History **2**
List of Definitions **3**
List of Abbreviations **4**
1 Introduction **9**
1.1 Purpose and Scope 9
1.2 About the ELD Rule 9
1.3 Background 9
1.4 Roles and Responsibilities 10
2 Working with FMCSA **11**
2.1 Request a User Account with FMCSA 11
2.2 Development of Your Device and Test for ELD Rule Compliance 11
2.2.1 Provider Certificates 11
2.2.2 File Validator 11
2.3 Register Your ELD and Self-Certify 12
2.3.1 ELD Registration 12
2.3.2 Maintain Your Self-Certified Status 13
3 Methods of Transferring ELD Data to FMCSA **14**
3.1 ELD Web Service Interface 14
3.1.1 Process Overview 14
3.1.2 ELD Requirements 15
3.1.3 Interface 15
3.2 ELD Email Interface 20
3.2.1 Overview 20
3.2.2 ELD Requirements 21
3.2.3 Interface 22
3.2.4 FMCSA Public Certificate Expiration 26
3.3 USB 2.0 Interface 26
3.3.1 Overview 26
3.3.2 ELD Requirements 27
3.3.3 Process 27
3.4 Bluetooth® Interface 27
3.4.1 Overview 28
3.4.2 ELD Requirements 29
3.4.3 Process 29
4 ELD Output File **30**
4.1 Provider Confirmation of Certification 30
4.2 File Validation 30
4.2.1 Validation Status Values 30
4.2.2 Potential Validation Messages 30
4.3 Data Check Values 33
4.3.1 ASCII Character Mapping 33
4.3.2 Event Data Check Calculation 34
4.3.3 Line Data Check Calculation 35
4.3.4 File Data Check Calculation 36

4.4 VIN Check Digit Calculation 38
4.4.1 Example 39
4.5 Output File Data Dictionary 40
4.5.1 Header Segment 41
4.5.2 User List 46
4.5.3 CMV List 47
4.5.4 ELD Event List for Driver's Record of Duty Status 47
4.5.5 Event Annotations, Comments, and Driver's Location Description 50
4.5.6 ELD Event List for Driver's Certification of Own Record 51
4.5.7 Malfunction and Diagnostic Event Records 52
4.5.8 ELD Login/Logout Report 53
4.5.9 CMV's Engine Power-Up and Shut-Down Activity 54
4.5.10 Event Log List for the Unidentified Driver Profile 56
4.6 File Data Check Value 59
4.6.1 File Data Check Line 59
4.6.2 Empty Line 59
Appendix A: ELD Technical Specifications—Points of Clarification 60
Appendix B: Additional Resources 61
Appendix C: References 62

List of Figures

Figure 1-1. Data Transfer Operational Environment 10
Figure 3-1. Web Service Data Transfer Process (Telematics) 15
Figure 3-2. Email Data Transfer Process (Telematics) 21
Figure 3-3. USB 2.0 Data Transfer Process (Local) 27
Figure 3-4. Bluetooth® Data Transfer Process (Local) 28

List of Tables

Table 1-1. Roles and Responsibilities 10
Table 3-1. ELD Submission Elements 16
Table 3-2. Description of Version Value V1 17
Table 3-3. Validity of ELD Submission Response Object 17
Table 3-4. ValidationError Elements 18
Table 3-5. DiagnosticRequest Elements 18
Table 3-6. DiagnosticResponse Elements 19
Table 3-7. DiagnosticResponseStatus Values 20
Table 3-8. Composing an Email Message 22
Table 3-9. Subject Line Formatting 22
Table 3-10. Submitted Email File Description 23
Table 3-11. Response to a Test ELD Submission 24
Table 3-12. Diagnostic Submission Test 24
Table 3-13. Response Parameters Definitions ..... **Error! Bookmark not defined.**
Table 3-14. Response to Parameters Definitions ..... **Error! Bookmark not defined.**
Table 4-1. Validation Status Values 30
Table 4-2. Validation Messages—Descriptions 31
Table 4-3. Encoded Character Sequence Example 33
Table 4-4. Event Data Check Calculation Example 34
Table 4-5. Line Data Check Calculation—Numeric Values—Example 36
Table 4-6. Line Data Check Calculation—Values Example 37
Table 4-7. VIN Check Digital Calculation Mapping 39
Table 4-8. Numeric Digit Equivalents Based on Placement in VIN 39
Table 4-9. VIN Check Digital Calculation Mapping Conversion Example 39
Table 4-10. Numeric Digit Equivalents Based on Placement in VIN Example 39
Table 4-11. Driver Line Definition 41
Table 4-12. Co-Driver Line Definition 42
Table 4-13. Power Unit Line—Definition 42
Table 4-14. Carrier Line—Definition 43
Table 4-15. Shipping Line—Definition 44
Table 4-16. Time/Place Line—Definition 44
Table 4-17. ELD ID Line—Definition 45
Table 4-18. User List—Definition 46
Table 4-19. CMV List Line—Definition 47
Table 4-20. Event List—Driver's Record of Duty Status Line Definition 47
Table 4-21. Event Annotations, Comments, and Driver's Location—Line Definition 50
Table 4-22. Event List—Driver's Certification of Own Record Line Definition 51
Table 4-23. Records—Malfunction and Diagnostic Event Line Definition 52

Table 4-24. Login and Logout Report Line Definition 53
Table 4-25. Activity for the CMV's Engine Power-Up and Shut-Down Line Definition 54
Table 4-26. Event Log List—Unidentified Driver Profile Line Definition 57
Table 4-27. File Data Check Line 59

1 Introduction

1.1 Purpose and Scope

This Interface Control Document and Electronic Logging Device Web Services Development Handbook has been prepared by the Volpe National Transportation Systems Center (Volpe Center) for the Federal Motor Carrier Safety Administration (FMCSA) to guide and support providers with the development of their electronic logging devices (ELDs) in accordance with FMCSA's published specifications of the Final Rule.

ELD providers are required to create an account with FMCSA in order to register their ELDs. As part of the ELD registration process, ELD providers must self-certify that they have conducted tests to verify their device meets the technical specifications detailed in the ELD Rule. The ELD registration process is described in Section 2, along with necessary technical components and optional tools made available by FMCSA that provide assistance.

Section 3 lists and describes the four methods of transferring ELD data to FMCSA: Web Service, USB, Email, and Bluetooth® interfaces.

The tables in Section 4 provide guidance to providers and developers to follow the specifications described in the ELD rule when generating ELD output files.

Updated versions of this document may be made available as changes occur to ELD input/output values, validation, error, or data check messaging, and example scenarios, as well as to the ELD Rule.

1.2 About the ELD Rule

The ELD Rule, mandated by Congress as part of the Moving Ahead for Progress in the 21st Century Act (MAP-21), calls for regulations requiring the use of ELDs in commercial motor vehicles (CMVs) involved in interstate commerce, when operated by drivers who are required to keep records of duty status (RODS).

The purpose of implementation of the ELD Rule is to improve compliance with FMCSA's Hours-of-Service (HOS) rules regulating the length of time a driver can operate a CMV. The intended result is a decrease in the frequency of fatigued driving by commercial truck drivers—reducing crashes, injuries, and fatalities involving large trucks and buses on our highways.

The deadline for adopting ELDs is December 18, 2017. Carriers that adopt automatic on-board recording devices (AOBRDs) prior to this date will have until December 16, 2019, to convert to ELDs. (See 49 CFR 395.15).

The ELD Rule details the minimum performance and design standards for ELDs, including all operational, hardware and software interface specifications, as well as requirements for use. This document provides developers with the interface functions and output file parameters required for ELDs to be fully functional and compliant.

1.3 Background

ELDs must be capable of generating and transmitting a data file containing driver RODS/HOS data, and capable of transmitting that file to FMCSA. Upon receipt of the ELD's data file, safety enforcement personnel will review the data using RODS/HOS business rules, derived from FMCSA regulations, to determine driver compliance during a roadside inspection. ELDs must also be capable of displaying RODS/HOS data via either screen display or printout.

Figure 1-1 is a high-level graphical depiction of the data transfer operational environment.

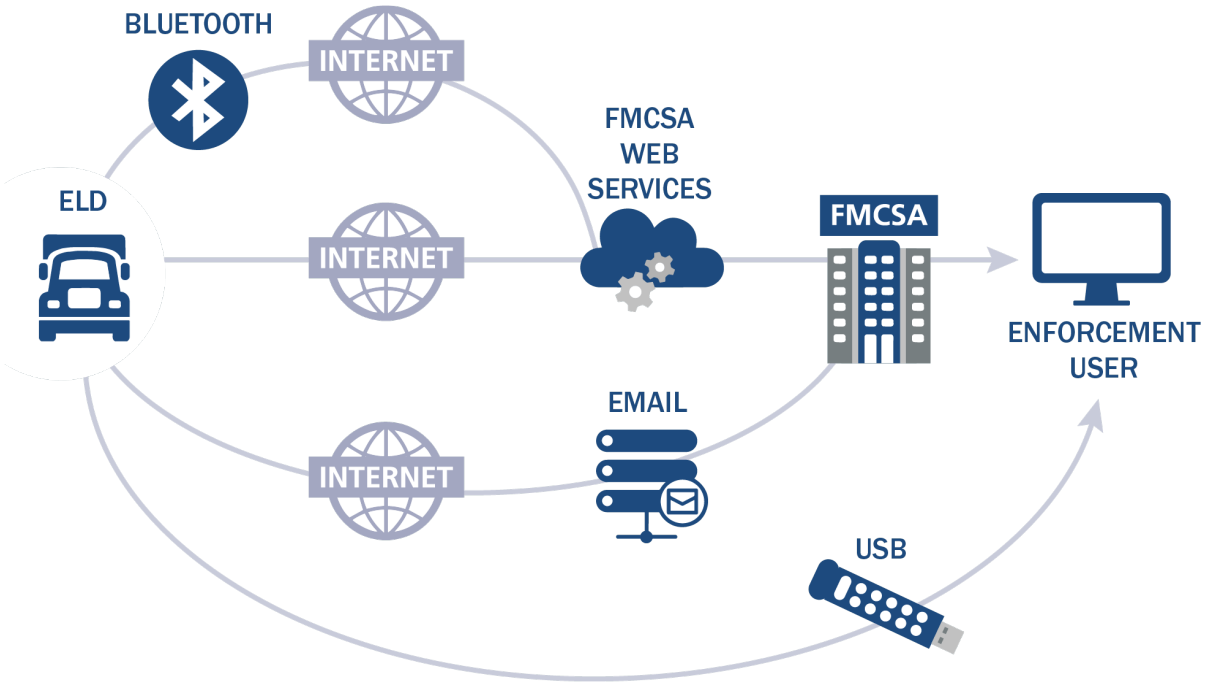

Figure 1-1. Data Transfer Operational Environment

1.4 Roles and Responsibilities

FMCSA, carriers, and providers each have a role in implementing and adhering to the ELD rule. These rules are described in Table 1-1.

Table 1-1. Roles and Responsibilities

FMCSA	Carrier	Provider
• Inform carriers/drivers and providers about requirements of ELD Final Rule • Maintain Web Services to facilitate data transfer (coming soon) • Train enforcement personnel on how to use ELDs (coming soon) • Remove ELDs known to not meet requirements set forth in Final Rule from list of self-certified ELDs	• Select ELDs that best fit their needs • Train drivers on how to use ELDs • Ensure that all non-exempt vehicles and drivers have functioning ELDs	• Register company with FMCSA • Self-certify and register devices with FMCSA • Ensure security of devices • Respond to carriers to quickly resolve any ELD malfunctions • Keep ELD self-certification up-to-date with FMCSA

2 Working with FMCSA

FMCSA is committed to working with our partners throughout the entire process while providers develop, manufacture, market, and sell their ELDs. To ensure a smooth transition, FMCSA's ELD Website provides essential up-do-date information and the latest developments for providers, carriers, and drivers to stay compliant with the ELD Rule.

2.1 Request a User Account with FMCSA

ELD product providers will need to request a user account with FMCSA. Only individuals granted permission to authorize devices on behalf of the provider may register for an account.

> ***To request an ELD Provider Account visit the FMCSA ELD website: https://eld.fmcsa.dot.gov and select "request a user account."***

2.2 Development of Your Device and Test for ELD Rule Compliance

This section contains information about ELD Provider certificates and the File Validator tool available for providers to verify that their ELD output file conforms to the technical specifications in the ELD Rule.

2.2.1 Provider Certificates

All providers will need a public/private key pair for their ELDs. Key pairs do not have to be unique for individual devices—the same public/private key pair can be used by a provider for all ELD devices. However, each provider must have their own public/private key pair (they may not be shared by providers). Providers must register the public key portion of the public/private key pair used by a device, by means of a certificate, during the self-certification process.

Providers may purchase a certificate from a certificate authority (CA), or may use a self-signed certificate. When requesting a certificate from a CA or generating a self-signed certificate, providers must make certain the certificate adheres to best practices:

- Signature Algorithm: SHA-256 (also SHA-384 and SHA-512) with PKCS #1 RSA Encryption (e.g sha256RSA, sha384RSA, sha512RSA) or ANSI X9.62 ECDSA Signature with SHA256 (also SHA-384 and SHA-512) (e.g., sha256ECDSA, sha384ECDSA, sha512ECDSA)
- Signature Hash Algorithm: sha256, sha384, sha512
- Public Key Length: (at least) 2048 bits for RSA or 256 bits for ECDSA
- If certificate usage is restricted with a Key Usage extension, then "Digital signature", "Non-repudiation", "Key encipherment", "Data encipherment", and "Key agreement" should be allowed explicitly in that extension.

Providers will use their certificates when:

- Electronically signing emails when submitting ELD data to FMCSA via email
- Connecting to FMCSA ELD web services to submit ELD data
- Calculating ELD Authentication Values when generating ELD files

FMCSA will honor the expiration date listed in providers' certificates. Should an ELD device submit data using an expired certificate, FMCSA will consider the device to be out of compliance with the ELD rule.

2.2.2 File Validator

The ELD File Validator is an online tool that FMCSA has provided for providers to verify that an ELD output file conforms to the technical specifications specified in the ELD Rule. This tool utilizes the same

ELD data file validation process that FMCSA performs on all ELD files that are transmitted to FMCSA via email, web service, Bluetooth®, or USB transfer methods.

The File Validator checks for:

- Required fields
- Field lengths
- Line and file data check values
- Invalid characters
- Date, time, and number validity

Approved files will be validated with a message of "okay," or failed files will see details on specific error responses.

The File Validator will only validate the technical specifications of an ELD file, not the file's content. Compliance with FMCSA's Hours of Service or other regulations will be determined by enforcement personnel's interpretation of the data after it has successfully transferred through FMCSA's systems.

> ***The File Validator is not a mandatory step to self-certify; however, the tool is provided to assist providers in verifying that their ELD files meet with the technical specifications specified in the ELD rule. For instructions to test files using the ELD File Validator and for special tips, visit the FMCSA ELD website:***
>
> ***https://eld.fmcsa.dot.gov/Provider/Validator***

2.3 Register Your ELD and Self-Certify

After taking the necessary steps as described in section 2.2 to self-certify that your ELD is compliant, you can now register the ELD with FMCSA. Visit the ELD Website "Register your ELD."

2.3.1 ELD Registration

Once ELD Providers receive confirmation that their user account has been successfully created with FMCSA, information to the ELD Providers Portal will be sent. ELD Providers can then proceed through the registration process for each ELD that meets the technical specifications set forth in the ELD Rule.

2.3.1.1 Self-Certify Your ELD

During ELD Registration, ELD Providers must provide a "Certifying Statement of FMCSA Regulation Testing" that explains to FMCSA that the ELD model and version has been sufficiently tested to meet the functional requirements included in the technical specifications in the Appendix to subpart B of part 395, title 49 of the Code of Federal Regulations, under the conditions in which the ELD would be used. Once the ELD has been reviewed and approved by FMCSA, the ELD Provider will receive email confirmation, and the ELD will be placed on the list of self-certified ELDs.

2.3.1.2 Rules of Behavior

Self-Certifying your ELD Device constitutes an electronic signature conveying acceptance of the following rules of behavior:

1. I will not knowingly interfere with, disable, circumvent, or compromise any and all security controls, auditing, or monitoring enabled on FMCSA networks supporting ELDs. I will not knowingly introduce any malicious code into the system or the DOT network.
2. I will not share security-related information about the FMCSA information systems, software, or networks with entities outside the FMCSA unless otherwise authorized and approved in writing. I will not share any ELD-specific data, such as authentication values or private key information.

3. I will not pursue any other unspecified activities using FMCSA information systems resources that I know to be wrong, or that is patently outside the purpose of those systems in supporting FMCSA programs and the FMCSA mission.
4. I understand that violations of the above principles and practices may lead to reprimand and or civil or criminal prosecution.
5. I understand that the system is an official U.S. Federal Government web-based system and that my acceptance expressly gives assurance that I will comply with all U. S. Federal Government and Department of Transportation (DOT) regulations, policies, and procedures governing the protection, handling, processing, transmission, distribution, and destruction of sensitive unclassified information utilized by the system.

I understand that I must comply with all restrictions, procedures, and processes specified in the ELD Rule.

2.3.2 Maintain Your Self-Certified Status

Providers are responsible to keep their ELDs current. When products are modified, updates need to be added on the registration site located on the FMCSA ELD Website. FMCSA's goal is to make sure carriers are using compliant ELDs and is committed to working with providers to ensure you have all the information needed to comply.

Should FMCSA find a device that does not conform to the ELD Rule, the provider will receive written notice and be given the opportunity to take corrective actions, if necessary. After a specified time period to make corrections, ELDs that remain non-compliant may be removed from the Self-Certified ELD list. See Final Rule, section 5.4.1 for details on the removal process.

3 Methods of Transferring ELD Data to FMCSA

There are four acceptable methods for transferring ELD data to FMCSA enforcement personnel. The four data transfer methods are grouped into two options: telematics (Web Services and Email) and local transfers (USB 2.0 and Bluetooth®). Providers must ensure that ELDs offer at least one complete option group.

The four data transfer methods are described below. Each method includes a process overview with detailed interface description.

3.1 ELD Web Service Interface

The ELD web service defines functions which may be used by the ELD: to submit ELD output files, and to verify that the ELD's certificate, ELD Identifier, and Registration ID are still valid.

3.1.1 Process Overview

The FMCSA ELD SOAP web service and endpoint will be provided on the ELD Provider Registration website (https://eld.fmcsa.dot.gov) for users with an approved ELD Provider account.

Transfer of ELD data to FMCSA via Web Services will utilize these standards:

- Web Services Description Language (WSDL) 1.1
- Simple Object Access Protocol (SOAP) 1.2
- Extensible Markup Language (XML) 1.0 5th Edition
- Transport Layer Security (TLS) Protocol Version 1.2

How It Works

1. ELD connects to a FMCSA ELD SOAP web service and submits:
   - The ELD data file.
   - An Output File Comment, as provided by safety enforcement.
   - (optional) "Test" flag.

   Access to the ELD FMCSA Web Service will require the ELD device to utilize the provider certificate described in section 2.2.1 above as a "client certificate".
2. FMCSA validates the client certificate with certificate submitted by the provider during self-certification of ELD, and verifies that the client certificate has not expired or been removed by the provider and that the ELD has not been removed from the self-certified list.
3. ELD data file is validated and response is sent back to the caller.
4. Based on the validation status the file will:
   - If no errors are found, it will be passed on to the inspector.
   - If errors are found, they will be indicated in the SOAP response and the inspector will be informed of the validation failure.

How To Test

- ELD submit function will have an optional "test" flag. When set, submissions will not be sent on to inspectors or be used by FMCSA for verifying device compliance with the ELD Final Rule.
- Certificate validation will be enforced when using the test flag.
- To enable testing prior to device registration, FMCSA will provide:

- Testing device certificate containing both public and private keys.
- Sample ELD Identifier.
- Sample ELD Registration ID.

- Once the provider has a registered and approved device, they may continue testing using the key(s), ELD Identifier, and ELD Registration ID of the registered device.

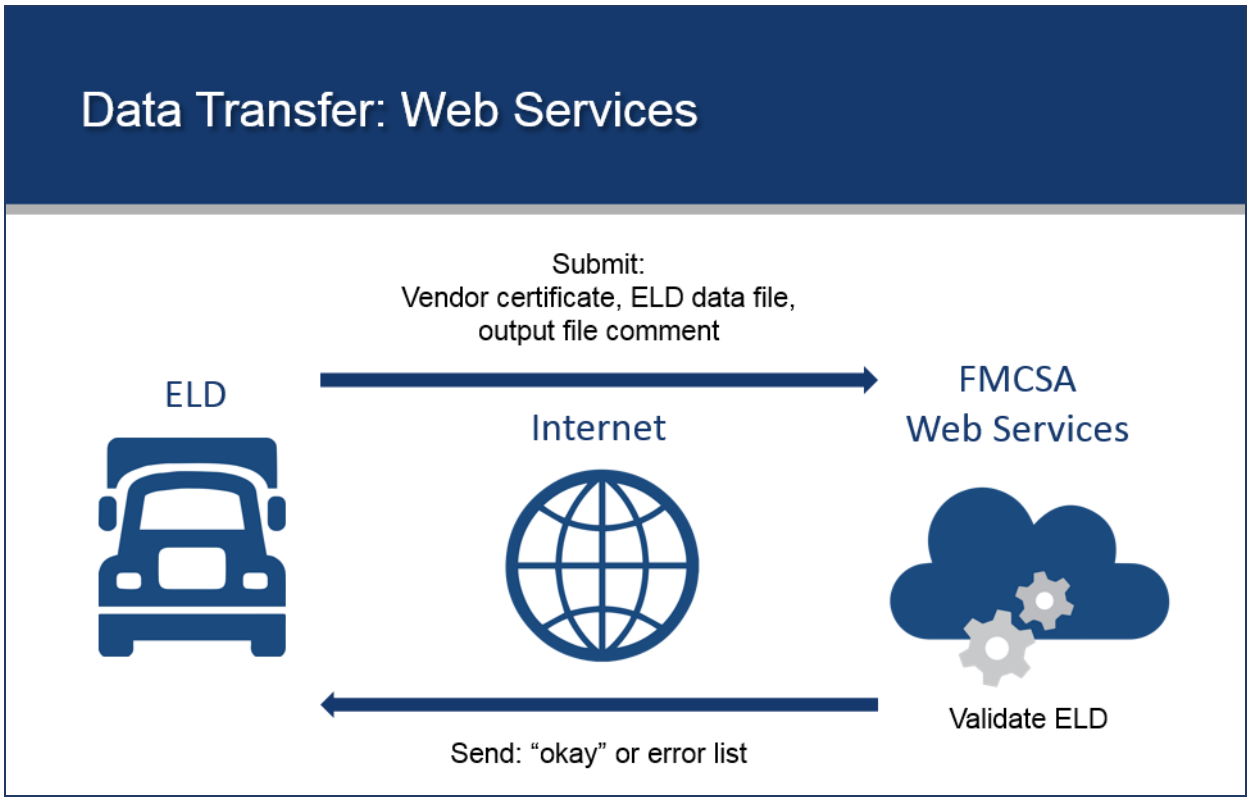

Figure 3-1. Web Service Data Transfer Process (Telematics)

3.1.2 ELD Requirements

The ELD:

- Has its own internet connection.
- Has been self-certified and approved via the ELD registration website.
- Uses the ELD Identifier ELD Provider's certificate supplied during the ELD self-certification process.
- Uses the ELD Registration ID provided to the ELD provider when their device registration has been approved.
- Is capable of establishing a secure communication channel with the SOAP web service endpoint.
- When using the test flag defined below, the provider may utilize the sample ELD Identifier, sample ELD Registration ID, and testing device certificate, which will be provided to registered providers through the ELD registration website.

3.1.3 Interface

The following sections provided implementation details for the ELD submission web service functions. The details that follow should be used in conjunction with the web service definition language (WSDL) and service end points which will be provided to registered ELD providers via the registration website.

3.1.3.1 Submit

The submit function will allow an ELD to transmit an ELD output file to FMCSA for validation and relay to an inspector unless the optional "test" flag is set. The function accepts an instance of the composite type "ELDSubmission" and returns an instance of the composite type "ELDResponse".

3.1.3.1.1 ELD Submission

The submission object contains information necessary to submit an ELD output file to FMCSA for validation and delivery to the inspector. When submitting data to the ELD submission service, the ELDIdentifier, ELDRegistrationID, and client certificate are validated against devices registered and approved via the ELD Provider Registration website. For submissions with the "test" flag set the additional sample certificate and registration information will be considered valid.

Table 3-1. ELD Submission Elements

Element Name	Description	Data Type	Constraints
OutputFileComment	Required: A textual field that may be populated with information pertaining to the created ELD output file; An authorized safety official may provide a key phrase or code to be included in the output file comment, which may be used to link the requested data to an inspection, inquiry, or other enforcement action; if provided to the driver by an authorized safety official, it must be entered into the ELD and included in the exchanged dataset as specified.	String	0-60 characters in length.
ELDIdentifier	Required: An alphanumeric identifier assigned by the ELD provider to the ELD technology that is certified by the registered provider at FMCSA's website.	String	6 characters.
ELDRegistrationId	Required: An alphanumeric registration identifier assigned to the ELD provider that is registered with FMCSA during the ELD registration process.	String	4 characters.
OutputFilename	Required: Name of the ELD output file as defined in section 4.8.2.2 of the Final Rule.	String	25 characters in length, plus an optional file extension (ex .csv, .txt, etc.)
OutputFileBody	Required: Contents of the ELD output conforming to the standard outlined in section 4.8.2.1 of the Final Rule.	String	String of variable length.
Version	Required: Indicates the version of the ELD output file being submitted. Currently there is only a single valid version of the file as defined by the Final Rule published December 16, 2015.	Version (Enum)	Currently only the value V1 (1) is available.
Test	Optional: If provided a value of true will indicate that the service is being used by a provider to perform compliance testing of their device with FMCSA's service. When the service is run in test mode the ELD output file will not be made available to any inspectors through internal mechanisms.	Boolean	True or false, If no value is provided, false is assumed. True or false, If no value is provided, false is assumed.

3.1.3.1.1.1 Version

The version enum only lists V1 (1) as a possible value. This enum will be edited to include new items if new versions of the ELD file specification are released in the future. There are currently no active plans for such a release and this parameter is merely meant to add a measure of future-proofing to the interface.

Table 3-2. Description of Version Value V1

Value	Description	Numeric Equivalent
V1	Version of the ELD output file conforming to the specification defined in the ELD Final Rule published December 16, 2015.	1

3.1.3.1.2 ELDSubmissionResponse

The response object contains details about the validity of the ELD submission, which may be used by the provider to display a success message or diagnose errors.

Table 3-3. Validity of ELD Submission Response Object

Element Name	Description	Data Type	Constraints
Status	Required: Overall status of the submission, indicates the most severe status of any individual message in order from Valid, Informational, Warning, Error.	ValidationStatus (Enum) See File Validation section for a definition of the different status types	Valid (1), Error (2), Warning (3), Info (4).
ErrorCount	Required: Number of validation messages identified.	Integer	Integer of 0 or greater.
Errors	Optional: If ErrorCount is greater than 0, an array of ValidationError objects describing the individual validation issues found with the file.	ValidationError[]	Array of 0 or more items.
Broadcast	Required: Global message from FMCSA, will be used in conjunction with email and other distribution channels to communicate major program announcements.	String	Max length of 4000 characters.
SubmissionId	Required: Identifier used to track the submission internally, can be used to identify a specific submission when discussing validation issues with FMCSA support staff.	GUID	Globally unique value

3.1.3.1.2.1 ValidationError

Contains information about a single instance of a validation issue discovered within an ELD output file. For details on all possible validation errors, see 4.2.2.

Table 3-4. ValidationError Elements

Element Name	Description	Data Type	Constraints
ErrorType	Required: Indicator of the severity of the issue identified and whether it will cause the ELD file to be unreadable by the inspector or not. In case of a warning the file will be displayed to the inspector with indicators identifying potential issues with the file contents.	ValidationStatus (Enum) See File Validation section for a definition of the different status types	Error (2), Warning (3), Info (4).
Message	Required: Short general description of the issue encountered when validating the file and ELD. A comprehensive list of potential errors is included with this handbook.	String	Max length of 200 characters.
Detail	Optional: If supplied, the detailed message will give additional information which will aid the provider in diagnosing the specific instance of the issue. For example, the error message "Missing Required Field" would be accompanied by a detailed message indicating which field was impacted and under what circumstances it is required.	String (HTML)	HTML snippet.
Line	Required; Number of the file line on which the error was encountered. For errors related to missing lines or global file errors, a value of 0 will be used.	Integer	First line of the file will be considered 1.
Start	Required: Column within the line at which the error begins, for errors in which a 0 would be returned for the Line value, a 0 will also be returned for the Start value.	Integer	First position in the line is 1, final position in the line is the line length.
End	Required: Column within the line at which the error ends, for errors in which a 0 would be returned for the Line value, a 0 will also be returned for the End value.	Integer	First position in the line is 1, final position in the line is the line length.

3.1.3.2 Ping

The ping SOAP function allows an ELD to confirm access to the ELD submission service to satisfy the connectivity diagnostic check when no data files have been submitted to FMCSA. Submitting a ping request will ensure that the device can connect to the FMCSA service and that its supplied certificate, ELD Identifier, and ELD Registration ID are still mapped to a certified device in FMCSA's systems.

3.1.3.2.1 DiagnosticRequest

This section contains descriptive information for data element names ELDIdentifier and ELD RegistrationID as it pertains to Diagnostic Request.

Table 3-5. DiagnosticRequest Elements

Element Name	Description	Data Type	Constraints
ELDIdentifier	Required: An alphanumeric identifier assigned by the ELD provider to the ELD technology that is certified by the registered provider at FMCSA's website.	String	6 characters.

Element Name	Description	Data Type	Constraints
ELDRegistrationId	Required: An alphanumeric registration identifier assigned to the ELD provider that is registered with FMCSA during the ELD registration process.	String	4 characters.

3.1.3.2.2 DiagnosticResponse

This section contains descriptions for the element names Status, Detail, and Broadcast as they pertain to the DiagnosticResponse.

Table 3-6. DiagnosticResponse Elements

Element Name	Description	Data Type	Constraints
Status	Required: Defines the status of the provider registration data.	DiagnosticResponseStatus (Enum)	Any status.
Detail	Optional: If supplied the detailed message will give additional information which will aid the provider in diagnosing the specific instance of the issue. For example, the error message "Missing Required Field" would be accompanied by a detailed message indicating which field was impacted and under what circumstances it is required.	String (HTML)	HTML snippet
Broadcast	Optional: Global message from FMCSA, will be used in conjunction with email and other distribution channels to communicate major program announcements.	String	Optional, max length of 4000 characters

3.1.3.2.2.1 DiagnosticResponseStatus

This section contains Enum response codes associated with a ping request to the FMCSA ELD web service.

Table 3-7. DiagnosticResponseStatus Values

Value	Description	Numeric Equivalent
Success	Provider information is current and valid	1
InvalidRegistrationData	Information submitted in the ping request does not match any known ELD	2
ELDDecertified	Information submitted matches an ELD that has been decertified by FMCSA	3
UnexpectedError	Some other error has been encountered by the system	4

3.2 ELD Email Interface

The ELD email interface defines the specifics of the method through which an ELD may submit an ELD output file via a secure email message to FMCSA for delivery to the inspector. Files will be received and validated by the email service and a reply will be sent back to the "From" address used in the email with success or error message.

The FMCSA ELD submission email address will be provided via the ELD Provider Registration Website at: (https://eld.fmcsa.dot.gov).

3.2.1 Overview

How It Works

1. Transfer via email to FMCSA's ELD email address.

> ***Email transfers should only be used to transfer ELD data via FMCSA's ELD email address, not directly to a roadside inspector.***

2. Using the secure/multipurpose internet mail exchange (S/MIME) standard, the email must be encrypted using AES-256 (AES cipher with a 256-bit key length) and FMCSA's ELD public key. The message must be signed using the manufacturer's ELD private key that corresponds with the ELD public key submitted to FMCSA by the provider when self-certifying the ELD.

3. Once transmitted to FMCSA:
   - FMCSA will decrypt the email using FMCSA's ELD private key.
   - The provider's signature will be validated using the manufacturer's public key submitted to FMCSA by the provider when self-certifying the ELD.
   - The ELD file will be validated.

4. A reply will be sent to the "From" address indicating success or providing a list of errors.

How To Test

- Test emails will be identified by prefixing the subject line with the keyword "TEST."

For example:

TEST: ELD records from <ELD REGISTRATION ID>:<ELD IDENTIFIER>

- "TEST" submissions will not be sent on to inspectors or used by FMCSA for verifying device compliance with the final rule.

- Signature will be validated using the ELD registration database.
- To enable testing prior to device registration, FMCSA will provide:
    - Testing device certificate containing both public and private keys
    - Sample ELD Identifier
    - Sample ELD Registration ID

> ***KEY TERMS:***
>
> ***FMCSA ELD public key:*** ***available to download from ELD web site provider portal after registration.***
>
> ***Manufacturer private key:*** ***corresponds to manufacturer's public key, which is submitted during device self-certification.***

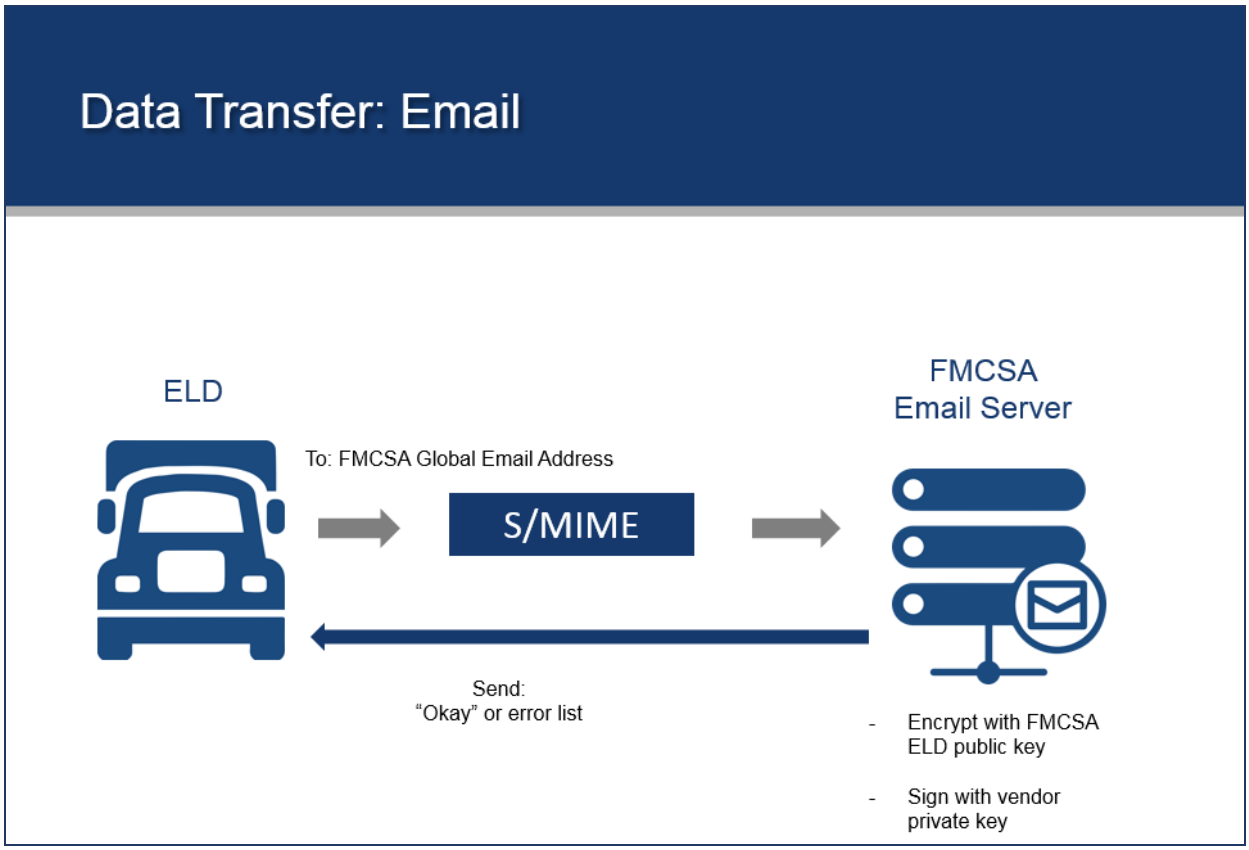

Figure 3-2. Email Data Transfer Process (Telematics)

3.2.2 ELD Requirements

The ELD:

- Has its own internet connection and access to an email server of the provider's choice.
- Has been registered and approved via the ELD registration website.
- Uses the ELD Identifier ELD Provider's certificate supplied during the ELD self-certification process.
- Uses the ELD Registration ID provided to the provider when their device registration has been approved.

- Must be capable of generating an encrypted email in compliance with the S/MIME standard using the FMCSA ELD public key for encryption and Manufacturer's ELD private key (paired to one of the certificates supplied to FMCSA during device registration).
- Has a copy of the FMCSA public key to be used in S/MIME encryption.

When using the test method defined below, in addition to values associated with registered and approved ELDs, the provider may utilize the sample ELD Identifier, ELD Registration ID and Certificate which will be provided to registered providers through the ELD registration site prior to device registration.

3.2.3 Interface

The following section defines the email interface.

3.2.3.1 Submission Process

To submit an ELD output file via the email mechanism the ELD should:

- Create an email message with characteristics that are detailed in Table 3-8.
- Encrypt the email using the S/MIME protocol and the FMCSA public key provided on the ELD registration site using AES-256.
- Sign the encrypted email using the provider's private key matching the certificate provided by the provider during device self-certification.

Table 3-8. Composing an Email Message

Headings	Description
To	<ELD-SUBMIT-ADDRESS>@dot.gov
From	<Desired return address for confirmation>
Subject	<Subject Routing Information>
Body	<Output file comment>
Attachment	<ELD Output File/Sample File>

3.2.3.2 Subject Routing Information

The subject line of the email submission determines how the email is handled when received. It can be used to test the submission process or to test email connectivity between the ELD and FMCSA. Subjects should be formatted as shown in Table 3-9.

Table 3-9. Subject Line Formatting

Format	Purpose
ELD records from <ELD Registration ID>:<ELD Identifier>	**ELD Submission** Normal routing mechanism: • Received email will be decrypted. • Provider registration checked and signature confirmed. • File will be validated. • A response will be sent back to the "From" address with a success message or list of issues. • File will be stored for retrieval by the inspector. •
TEST: ELD records from <ELD Registration ID>:<ELD Identifier>	**Test ELD Submission** Test version of the normal routing mechanism which may be used by the ELD Provider for testing their ELD to ensure it can correctly interface with FMCSA for data submission. The test operation is identical to normal

Format	Purpose
(Cont.)	operation except that the ELD file is not stored for retrieval by the inspector.
ELD ping from <ELD Registration ID>:<ELD Identifier>	**Diagnostic Submission Test** Diagnostic routing mechanism, when this mechanism is used the output file comment and output file should be a simple text string and text file of the providers choosing. Once received the email service will do the following: • Received email will be decrypted. • Provider registration will be checked and signature confirmed. • Success or error response will be sent indicating the status of the carrier's certification.

3.2.3.3 Response

Responses for the live and test versions of the record submission email will be almost identical, while the ping response will have a different format as it does not include any detailed validation messaged.

Unlike the email submissions, all confirmation responses will be sent as plain text email without encryption.

3.2.3.4 ELD Submission

The response to a normal ELD file submission email will contain information on the submitted file including:

- Validation status
- Submission ID
- Error list (if applicable)
- Broadcast message (optional)

Table 3-10. Submitted Email File Description

Headings	Description
To	<Desired return address for confirmation>
From	<ELD-SUBMIT-ADDRESS>@dot.gov
Subject	ELD records from <ELD Registration ID>:<ELD Identifier> received with <Validation Status>
Body	Submission ID:<Submission ID> Broadcast:<Message from FMCSA> Errors: <Line Number>:<Start Column>:<End Column>:<Status>:<Message> (Line Repeated for each error encountered)

3.2.3.4.1 Test ELD Submission

The response to a test ELD submission is largely identical to a normal response with a few exceptions:

- ELD Submission ID will not be tied to any saved submission as test services are for provider testing only and are not saved to make them available for inspector review.
- Subject line will include a "TEST:" prefix just like the email submission.

Table 3-11. Response to a Test ELD Submission

Headings	Description
To	<Desired return address for confirmation>
From	<ELD-SUBMIT-ADDRESS>@dot.gov
Subject	TEST: ELD records from <ELD Registration ID>:<ELD Identifier> received with <Validation Status>
Body	Submission ID:<Submission ID> Broadcast:<Message from FMCSA> Errors: <Line Number>:<Start Column>:<End Column>:<Status>:<Message> (Line Repeated for each error encountered)

3.2.3.4.2 Diagnostic Submission Test

The response to a diagnostic submission will contain information about the current registration status of the ELD allowing an ELD to confirm its ability to connect to FMCSA via the email mechanism to submit an ELD file.

Table 3-12. Diagnostic Submission Test

Headings	Description
To	<Desired return address for confirmation>
From	<ELD-SUBMIT-ADDRESS>@dot.gov
Subject	ELD ping from <ELD Registration ID>:<ELD Identifier> received with <Diagnostic Status>
Body	Diagnostic result <Diagnostic Status>

3.2.3.4.3 Response Parameters Definitions

The table below provides detail for the response parameters.

Table 3-13. Response Parameters Definitions

Parameter	Description	Constraints
Validation Status	Overall status of the submission, indicates the most severe status of any individual message in order from Valid, Informational, Warning, Error.	May be: Error, Warning, Information, Valid
Line Number	Number of the file line on which the error was encountered. For errors related to missing lines or global file errors, a value of 0 will be used.	First line of the file will be considered 1
Start Column	Column within the line at which the error begins, for errors in which a 0 would be returned for the Line value, a 0 will also be returned for the Start value.	First position in the line is 1, final position in the line is the line length
End Column	Column within the line at which the error ends, for errors in which a 0 would be returned for the Line value, a 0 will also be returned for the End value.	First position in the line is 1, final position in the line is the line length
Status	Required: Indicator of the severity of the issue identified and whether it will cause the ELD file to be unreadable by the inspector or not. In the case of a warning the file will be displayed to the inspector with indicators identifying potential issues with the file contents.	Error, Warning or Info
Message	Optional: If supplied the detailed message will give additional information which will aid the provider in diagnosing the specific instance of the issue. For example the error message “Missing Required Field” would be accompanied by a detailed message indicating which field was impacted and under what circumstances it is required.	HTML snippet
Submission ID	Identifier used to track the submission internally, can be used to identify a specific submission when discussing validation issues with FMCSA support staff.	GUID
Broadcast Message	Global message from FMCSA, will be used in conjunction with email and other distribution channels to communicate major program announcements.	Optional: up to 4000 characters
Diagnostic Status	Required: Defines the status of the provider registration data.	See Table 3-12.

Table 3-14. Response to Parameters Definitions

Headings	Description
Success	Provider information is current and valid.
InvalidRegistrationData	Information submitted in the ping request does not match any known ELD.
ELDDecertified	Information submitted matches an ELD that has been decertified by FMCSA.
UnexpectedError	Some other error has been encountered by the system.

3.2.4 FMCSA Public Certificate Expiration

FMCSA public certificates are valid for a period of time, after which they expire. FMCSA's public key is included within the metadata of FMCSA's public certificate. Prior to the expiration date, FMCSA will publish a new FMCSA certificate to the ELD provider page on the ELD web site (https://eld.fmcsa.dot.gov/provider). Until the old public certificate has expired, both the old and new FMCSA key may be used to encrypt emails per section 3.2.1 of this document. Once the old public certificate has expired, only the new FMCSA public key may be used when encrypting emails per section 3.2.1. After the expiration date, any email that uses the old certificate will be rejected. FMCSA strongly encourages ELD providers to update their software and push updates to ELDs using the updated FMCSA key as soon as possible after a new FMCSA public certificate is published.

3.3 USB 2.0 Interface

The USB transfer method provides the simplest mechanism for transferring an ELD output file from the ELD to the inspector's laptop for review. Only the ELD, laptop, and a secure USB drive are required so the transfer can occur even when it is not conceivable to have an internet connection of any type.

3.3.1 Overview

How It Works

1. Inspector connects a hardware-encrypted USB device to the ELD and inputs the device key to decrypt the USB drive.
2. Driver initiates the ELD transfer of the output file to the USB device.
3. ELD verifies the contents of the USB verification file provided on the ELD registration website to ensure proper device connectivity.
4. ELD saves the ELD output file to the verified USB device.
5. Inspector connects USB device to his/her laptop and enters the USB device key to decrypt it.
6. ELD file is validated locally using software on the inspector's PC.

How To Test

- Confirm the ELD can transfer data files to various USB devices.

> ***Safety Officials will only make use of devices that provide a FIPS 140-2 validated hardware mechanism for device decryption.***

- Use the file validator website to confirm the generated ELD file meets the ELD specification.

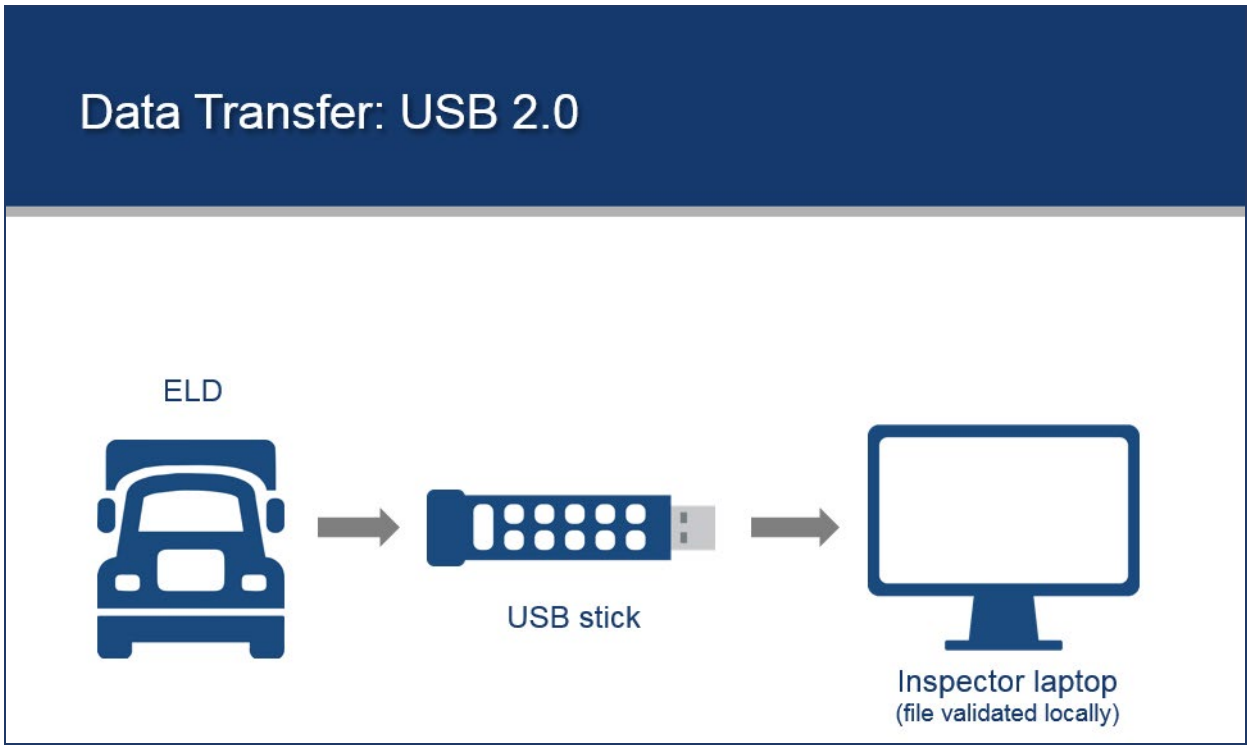

Figure 3-3. USB 2.0 Data Transfer Process (Local)

3.3.2 ELD Requirements

- A USB drive supporting hardware encryption will be provided by the inspector. This drive will not require any software to run on the ELD to provide encryption/decryption and will instead make use of a physical key input mechanism on the USB device.
- The ELD is not required to verify that the USB device it is connecting to meet the FMCSA encryption requirements; this will be the responsibility of FMCSA.
- The USB drive will contain a verification file which will be used by the ELD to confirm proper connection to the USB device by matching the file contents to the reference file which will be provided by FMCSA through the registration website.
- The ELD must be self-certified and approved on the ELD registration site at least 60 days prior to the ELD being used for USB-based data transfer.

3.3.3 Process

- Inspector connects a hardware-encrypted USB device to the ELD and inputs the device key to decrypt the USB drive.
- Driver initiates the ELD transfer of the output file to the USB device.
- ELD verifies the contents of the USB verification file provided on the ELD registration website to ensure proper device connectivity.
- Inspector connects USB device to his/her laptop and enters the USB device key to decrypt it.
- ELD file is validated locally using software on the inspector's PC.

3.4 Bluetooth® Interface

The Bluetooth® transfer method provides a mechanism for ELDs without their own internal internet connection to connect to the internet and then transfer the ELD Output File using the ELD web services as described in section 3.1 of this document.

3.4.1 Overview

How It Works

1. A **personal area network** (**PAN)** is made available by enforcement, via Bluetooth®, to the ELD, providing an operational internet connection. The ELD will use the internet connection provided by the Bluetooth® device to submit the ELD data file via FMCSA Web Services.

> ***Bluetooth® is not intended to allow direct transfer of the ELD data file to an inspector device.***

2. ELD connects to an FMCSA SOAP service and submits:
   - The ELD data file.
   - An Output File Comment, as provided by safety enforcement.
   - (optional) "Test" flag.
3. FMCSA validates ELD certification status.

4. ELD data file is validated.
   - If no errors are found, it will be passed onto the inspector.
   - If errors are found, they will be indicated in the SOAP response.

How To Test

- Providers should confirm the ELD can effectively pair with a variety of third-party devices sharing an internet connection via Bluetooth.
- Web services testing methods should be used once it is confirmed the device can successfully connect to the internet.

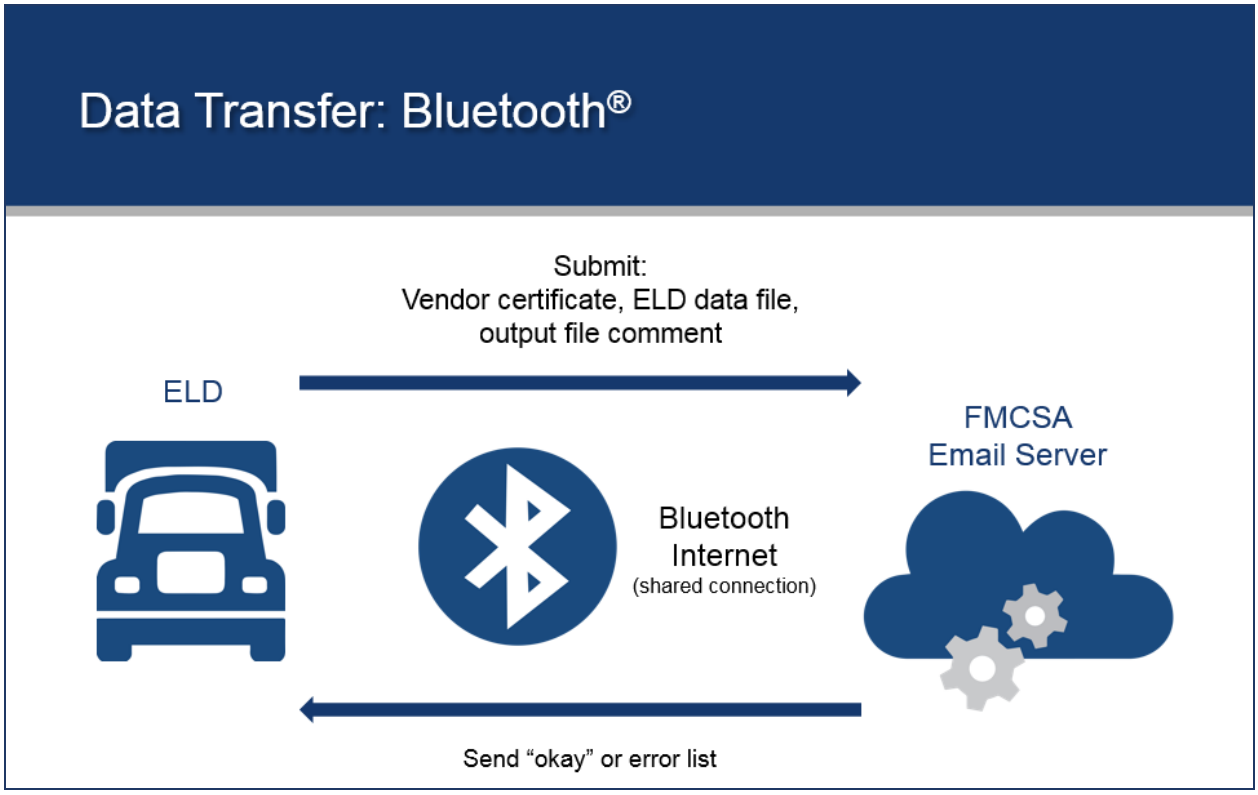

Figure 3-4. Bluetooth® Data Transfer Process (Local)

3.4.2 ELD Requirements

- The ELD is capable of using at a minimum Bluetooth 2.1 to connect to a shared internet connection provided by the roadside inspector.
- The shared internet connection will provide internet access to reach the FMCSA ELD submission endpoint.
- The ELD meets all requirements for web service data transfer defined in 3.1.

3.4.3 Process

- PAN is made available by enforcement, via Bluetooth®, to the ELD, providing an operational internet connection. The ELD will use the internet connection provided by the Bluetooth® device to submit the ELD data file via FMCSA Web Services as defined in 3.1.3.

4 ELD Output File

4.1 Provider Confirmation of Certification

As a part of the ELD file validation process, the ELD's registration information will be checked to ensure the ELD is self-certified, approved, and up-to-date. Specifically, the validation process will confirm:

- The ELD Identifier and ELD Registration ID is provided in the file and—in all cases except for USB transfer—as parameters during the file submission match the values from an approved ELD registration.
- The certificate used to authenticate (via key exchange for web services or S/MIME signing for email) the ELD is one of the certificates provided during ELD registration and has not yet expired or been removed by the provider.

4.2 File Validation

File validation examines two aspects of the ELD Output File:

1. Does the file meet the basic requirements defined in section 4.8.2 ELD Data File of the Final Rule Appendix? Examples:
    a. Required field was missing.
    b. Format of a field in the file does not match what is required.
2. Does the file contain data which indicates the ELD was in an invalid state? Examples:
    a. Lower precision location information is provided in intermediate logs without the indication that the CMV is being used for authorized personal use.
    b. Engine hours and/or vehicle miles are blank even though the CMV engine is in the on state.

4.2.1 Validation Status Values

Validation status values indicate whether or not a particular issue or situation was encountered.

Table 4-1. Validation Status Values

Value	Description	Numeric Equivalent
Valid	No errors encountered when validating the ELD output file.	1
Error	An issue was discovered during the validation process which will result in the inspector being unable to open or trust the contents of the ELD Output File.	2
Warning	An issue was discovered which makes the file out of compliance with the rule, but the file can still be loaded and viewed by the inspector so the decision of whether to accept or reject the contents lies with them.	3
Info	Indicated a situation that is being flagged for informational purposes. These messages will be passed to the inspector for review, but do not necessarily indicate any issue with the data file. Example: An informational message would be passed indicating that the file contains malfunction events to aid the inspector in reviewing the file.	4

4.2.2 Potential Validation Messages

The table below describes each message that carries a potential validation occurrence.

Table 4-2. Validation Messages—Descriptions

Message	Severity	Description
Incorrect File Data Check Value	Error	File data check value computed based on the file contents does not match the values included in the file line of the ELD Output File. The detailed message will include intermediate calculation values to make debugging the issue simpler.
Incorrect Line Data Check Value	Error	Line data check value computed using the contents of the file line does not match the value included in the final field of the line. The detailed message will include intermediate calculation values to make debugging the issue simpler.
Incorrect Number of Line Value(s)	Error	File line contains fewer or more than the expected number of fields for a line of its type.
Invalid Character	Warning	File contains a character that is not a part of the ASCII character set defined by ANSI INCITS 4-1986; this may result in invalid data being displayed to the enforcement user.
Unexpected Line	Error	A line was encountered that contains text but could not be identified. Section headers are used to identify line types so this error typically indicates a typo in a section header or incorrect layout of one of the End of File or ELD File Header sections.
Missing File Section	Error	A section of the file could not be identified, sections are identified by matching the section header text with the contents of each file line. Check the supplied section headers to ensure there are no errors. When looking for errors whitespace around each section header is ignored, but internal whitespace must match the specification.
Missing CMV	Error	A CMV Order Number referenced in an event record was not found in the CMV List. All CMVs referenced in the ELD file should be included in the CMV List.
Missing ELD User	Error	An ELD User Order Number referenced in an event record was not found in the User List. All ELD Users referenced in the ELD file should be included in the User List.
Missing File Line	Error	Line expected to exist was not found in the file. Only the ELD File Header Segment and End of File sections require specific line mapping and this error will always refer to a line from one of those sections.
Duplicate File Section	Error	A section header value appeared more than once in the ELD Output File.
Missing Required Field	Context Dependent	A field defined by the rule as required has not been supplied. When analyzing the file, fields with only whitespace will be considered blank.
Invalid Field Length	Error	A field with a restricted length does not match a specific length, or it is outside the valid range of length.
Field Value is Outside Valid Range	Error	For numeric fields with a specific range of possible values, the value supplied is a number but it falls outside the range of values defined in the Final Rule.
Invalid Field Format	Error	For fields which define a specific structure, the value supplied does not match the format specified in the rule, when this error is encountered the regular expression used to validate the field's contents will be supplied in the error details.
Invalid Value	Error	For fields which are restricted to a specific list of values, the supplied value was not found in the list. When this error is encountered the list of potential values for the field will be supplied in the detailed error response.
Invalid Decimal	Error	The supplied value could not be parsed as a decimal number.

Message	Severity	Description
Invalid Integer	Error	The field value cannot be parsed as an integer. When parsing integer numbers, a trailing ".0" will not be considered valid.
Invalid Date	Error	The field value could not be parsed as a date. Dates should be encoded using the format "Mmddyy", where "MM" is the two digit month number, "dd" is the two digit day of the month and "yy" are the final two digits of the year.
Invalid Time	Error	The field value could not be parsed as a time. Times should be encoded using the format "HHmmss", where "HH" is the two digit hour value using a 24-hour clock, "mm" is the minute value and "ss" is the second value.
Invalid VIN	Warning	The VIN does not have a valid check-digit. See 49 C.F.R. & sect. 565 and ISO 3779:2009 for information on the VIN format.
Invalid Hex Value	Error	The field could not be parsed as a hex value (containing only 0-9, A-F and a-f).
Unexpected Empty Line	Warning	For the purpose of the ELD file, a line is defined as the text between two <CR> characters, as well as the text before the first <CR> character in the file and after the final <CR> in the file. A valid ELD file should contain only a single empty line following the <CR> character which proceeds the File Data Check Value. Presence of additional empty lines in the file could indicate multiple <CR> characters being used as a line delimiter, or un-escaped <CR> characters in contents of a file line (<CR> characters should be replaced by ";" characters to conform to the ELD specification).
Invalid Line Delimiter	Warning	The file is using something other than a single <CR> as a line delimiter.
Unexpected Quote Delimiters	Error	Individual field values in this ELD file have been wrapped with double quote characters. This is a method often used to allow delimiter characters <CR> or ',') to appear within individual field values. The ELD file specification instructs providers to replace any <CR> or ',' characters encountered in ELD data with ';' characters.
No Lines	Error	The submitted ELD file does not contain any line delimiters. Single <CR> characters should be used to identify lines. Please review the submitted file to ensure the correct delimiter has been used.
Empty File	Error	The submitted ELD file is blank and does not contain any usable information. Please check to make sure you have submitted the correct file.
Invalid Coordinate Value	Error	The value supplied is not valid for a coordinate component (longitude or latitude). This means it should be either a decimal number with one or two digits of precision, the character "X" (indicating location could not be determined), or the character "M" (indicating the location was manually entered by the driver).
Invalid ELD Registration Information	Error	The ELD Identifier, ELD Registration ID and (if supplied) the certificate value do not match a valid ELD registration. This will be a warning if the issue is an expired or inactive certificate.
ELD Revoked	Error	The ELD Identifier, ELD Registration ID and (if supplied) the certificate value to match a valid ELD registration, but that registration has been revoked for failure to conform to the ELD Final Rule.
Certificate Expired	Warning	The certificate used to sign the S/MIME email or authenticate for connection to the web service has expired.
Parameter Mismatch	Context Dependent	The ELD Registration ID, ELD Identifier or Output File Comment sent in the subject/body of the S/MIME email or as parameters in the web service call do not match those values contained in the ELD output

Message	Severity	Description
(Cont.)	(Cont.)	file. This will be a Warning severity when submitted using the test flag, but will be an Error when submitted without this flag set.
Test Information	Context Dependent	The ELD Registration Id or ELD Certificate used to submit the ELD Output file are the test values provided by FMCSA. When the test flag is set these will have a severity of Info; without the test flag they will have a severity of Error.
Unable to Verify S/MIME Signature	Error	Either the email was not signed or it was signed using a certificate not associated with the ELD. Note: All signatures submitted with the S/MIME email will be verified; if any of them cannot be verified this error will be returned.
Unable to Decrypt the S/MIME Message	Error	Either the email was not encrypted or it was not encrypted using the public key certificate provided by FMCSA on the ELD Provider Registration website.
Invalid Message Subject	Error	When using email transfer, the subject line of the email did not conform to any of the three formats described in.3.2.3.2.
Multiple Attachments	Error	After decrypting the email message, more than one attachment was found. When submitted multiple ELD Output Files, each file should be sent as a separate attachment.
No Attachment	Error	After decrypting the email message, no ELD Output File was found as an attachment.

4.3 Data Check Values

The ELD specification defines three (3) data checks which will be performed on data in the ELD:

- Event Data Check – calculated when the event is created and transmitted as part of the ELD output file.
- Line Data Check – used to verify the data in most lines in the ELD CSV file (except section headers and the file data check value).
- File Data Check – used to verify the total contents of the file. It is calculated using the Line Data Check values as a source.

4.3.1 ASCII Character Mapping

See Table 3, Appendix A of the Final Rule.

Each of the three (3) data check values use a mapping formula to translate the text contained in the file into a numeric value. For a single character to derive the numeric encoding:

1. If the character is not in the character set 1-9, A-Z or a-z it should be represented by the number 0.
2. If the character is 1-9, A-Z or a-z, the numeric representation of the character is the characters ASCII code minus 48.

4.3.1.1 Example

The character sequence “012, ABC, xyz!” would be encoded. See below.

Table 4-3. Encoded Character Sequence Example

Character	0	1	2	,	N/A	A	B	C	,		X	Y	Z	!
ASCII	N/A	49	50	N/A	N/A	65	66	67	N/A	N/A	120	121	122	N/A
Encoding	0	1	2	0	0	17	18	19	0	0	72	73	74	0

4.3.2 Event Data Check Calculation

See section 4.4.5.1 in Appendix A of the Final Rule. The event data check should be calculated at the time the event is created and stored along with the event. It is included in the ELD output file but because all user account usernames are not included in the ELD output file it cannot necessarily be validated by FMCSA without additional information from the ELD.

To calculate the event data check:

1. Collect the values for the following fields:
    a. Event Type
    b. Event Code
    c. Event Date
    d. Event Time
    e. Vehicle Miles
    f. Engine Hours
    g. Event Latitude
    h. Event Longitude
    i. CMV Power Unit Number
    j. ELD Username
2. Use the ASCII character mapping to compute a numeric value for each of the characters in each of the fields listed in step 1 and sum all these values to produce a single number.
3. Extract the lowest byte from the total value.
4. Perform three consecutive circular shift left operations on this byte.
5. XOR the output with the value 195 (decimal)/C3 (hex)/11000011 (binary).
6. Convert the result to a two character hexadecimal string representation and save this value as your Event Data Check.

4.3.2.1 Example

1. Collect the values for the types identified in step 1 and use the ASCII mapping to compute a numeric mapping for each value and sum those values to get a total value.

Table 4-4. Event Data Check Calculation Example

Field	Value	Numeric Mapping
Event Type	1	1
Event Code	1	1
Event Date	051217	0+5+1+2+1+7=16
Event Time	134410	1+3+4+4+1+0=13
Vehicle Miles	123	1+2+3=6
Engine Hours	2.4	2+0+4=6
Event Latitude	34.21	3+4+0+2+1=10
Event Longitude	-87.07	0+8+7+0+0+7=22
CMV Power Unit Number	ZZZZZ12345	42+42+42+42+42+1+2+3+4+5=225
ELD Username	Jon_Doe	26+63+62+0+20+63+53=287
Total	N/A	1+1+16+13+6+6+22+10+225+287=587

2. Extract the lower byte from the total value.

   0=>587
   1=>1001001011
   2=> 01001011

3. Perform three consecutive circular shift left operations on this byte.

   0=>01001011
   1=>10010110
   2=>00101101
   3=>01011010

4. XOR the output with the value 195 (decimal)/C3 (hex)/11000011 (binary).

```
      01011010
XOR 11000011
============
      10011001
```

5. Convert the result to a two character hexadecimal string representation and save this value as your Event Data Check.

   0=>10011001
   1=>99

4.3.3 Line Data Check Calculation

See section 4.4.5.2 in Appendix A of the Final Rule.

The line data check value is calculated on each line of the ELD output file, with the exception of the section headers and the File Data Check line. The value is appended as a final field in the line when the data file is created.

To calculate the line data check:

1. Use the ASCII character mapping to compute a numeric value for each of the characters in the line.
2. Extract the lowest byte from the total value.
3. Perform three consecutive circular shift left operations on this byte.
4. XOR the output with the value 150 (decimal)/96 (hex)/10010110 (binary).
5. Convert the result to a two-character hexadecimal string representation and save this value as your Line Data Check.

4.3.3.1 Example

1. Use the ASCII character mapping to compute a numeric value for each of the characters in the line: 0123,1,1,1,1,051217,134410,123,2.4,34.21,-87.07,1,1,1,0,0,62.

Table 4-5. Line Data Check Calculation—Numeric Values—Example

Value	Map	Value	Map	Value	Map	Value	Map	Value	Map
0	0	,	0	1	1	4	4	1	1
1	1	0	0	0	0	.	0	,	0
2	2	5	5	,	0	2	2	1	1
3	3	1	1	1	1	1	1	,	0
,	0	2	2	2	2	,	0	1	1
1	1	1	1	3	3	-	0	,	0
,	0	7	7	,	0	8	8	0	0
1	1	,	0	2	2	7	7	,	0
,	0	1	1	.	0	.	0	0	0
1	1	3	3	4	4	0	0	,	0
,	0	4	4	,	0	7	7	9	9

2. Extract the lowest byte from the total value.

   0=>104
   1=>01101000
   2=>01101000

3. Perform three consecutive circular shift left operations on this byte.

   0=>01101000
   1=>11010000
   2=>10100001
   1=>01000011

4. XOR the output with the value 195 (decimal)/C3 (hex)/10010110 (binary).

```
      01000011
XOR 10010110
============
      11010101
```

5. Convert the result to a two-character hexadecimal string representation and save this value as your Line Data Check.

   0=>11010101
   1=>D5

4.3.4 File Data Check Calculation

See section 4.4.5.3 in Appendix A of the Final Rule.

The file data check value is calculated once the ELD Output File is generated. It incorporates each of the line data check values into a final check value. The value is appended as the final field in the file and followed by a <CR> character.

To calculate the file data check:

1. Extract the Line Data Check values from each line in the ELD output file for which they were generated, convert them back into decimal numbers and sum them to find a file total.
2. Extract the lowest two bytes from the total value.
3. Perform three consecutive circular shift left operations on each byte of the extracted value
4. XOR the output with the value 38556 (decimal)/ 969C (hex)/10010110 10011100 (binary)
5. Convert the result to a four-character hexadecimal string representation and save this value as your File Data Check.

4.3.4.1 Example

1. Extract the Line Data Check values from each line in the ELD output file for which they were generated, convert them back into decimal numbers, and sum them to find a file total.

> ***The example file presented here meets the valid format of an ELD Output File but does not contain data which would be considered valid and is intended only to demonstrate the File Data Check calculation.***

Table 4-6. Line Data Check Calculation—Values Example

Line	Line Data Check	Value
ELD File Header Segment:	N/A	0
DOE,JON,Jon_Doe,MA,S1326545,DF	DF	223
,,,96	96	150
ZZZZZ12345,ABCDEFG1534567890,1234 567 891,C8	C8	200
5555555,FMCSA TRUCKING INC,7,000000,04,58	58	88
ABC12345,0,BC	BC	188
051217,154410,34.21,-87.07,123456,3086.4,DD	DD	221
0001,012345,ABCDEFGHIJ12334567,FMCSA Example,71	71	113
User List:	N/A	0
1,D,DOE,JON,33	33	51
CMV List:	N/A	0
1,MA12345, ABCDEFG1534567890,41	41	65
ELD Event List:	N/A	0
0120,1,1,1,1,051217,134410,123,2.4,34.21,-87.07,1,1,1,0,0,99,BD	BD	189
0121,1,1,1,1,051217,134410,123,2.4,34.21,-87.07,1,1,1,0,0,99,A5	A5	165
0122,1,1,1,1,051217,134410,123,2.4,34.21,-87.07,1,1,1,0,0,99,AD	AD	173
0123,1,1,1,1,051217,134410,123,2.4,34.21,-87.07,1,1,1,0,0,99,D5	D5	213
ELD Event Annotations or Comments:	N/A	0
Driver's Certification/Recertification Actions:	N/A	0
Malfunctions and Data Diagnostic Events:	N/A	0
ELD Login/Logout Report:	N/A	0
011F,2,FBITH741121,021317,143318,624727,18234.5,71	71	113
0124,1,FBITH741121,021317,100127,624542,18230.0,08	08	8
CMV Engine Power-Up and Shut Down Activity:	N/A	0
011E,3,021317,144036,624727,18234.6,34.2,-87.07,MA12345,ABCDEFG1534567890,316,19475A,4B	4B	75

Line	Line Data Check	Value
0125,1,021317,090911,624541,18229.1,33.96,-84.51,MA12345,ABCDEFG1534567890,345,19475A,EB	EB	235
Unidentified Driver Profile Records:	N/A	0
End of File:	N/A	0
Total = 2470	N/A	N/A

2. Extract the lowest two bytes from the total value.

   0=>2470
   1=>00001001 10100110
   2=>00001001 10100110

3. Perform three consecutive circular shift left operations on each byte of the extracted value.

   0=>00001001 10100110
   1=>00010010 01001101
   2=>00100100 10011010
   3=>01001000 00110101

4. XOR the output with the value 38556 (decimal)/ 969C (hex)/10010110 10011100 (binary).

```
       01001000 00110101
XOR    10010110 10011100
=====================
       11011110 10101001
```

5. Convert the result to a four-character hexadecimal string representation and save this value as your File Data Check.

   0=>11011110 10101001
   1=>DEA9

4.4 VIN Check Digit Calculation

See 49 C.F.R. § 565 and ISO 3779:2009 for more information.

For both manually entered and electronic control module (ECM)-supplied VIN numbers, validation will be performed on the VIN check-digit to help ensure accuracy of the supplied data. Errors will be flagged for the inspector to review and it would be advisable to perform similar edit checks on manually entered VIN numbers.

To calculate the VIN check digit:

1. Ensure the VIN:
   a. contains 17 characters;
   b. only contains capital letters and numbers;
   c. does not contain the characters ‘I’, ‘O’, or ‘Q’
2. Convert all letters in the VIN number into their numeric equivalent using the mapping in the table below.

Table 4-7. VIN Check Digital Calculation Mapping

Vin Check Mapping								
A:1	B:2	C:3	D:4	E:5	F:6	G:7	H:8	N/A
J:1	K:2	L:3	M:4	N:5	N/A	P:7	N/A	R:9
N/A	S:2	T:3	U:4	V:5	W:6	X:7	Y:8	Z:9

3. Multiply each numeric equivalent (or numeric digit) based on its placement in the VIN using the table below.

Table 4-8. Numeric Digit Equivalents Based on Placement in VIN

Vin Check Digits																
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
8	7	6	5	4	3	2	10	0	9	8	7	6	5	4	3	2

4. Sum the resulting values to produce a total for the VIN.

5. Modulus the sum by 11.

6. This value will be the check digit which is placed or compared to position 9 of the VIN based on the Rule:

    a. 0-9: check digit is the value
    b. 10: check digit is 'X'

4.4.1 Example

Perform a check digit calculation on the sample VIN: ABCDEFG1534567890

1. Check that the VIN is the appropriate length and contains only valid characters:
   Confirmed
   Convert all letters in the VIN number into their numeric equivalent.

Table 4-9. VIN Check Digital Calculation Mapping Conversion Example

Vin Check Digits - Conversion																
A	**B**	**C**	**D**	**E**	**F**	**G**	**1**	**5**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**
1	2	3	4	5	6	7	1	5	3	4	5	6	7	8	9	0

2. Multiply each numeric equivalent (or numeric digit) based on its placement in the VIN.

Table 4-10. Numeric Digit Equivalents Based on Placement in VIN Example

Vin Check Digits - Conversion																	
Pos.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Val.	1	2	3	4	5	6	7	1	5	3	4	5	6	7	8	9	0
X	8	7	6	5	4	3	2	10	0	9	8	7	6	5	4	3	2
Res.	8	14	18	20	20	18	14	10	0	27	32	35	36	35	32	27	0

3. Sum the resulting values to produce a total for the VIN.

   8+14+18+20+20+18+14+10+0+27+32+35+36+35+32+27+0=346

4. Modulus the sum by 11.

   346 MOD 11 = 5

5. Using the mapping rule identify the value of the check digit and compare is to the value in position 9 of the VIN.

   5=>5
   ABCDEFG1534567890

4.5 Output File Data Dictionary

This section is an enhancement to the output file format and data dictionary from sections 4.8.2.1 and 7 of the Final Rule, "Appendix A to Subpart B of Part 395—Functional Specifications for All Electronic Logging Devices (ELDs)." The format in this document is organized by data file section rather than generic element type and pulls in additional supporting information from the earlier parts of the Final Rule to clarify specific scenarios.

> ***The segment identifiers should be used as they appear here without the surrounding quotes.***

4.5.1 Header Segment

Segment Identifier: "ELD File Header Segment:"

Each of the next seven (7) lines must then appear in the specific order that follows. The information will be tied to specific line layouts based on the order the lines appear after the header segment identifier.

4.5.1.1 Driver Line

Information on this line will define the driver for whom the ELD output file was generated. The driver's account must also appear in the "User List" section of the file.

Table 4-11. Driver Line Definition

Name	Description	Required	Constraints
Driver's Last Name	Last name of the driver holding an ELD account, should match the value from the driver's license.	Yes	String between 2 and 30 characters
Driver's First Name	First name of the driver holding an ELD account, should match the value from the driver's license.	Yes	String between 2 and 30 characters
ELD Username for the driver	Unique user identifier assigned to the account holder on the ELD to authenticate the corresponding individual during an ELD login process.	Yes	String between 4 and 60 characters
Driver's License Issuing State	State, Province, or jurisdiction of the listed Driver's License for the ELD account holder.	Yes	String of exactly 2 characters restricted to values from Table 5 of the appendix to the Final Rule
Driver's License Number	Unique Driver's License information required for each driver account on the ELD. Only a single ELD account may be associated with this specific license number in combination with the license issuing state.	Yes	String between 1 and 20 characters
Line Data Check Value	A hexadecimal ''check'' value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F

4.5.1.2 Co-Driver Line

Information on this line will define the co-driver (if one exists) operating at the conclusion of the time period for which the file is generated. With the exception of the line data check value all fields are required only if a co-driver exists. If no co-driver exists all fields—except for the line data check value—should be left blank.

Table 4-12. Co-Driver Line Definition

Name	Description	Required	Constraints
Co-Driver's Last Name	Last name of the co-driver holding an ELD account, should match the value from the driver's license.	Yes	String between 2 and 30 characters
Co-Driver's First Name	First name of the co-driver holding an ELD account, should match the value from the driver's license.	Yes	String between 2 and 30 characters
ELD Username for the co-driver	Unique user identifier assigned to the account holder on the ELD to authenticate the corresponding individual during an ELD login process.	Yes	String between 4 and 60 characters
Line Data Check Value	A hexadecimal ''check'' value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F

4.5.1.3 Power Unit Line

For ELD output files generated at the roadside during an inspection this information should reflect the CMV in use at the time. For files generated at a later date as part of a review, it should reflect the final CMV used in the reporting period the file is generated for.

Table 4-13. Power Unit Line—Definition

Name	Description	Required	Constraints
CMV Power Unit Number	The identifier the motor carrier uses for their CMVs in their normal course of business.	Yes	String between 1 and 10 characters in length.
CMV VIN	Provider-assigned vehicle identification number (VIN) for the CMV powered unit. VIN should be prefixed by a "-" character when entered manually. The VIN number should contain a valid check-digit (see 4.4).	Yes	String of 17 or 18 characters conforming to the VIN standard as defined in 49 C.F.R. § 565 and ISO 3779:2009.
Trailer Number(s)	Identifier(s) the motor carrier uses for the trailers in their normal course of business.	No	String up to 32 characters in length containing up to 3 trailer numbers of up to 10 characters in length separated by spaces.
Line Data Check Value	A hexadecimal ''check'' value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.1.4 Carrier Line

This line of the ELD Header Segment contains information on the carrier under which the driver is operating.

Table 4-14. Carrier Line—Definition

Name	Description	Required	Constraints
Carrier's USDOT Number	Motor carrier's USDOT number.	Yes	Integer containing between 1 and 9 digits.
Carrier Name	Motor carrier's legal name for conducting commercial business.	Yes	String between 4 and 120 characters in length.
Multiday Basis Used	Multiday basis (7 or 8 days) used by the motor carrier to compute cumulative duty hours.	Yes	Number with a value of 7 or 8.
24-Hour Period Starting Time	24-hour period starting time specified by the motor carrier for driver's home terminal. This value identifies the beginning time of each day for HOS record keeping. Certification of daily logs will contain logs for a given day will contain logs beginning at the specified time on the given day and ending one second prior to this time in the following day unless 000000 is chosen in which case the day's logs will end at 235959 that same day.	Yes	Time of day in the format HHMMSS, using a 24-hour time format with 000000 representing midnight.
Time Zone Offset from UTC	Offset in time between UTC time and the time standard in effect at the driver's home terminal excluding the leading "-" symbol. All time values submitted in the ELD output file should be converted to use this same time zone offset value.	Yes	2-digit number between 4 and 11 with single digit number containing a leading 0.
Line Data Check Value	A hexadecimal ''check'' value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.1.5 Shipping Line

This line in the ELD Header Segment contains information on the in current shipment and whether an exempt driver configuration is in use.

Table 4-15. Shipping Line—Definition

Name	Description	Required	Constraints
Shipping Document Number	Shipping document number the motor carrier uses in their system and dispatch documents, required to make ELD conform to § 395.8 requirements.	No	String of up to 40 characters.
Exempt Driver Configuration	A parameter indicating whether the motor carrier configured a driver's profile to claim exemption from ELD use.	Yes	Single character of value 'E' of '0' with E indicating the driver's profile has been configured to claim exemption from ELD use and 0 indicating such a configuration has not been made.
Line Data Check Value	A hexadecimal ''check'' value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.1.6 Time/Place Line

This line in the ELD Header Segment contains information identifying the place and time of the ELD Output File generation.

Table 4-16. Time/Place Line—Definition

Name	Description	Required	Constraints
Current Date	Date component of the current date/time when the record was created. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Date in the format YYMMDD.
Current Time	Time component of the current date/time when the record was created. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Time in the format HHMMSS, using a 24-hour time format with 000000 representing midnight.
Current Latitude	An angular distance in degrees north and south of the equator identifying one component of the ELD position when the data file was generated. A value of 'X' must be supplied if the file was generated by a device not connected to a CMV (for example a file generated during a review by a back-office system) or the ELD has not been able to acquire its position for at least 5 miles. A value of 'E' must be supplied if the file was generated by a device that has an active position compliance malfunction.	Yes	Single character 'X', single character 'E' or a 2-decimal point precision value between -90.00 and 90.00.
Current Longitude	An angular distance in degrees measured on a circle of reference with respect to the zero (or prime) meridian; the prime meridian runs through Greenwich, England identifying one component of the ELD position when the data file was generated.	Yes	Single character 'X', single character 'E' or a 2-decimal point precision value between -179.99 and 180.00.

Name	Description	Required	Constraints
(Cont.)	A value of 'X' must be supplied if the file was generated by a device not connected to a CMV (for example, a file generated during a review by a back-office system) or the ELD has not been able to acquire its position for at least 5 miles. A value of 'E' must be supplied if the file was generated by a device that has an active position compliance malfunction.	(Cont.)	(Cont.)
Current Total Vehicle Miles	The distance traveled using the CMV in whole miles since inception, this value should be equivalent to the odometer reading except in the case where the CMV engine has been replaced and is reporting a different value via the ECM. In this scenario, it would be advisable to retain documentation of the internal engine vehicle miles and equivalent odometer reading at the time of install.	Yes	Integer between 0 and 9,999,999.
Current Total Engine Hours	Time the CMV's engine is powered in decimal hours with 0.1 hr (6-minute) resolution since inception.	Yes	1 decimal point precision values between 0 and 99,999.9.
Line Data Check Value	A hexadecimal ''check'' value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.1.7 ELD ID Line

This line in the ELD Header segment contains information identifying the ELD submitting data.

Table 4-17. ELD ID Line—Definition

Name	Description	Required	Constraints
ELD Registration ID	An alphanumeric registration identifier assigned to the ELD provider that is registered with FMCSA during the ELD registration process. Provides ability to cross-check that the ELD provider has registered as required.	Yes	A four character alphanumeric registration identifier using characters A–Z and numbers 0–9.
ELD Identifier	An alphanumeric identifier assigned by the ELD provider to the ELD technology that is certified by the registered provider at FMCSA's Web site. Provides the ability to cross-check that the ELD used in the recording of a driver's records is certified through FMCSA's registration and certification process as required.	Yes	A six character alphanumeric identifier using characters A–Z and number 0–9.
ELD Authentication Value	An alphanumeric value that is unique to an ELD and verifies the authenticity of the given ELD. Provides ability to cross-check the authenticity of an ELD used in the recording of a driver's records during inspections. For example, an ELD Authentication Value could be generated by creating a string that concatenates a predetermined selection of values that will be included in the ELD Output File; signing that string (using the ELD private key and a predetermined hash algorithm), then using a	Yes	Alphanumeric combination. Data Length: 16 or more characters.

Name	Description	Required	Constraints
(Cont.)	binary-to-text encoding algorithm to encode the signature into alphanumeric characters.	(Cont.)	(Cont.)
Output File Comment	A textual field that may be populated with information pertaining to the created ELD output file An authorized safety official may provide a key phrase or code to be included in the output file comment, which may be used to link the requested data to an inspection, inquiry, or other enforcement action; if provided to the driver by an authorized safety official, it must be entered into the ELD and included in the exchanged dataset as specified.	No	Blank or any alphanumeric combination specified and provided by an authorized safety official. Length: 0–60 characters.
Line Data Check Value	A hexadecimal ‘‘check’’ value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.2 User List

Segment Identifier: “User List:”

Information on this line must list all drivers and co-drivers with driving time records on the most recent CMV operated by the inspected driver and motor carrier’s support personnel who requested edits within the time period for which this file is generated.

Table 4-18. User List—Definition

Name	Description	Required	Constraints
Assigned User Order Number	A continuous integer number assigned in the forming of a list, starting at 1 and incremented by 1 for each unique item on the list. This allows for more compact report file output generation avoiding repetitious use of CMV identifiers and usernames affected in records.	Yes	Integer between 1 and 99.
User’s ELD Account Type	An indicator designating whether an ELD account is a driver account or support personnel (non-driver) account. This enables authorized safety officials to verify account type specific requirements set forth in this document.	Yes	Single character with value ‘D’ or ‘S’.
User’s Last Name	This data element refers to the last name of the individual holding an ELD account; it links an individual to the associated ELD account.	Yes	String with length of 2-30 characters.
User’s First Name	This data element refers to the given name of the individual holding an ELD account; it links an individual to the associated ELD account.	Yes	String with length of 2-30 characters.
Line Data Check Value	A hexadecimal ‘‘check’’ value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.3 CMV List

Segment Identifier: "CMV List:"

This line must list each CMV that the current driver operated and that has been recorded on the driver's ELD records within the time period for which this file is generated.

Table 4-19. CMV List Line—Definition

Name	Description	Required	Constraints
Assigned CMV Order Number	A continuous integer number assigned in the forming of a list, starting at 1 and incremented by 1 for each unique item on the list. This allows for more compact report file output generation avoiding repetitious use of CMV identifiers and usernames affected in records.	Yes	Integer between 1 and 99.
CMV Power Unit Number	Identifier the motor carrier uses for their CMVs in their normal course of business. It identifies the vehicle a driver operates while a driver's ELD records are recorded and makes ELD records consistent with § 395.8 requirements, which require the truck or tractor number to be included on the form.	Yes	String with length of 1-10 characters.
CMV VIN	Provider-assigned vehicle identification number (VIN) for the CMV powered unit. It uniquely identifies the operated CMV not only within a motor carrier at a given time but across all CMVs sold within a 30-year rolling period. The VIN number should contain a valid check-digit (see 4.4).	Yes	String of 17 characters or 18 characters with the initial character being a '-' indicating the VIN was entered manually.
Line Data Check Value	A hexadecimal ''check'' value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.4 ELD Event List for Driver's Record of Duty Status

Segment Identifier: "ELD Event List:"

This section includes ELD event records tagged with event types: a change in duty status, an intermediate log, and a change in driver's indication of conditions impacting driving time recording. The list must include all event record status types and all event record origins for the driver, rank ordered with the most current log on top in accordance with the date and time fields of the record.

Table 4-20. Event List—Driver's Record of Duty Status Line Definition

Name	Description	Required	Constraints
Event Sequence ID Number	This serial identifier assigned to each required ELD event provides the ability to keep a continuous record, on a given ELD, across all users of that ELD.	Yes	Hexadecimal string of 1-4 characters made up of the characters 0-9 and A-F.

Name	Description	Required	Constraints
Event Record Status	An attribute for the event record indicating whether an event is active or inactive and further, if inactive, whether it is due to a change or lack of confirmation by the driver or due to a driver's rejection of change request. This provides ability to keep track of edits and entries performed over ELD records while retaining original records.	Yes	1 character using one of the values defined in Table 8 of the technical appendix to the ELD Final Rule.
Event Record Origin	An attribute for the event record indicating whether it is automatically recorded, or edited, entered or accepted by the driver, requested by another authenticated user, or assumed from unidentified driver profile. This provides ability to track origin of records.	Yes	1 character using one of the values defined in Table 7 of the technical appendix to the ELD Final Rule.
Event Type	An attribute specifying the type of event record provides the ability to code the type of recorded event in electronic format.	Yes	1 character using one of the values defined in Table 9 of the technical appendix to the ELD Final Rule and restricted to just the values 1, 2, and 3.
Event Code	A dependent attribute on ''Event Type'' parameter that further specifies the nature of the change indicated in ''Event Type''; this parameter indicates the new status after the change. This provides the ability to code the specific nature of the change electronically.	Yes	1 character using one of the values defined in Table 6 of the technical appendix to the ELD Final Rule.
Event Date	Date component of the date/time of the event identified by the record. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Date in the format YYMMDD.
Event Time	Time component of the date/time of the event identified by the record. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Time in the format HHMMSS, using a 24-hour time format with 000000 representing midnight.
Accumulated Vehicle Miles	The accumulated miles in the given ignition power on cycle and is used in the recording of all other events. It provides the ability to track distance traveled while operating the CMV in each duty status.	Yes	Integer between 0 and 9,999.
Accumulated Engine Hours	Time the CMV's engine is powered in decimal hours with 0.1 hr (6-minute) resolution since the latest engine ignition.	Yes	1 digit decimal with a value between 0.0 and 99.9.
Event Latitude	An angular distance in degrees north and south of the equator. In combination with the variable ''Longitude'', this parameter stamps records requiring a position attribute with a reference point on the face of the earth. A value of 'X' must be supplied if the event was generated on a device not connected to a CMV (for example, a file generated during a review by	Yes	Single character 'X', single character 'M', single character 'E', a 1-decinal point precision value between -90.0 and 90.0 or a 2-decimal point precision value between -

Name	Description	Required	Constraints
(Cont.)	a back-office system) or the ELD has not been able to acquire its position for at least 5 miles when a manual location is not specified. A value of 'M' must be supplied if a manual location description was entered and the device does not have an active position compliance malfunction. A value of 'E' must be supplied if the event was generated by a device that has an active position compliance malfunction.	(Cont.)	90.00 and 90.00.
Event Longitude	An angular distance in degrees measured on a circle of reference with respect to the zero (or prime) meridian; the prime meridian runs through Greenwich, England. In combination with the variable ''Latitude'', this parameter stamps records requiring a position attribute with a reference point on the face of the earth. A value of 'X' must be supplied if the event was generated on a device not connected to a CMV (for example, a file generated during a review by a back-office system) or the ELD has not been able to acquire its position for at least 5 miles when a manual location is not specified. A value of 'M' must be supplied if a manual location description was entered and the device does not have an active position compliance malfunction. A value of 'E' must be supplied if the event was generated by a device that has an active position compliance malfunction.	Yes	Single character 'X', single character 'M', single character 'E', a 1-decinal point precision value between -179.9 and 180.0 or a 2-decimal point precision value between -179.99 and 180.00.
Distance Since Last Valid Coordinates	Distance in whole miles traveled since the last valid latitude, longitude pair the ELD measured with the required accuracy. This provides the ability to keep track of location for recorded events in cases of temporary position measurement outage.	Yes	Integer between 1 and 6.
Corresponding CMV Order Number	CMV identifier which references an entry and the CMV List of the ELD Output File as defined in 4.5.3.	Yes	Integer between 1 and 99 which exists in the CMV List.
User Order Number for Record Originator	User identifier which references and entry in the User List of the ELD Output File as defines in 4.5.2.	Yes	Integer between 1 and 99 which exists in the User List.
Malfunction Indicator Status for ELD	A code that further specifies the underlying malfunction or data diagnostic event. Enables coding the type of malfunction and data diagnostic event to cover the standardized set.	Yes	1 digit flag with values 0 – false and 1 – true.
Data Diagnostic Event Indicator Status for Driver	This is a Boolean indicator identifying whether the used ELD unit has an active data diagnostic event set for the authenticated driver at the time of event recording. It documents the snapshot of ELD's data diagnostic status for the authenticated driver at the time of an event recording.	Yes	1 digit flag with values 0 – false and 1 – true.
Event Data	A hexadecimal ''check'' value calculated in accordance with the procedure outlined in section	Yes	String of 2 characters using the

Name	Description	Required	Constraints
Check Value	4.3.2 and attached to each event record at the time of recording.	(Cont.)	characters 0-9 and A-F.
Line Data Check Value	A hexadecimal ‘‘check’’ value calculated in accordance with procedure outlined in section 0 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.5 Event Annotations, Comments, and Driver’s Location Description

Segment Identifier: “ELD Event Annotations or Comments:”

This section contains comment and/or annotations that have been made to event records contained in the ELD Output File. Events may be associated with multiple annotations and the relationship between event and annotation is defined using the Event Sequence ID Number, Event Date, and Event Time values.

Table 4-21. Event Annotations, Comments, and Driver’s Location—Line Definition

Name	Description	Required	Constraints
Event Sequence ID Number	Event Sequence ID Number of the event to which the comment or annotation is associated.	Yes	Hexadecimal string of 1-4 characters made up of the characters 0-9 and A-F.
ELD Username of the Record Originator	The unique username of the ELD user who created the annotation. Note: this will in some cases be different from the user who created the event being annotated.	Yes	String between 4 and 60 characters.
Event Comment Text or Annotation	A textual note related to a record, update, or edit capturing the comment or annotation a driver or authorized support personnel may input to the ELD. This provides ability for a driver to offer explanations to records, selections, edits, or entries.	Yes (If prompted by ELD.)	String of 0-60 characters.
Event Date	Date component of the date/time of the event to which the comment or annotation is associated.	Yes	Date in the format YYMMDD.
Event Time	Time component of the date/time of the event to which the comment or annotation is associated.	Yes	Time in the format HHMMSS, using a 24-hour time format with 000000 representing midnight.
Driver’s Location Description	This is a textual note related to the location of the CMV input by the driver upon ELD’s prompt. Provides ability for a driver to enter location information related to entry of missing records; provides ability to accommodate temporary positioning service interruptions or outage without setting positioning malfunctions.	Yes	String between 5 and 60 characters.
Line Data Check Value	A hexadecimal ‘‘check’’ value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.6 ELD Event List for Driver's Certification of Own Record

Segment Identifier: "Driver's Certification/Recertification Actions"

This section contains the list of event records with event type 4 for the inspected driver during the time period for which this file is generated.

Table 4-22. Event List—Driver's Certification of Own Record Line Definition

Name	Description	Required	Constraints
Event Sequence ID Number	The serial identifier assigned to each required ELD event as described in section 4.5.1., and provides the ability to keep a continuous record, on a given ELD, across all users of that ELD.	Yes	Hexadecimal string of 1-4 characters made up of the characters 0-9 and A-F
Event Code	A dependent attribute on ''Event Type'' (assumed to be 4 in this case) parameter that further specifies the nature of the change indicated in ''Event Type''; this parameter indicates the new status after the change. This provides the ability to code the specific nature of the change electronically.	Yes	1 character using one of the values defined in Table 6 of the technical appendix to the ELD Final Rule.
Event Date	Date component of the date/time of the event identified by the record. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Date in the format YYMMDD.
Event Time	Time component of the date/time of the event identified by the record. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Time in the format HHMMSS, using a 24-hour time format with 000000 representing midnight.
Date of the certified Record	Date of the records being certified or re-certified by the driver. A day for certification is defined as the period beginning with the 24-Hour Period Start Time on the day defined and ending with one second prior to the 24-Hour Period Start Time on the following day. For example, a certification record for the date 1/1/2017 (170101) when using a 24-Hour period start time of 1:00:00 (010000) would cover events occurring between 1/1/2017 1:00:00 and 1/2/2017 00:59:59 inclusively.	Yes	Date in the format YYMMDD.
Corresponding CMV Order Number	CMV identifier which references an entry and the CMV List of the ELD Output File as defined in 4.5.3.	Yes	Integer between 1 and 99 which exists in the CMV List.
Line Data Check Value	A hexadecimal ''check'' value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.7 Malfunction and Diagnostic Event Records

Segment Identifier: "Malfunctions and Data Diagnostic Events:"

This section contains information for a code that further specifies the underlying malfunction or data diagnostic event.

Table 4-23. Records—Malfunction and Diagnostic Event Line Definition

Name	Description	Required	Constraints
Event Sequence ID Number	The serial identifier assigned to each required ELD event as described in section 4.5.1., and provides the ability to keep a continuous record, on a given ELD, across all users of that ELD.	Yes	Hexadecimal string of 1-4 characters made up of the characters 0-9 and A-F.
Event Code	A dependent attribute on ''Event Type'' (assumed to be 7 in this case) parameter that further specifies the nature of the change indicated in ''Event Type''; this parameter indicates the new status after the change. This provides the ability to code the specific nature of the change electronically.	Yes	1 character using one of the values defined in Table 6 of the technical appendix to the ELD Final Rule.
Malfunction/Diagnostic Code	A code that further specifies the underlying malfunction or data diagnostic event. Enables coding the type of malfunction and data diagnostic event to cover the standardized set.	Yes	1 character using one of the values defined in Table 4 of the technical appendix to the ELD Final Rule.
Event Date	Date component of the date/time of the event identified by the record. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Date in the format YYMMDD.
Event Time	Time component of the date/time of the event identified by the record. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Time in the format HHMMSS, using a 24-hour time format with 000000 representing midnight.
Total Vehicle Miles	The distance traveled using the CMV in whole miles since inception, this value should be equivalent to the odometer reading except in the case where the CMV engine has been replaced and is reporting a different value via the ECM. In this scenario, it would be advisable to retain documentation of the internal engine vehicle miles and equivalent odometer reading at the time of install.	Yes	Integer between 0 and 9,999,999.
Total Engine Hours	Time the CMV's engine is powered in decimal hours with 0.1 hr (6-minute) resolution since inception.	Yes	1 decimal point precision values between 0 and 99,999.9.
Corresponding CMV	CMV identifier which references an entry and	Yes	Integer between

Name	Description	Required	Constraints
Order Number	the CMV List of the ELD Output File as defined in 4.5.3.	(Cont.)	1 and 99, which exists in the CMV List.
Line Data Check Value	A hexadecimal ‘‘check’’ value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.8 ELD Login/Logout Report

Segment Identifier: “ELD Login/Logout Report:”

This section contains the login and logout activity on the ELD for the inspected driver during the time period when this file is generated.

Table 4-24. Login and Logout Report Line Definition

Name	Description	Required	Constraints
Event Sequence ID Number	The serial identifier assigned to each required ELD event as described in section 4.5.1., and provides the ability to keep a continuous record, on a given ELD, across all users of that ELD.	Yes	Hexadecimal string of 1-4 characters made up of the characters 0-9 and A-F.
Event Code	A dependent attribute on ‘‘Event Type’’ (assumed to be 5 in this case) parameter that further specifies the nature of the change indicated in ‘‘Event Type’’; this parameter indicates the new status after the change. This provides the ability to code the specific nature of the change electronically.	Yes	1 character using one of the values defined in Table 6 of the technical appendix to the ELD Final Rule.
ELD Username	The unique user identifier assigned to the account holder on the ELD to authenticate the corresponding individual during an ELD login process; the individual may be a driver or a motor carrier’s support personnel.	Yes	String between 4 and 60 characters corresponding to an ELD user account.
Event Date	Date component of the date/time of the event identified by the record. The time zone used should be that of the carrier’s home terminal using the offset specified in the “Time Zone Offset from UTC” parameter.	Yes	Date in the format YYMMDD.
Event Time	Time component of the date/time of the event identified by the record. The time zone used should be that of the carrier’s home terminal using the offset specified in the “Time Zone Offset from UTC” parameter.	Yes	Time in the format HHMMSS, using a 24-hour time format with 000000 representing midnight.
Total Vehicle Miles	The distance traveled using the CMV in whole miles since inception, this value should be equivalent to the odometer reading except in the case where the CMV engine has been replaced and is reporting a different value via the ECM. In this scenario, it would be advisable to retain documentation of the internal engine vehicle miles and equivalent odometer reading at the time of install.	Yes	Integer between 0 and 9,999,999.

Name	Description	Required	Constraints
Total Engine Hours	Time the CMV's engine is powered in decimal hours with 0.1 hr (6-minute) resolution since inception.	Yes	1 decimal point precision values between 0 and 99,999.9.
Line Data Check Value	A hexadecimal ''check'' value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.9 CMV's Engine Power-Up and Shut-Down Activity

Segment Identifier: "CMV Engine Power-Up and Shut-Down Activity:"

This section includes information that the logs created when a CMV's engine is powered up and shut down for the time period when this file is generated.

Table 4-25. Activity for the CMV's Engine Power-Up and Shut-Down Line Definition

Name	Description	Required	Constraints
Event Sequence ID Number	The serial identifier assigned to each required ELD event as described in section 4.5.1., and provides the ability to keep a continuous record, on a given ELD, across all users of that ELD.	Yes	Hexadecimal string of 1-4 characters made up of the characters 0-9 and A-F.
Event Code	A dependent attribute on ''Event Type'' (assumed to be 6 in this case) parameter that further specifies the nature of the change indicated in ''Event Type''; this parameter indicates the new status after the change. This provides the ability to code the specific nature of the change electronically.	Yes	1 character using one of the values defined in Table 6 of the technical appendix to the ELD Final Rule.
Event Date	Date component of the date/time of the event identified by the record. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Date in the format YYMMDD.
Event Time	Time component of the date/time of the event identified by the record. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Time in the format HHMMSS, using a 24-hour time format with 000000 representing midnight.
Total Vehicle Miles	The distance traveled using the CMV in whole miles since inception, this value should be equivalent to the odometer reading except in the case where the CMV engine has been replaced and is reporting a different value via the ECM. In this scenario, it would be advisable to retain documentation of the internal engine vehicle miles and equivalent odometer reading at the time of install.	Yes	Integer between 0 and 9,999,999.

Name	Description	Required	Constraints
Total Engine Hours	Time the CMV's engine is powered in decimal hours with 0.1 hr (6-minute) resolution since inception.	Yes	1 decimal point precision values between 0 and 99,999.9.
Event Latitude	An angular distance in degrees north and south of the equator. In combination with the variable ''Longitude'', this parameter stamps records requiring a position attribute with a reference point on the face of the earth. A value of 'X' must be supplied if the event was generated on a device not connected to a CMV (for example, a file generated during a review by a back-office system) or the ELD has not been able to acquire its position for at least 5 miles when a manual location is not specified. A value of 'M' must be supplied if a manual location description was entered and the device does not have an active position compliance malfunction. A value of 'E' must be supplied if the event was generated by a device that has an active position compliance malfunction.	Yes	Single character 'X', single character 'M', single character 'E', a 1-decinal point precision value between -90.0 and 90.0 or a 2-decimal point precision value between -90.00 and 90.00.
Event Longitude	An angular distance in degrees measured on a circle of reference with respect to the zero (or prime) meridian; the prime meridian runs through Greenwich, England. In combination with the variable ''Latitude'', this parameter stamps records requiring a position attribute with a reference point on the face of the earth. A value of 'X' must be supplied if the event was generated on a device not connected to a CMV (for example, a file generated during a review by a back-office system) or the ELD has not been able to acquire its position for at least 5 miles when a manual location is not specified. A value of 'M' must be supplied if a manual location description was entered and the device does not have an active position compliance malfunction. A value of 'E' must be supplied if the event was generated by a device that has an active position compliance malfunction.	Yes	Single character 'X', single character 'M', single character 'E', a 1-decinal point precision value between -179.9 and 180.0 or a 2-decimal point precision value between -179.99 and 180.00.
CMV Power Unit Number	The identifier the motor carrier uses for their CMVs in their normal course of business.	Yes	String between 1 and 10 characters in length.
CMV VIN	Provider-assigned vehicle identification number (VIN) for the CMV-powered unit. VIN should be prefixed by a "-" character when entered manually.	Yes	String of 17 or 18 characters conforming to the VIN standard as defined in 49 C.F.R. § 565 and ISO 3779:2009.

Name	Description	Required	Constraints
Trailer Numbers	Identifier(s) the motor carrier uses for the trailers in their normal course of business.	No	String up to 32 characters in length containing up to 3 trailer numbers of up to 10 characters in length separated by spaces.
Shipping Document Number	Shipping document number the motor carrier uses in their system and dispatch documents. It links ELD data to the shipping records and makes ELD dataset consistent with § 395.8 requirements.	No	String between 0 and 40 characters.
Line Data Check Value	A hexadecimal ‘‘check’’ value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.5.10 Event Log List for the Unidentified Driver Profile

Segment Identifier: “Unidentified Driver Profile Records:”

This is the list that must include the ELD event records for the Unidentified Driver profile. It should be rank ordered with the most current log on top in accordance with the date and time fields of the log.

Table 4-26. Event Log List—Unidentified Driver Profile Line Definition

Name	Description	Required	Constraints
Event Sequence ID Number	This serial identifier assigned to each required ELD event provides the ability to keep a continuous record, on a given ELD, across all users of that ELD.	Yes	Hexadecimal string of 1-4 characters made up of the characters 0-9 and A-F
Event Record Status	An attribute for the event record indicating whether an event is active or inactive and further, if inactive, whether it is due to a change or lack of confirmation by the driver or due to a driver's rejection of change request. This provides the ability to keep track of edits and entries performed over ELD records while retaining original records.	Yes	1 character using one of the values defined in Table 8 of the technical appendix to the ELD Final Rule.
Event Record Origin	An attribute for the event record indicating whether it is automatically recorded, or edited, entered or accepted by the driver, requested by another authenticated user, or assumed from unidentified driver profile. This provides ability to track origin of records.	Yes	1 character using one of the values defined in Table 7 of the technical appendix to the ELD Final Rule.
Event Type	An attribute specifying the type of event record provides the ability to code the type of recorded event in electronic format.	Yes	1 character using one of the values defined in Table 9 of the technical appendix to the ELD Final Rule.
Event Code	A dependent attribute on ''Event Type'' parameter that further specifies the nature of the change indicated in ''Event Type''; this parameter indicates the new status after the change. This provides the ability to code the specific nature of the change electronically.	Yes	1 character using one of the values defined in Table 6 of the technical appendix to the ELD Final Rule.
Event Date	Date component of the date/time of the event identified by the record. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Date in the format YYMMDD.
Event Time	Time component of the date/time of the event identified by the record. The time zone used should be that of the carrier's home terminal using the offset specified in the "Time Zone Offset from UTC" parameter.	Yes	Time in the format HHMMSS, using a 24-hour time format with 000000 representing midnight.
Accumulated Vehicle Miles	The accumulated miles in the given ignition power on cycle and is used in the recording of all other events. It provides the ability to track distance traveled while operating the CMV in each duty status.	Yes	Integer between 0 and 9,999.

Name	Description	Required	Constraints
Accumulated Engine Hours	Time the CMV's engine is powered in decimal hours with 0.1 hr (6-minute) resolution since the latest engine ignition.	Yes	1 digit decimal with a value between 0.0 and 99.9.
Event Latitude	An angular distance in degrees north and south of the equator. In combination with the variable ''Longitude'', this parameter stamps records requiring a position attribute with a reference point on the face of the earth. A value of 'X' must be supplied if the event was generated on a device not connected to a CMV (for example, a file generated during a review by a back-office system) or the ELD has not been able to acquire its position for at least 5 miles when a manual location is not specified. A value of 'M' must be supplied if a manual location description was entered and the device does not have an active position compliance malfunction. A value of 'E' must be supplied if the event was generated by a device that has an active position compliance malfunction.	Yes	Single character 'X', single character 'M', single character 'E', a 1-decimal point precision value between -90.0 and 90.0 or a 2-decimal point precision value between -90.00 and 90.00.
Event Longitude	An angular distance in degrees measured on a circle of reference with respect to the zero (or prime) meridian; The prime meridian runs through Greenwich, England. In combination with the variable ''Latitude'', this parameter stamps records requiring a position attribute with a reference point on the face of the earth. A value of 'X' must be supplied if the event was generated on a device not connected to a CMV (for example, a file generated during a review by a back-office system) or the ELD has not been able to acquire its position for at least 5 miles when a manual location is not specified. A value of 'M' must be supplied if a manual location description was entered and the device does not have an active position compliance malfunction. A value of 'E' must be supplied if the event was generated by a device that has an active position compliance malfunction.	Yes	Single character 'X', single character 'M', single character 'E', a 1-decinal point precision value between -179.9 and 180.0 or a 2-decimal point precision value between -179.99 and 180.00.
Distance Since Last Valid Coordinates	Distance in whole miles traveled since the last valid latitude, longitude pair the ELD measured with the required accuracy. This provides the ability to keep track of location for recorded events in cases of temporary position measurement outage.	Yes	Integer between 1 and 6.
Corresponding CMV Order Number	CMV identifier which references an entry and the CMV List of the ELD Output File as defined in 4.5.3.	Yes	Integer between 1 and 99 which exists in the CMV List.

Name	Description	Required	Constraints
Malfunction Indicator Status for ELD	A code that further specifies the underlying malfunction or data diagnostic event. Enables coding the type of malfunction and data diagnostic event to cover the standardized set.	Yes	1 character using one of the values defined in Table 4 of the technical appendix to the final rule.
Event Data Check Value	A hexadecimal ‘‘check’’ value calculated in accordance with the procedure outlined in section 4.3.2 and attached to each event record at the time of recording.	Yes	String of 2 characters using the characters 0-9 and A-F.
Line Data Check Value	A hexadecimal ‘‘check’’ value calculated in accordance with procedure outlined in section 4.3.3 and attached to each line of output featuring data at the time of output file being generated.	Yes	String of 2 characters using the characters 0-9 and A-F.

4.6 File Data Check Value

4.6.1 File Data Check Line

The file data check line provides the ability to identify cases where an ELD output file may have been inappropriately modified after its original generation.

Table 4-27. File Data Check Line

Name	Description	Required	Constraints
File Data Check Value	A hexadecimal ‘‘check’’ value calculated in accordance with procedure outlined in section 4.3.4 and attached to the final section of the file.	Yes	String of 4 characters using the characters 0-9 and A-F.

4.6.1.1 Example

DEA9

4.6.2 Empty Line

The file data check value line should end with a <CR> character, which by the line definition rules results in an empty final “line” in the file.

Appendix A: ELD Technical Specifications—Points of Clarification

The following items refer to and clarify some of the technical specifications that are outlined in the Federal Register ELD Rule.

- Typo in the section header for section 4.8.2.1.6 "Driver's Certification/Recertification Actions" should be "Driver's Certification/Recertification Actions", in the Rule the highlight is a right-single quote (which is not a part of the ASCII character set) instead of a straight apostrophe.
- In the description of the print and screen display (4.8.1), the specification lists the value for the ELD ID part of the header as the ELD Registration ID, the displayed data does not match the ELD Registration ID, and the column header does not read ELD Registration ID, this should instead be the ELD Identifier (provider assigned).
- In the data element dictionary (7.31 and 7.33) it says that only decimal numbers -90.0- 90.0 and decimal numbers -179.9- 180.0 are valid for latitude and longitude, respectively. In section 4.6.1.4, three additional valid values for these elements are defined:
    - X – indicating position could not be acquired
    - M – indicating the position was manually entered by the driver
    - E – indicating the ELD has an active position compliance malfunction
- In the description of event code '0' for event type '3' (Table 6) it lists a status of WT to be cleared. WT should not be included as a status to clear since the WT status is not defined anywhere in the Rule.
- In the definition of the Event Data Check value Item 4.4.5.1.1(b)(9) references an element "CMV number" which is not defined in the rule, this should be "CMV Power Unit Number" which is defined in 7.4.
- Vehicle Miles (7.43) and Engine Hours (7.19) are listed as mandatory fields; they will be considered mandatory for any event whose origin is the ELD or the unidentified driver profile. For events created by the driver or another authenticated user when the engine hours and vehicle miles are not available and cannot accurately be determined these fields may be left blank.
- Login/Logout events (4.5.1.5) that occur in a back-office system or through a disconnected component of an ELD system (for example a tablet which has been taken out of the vehicle) are considered to have an origin of driver rather than ELD which allows them to meet the previous clarification and leave engine hours and vehicle miles blank. Login/Logout events which occur on a connected ELD are considered to have an origin of ELD and they must record these field values.

> ***For more information on ELDs and HOS supporting documents:***
>
> ***- FMCSA ELD Website: Quick Links, FAQs***
>
> ***- FMCSA Hours of Service Web Site***

Appendix B: Additional Resources

This section provides some of the resources and documents that are most closely related to or referenced within this document, such as the Final Rule below.

- Federal Register, Electronic Logging Devices and Hours of Service Supporting Document – Final Rule 49 CFR 385, 386, 390, and 395, published December 16, 2015.

Appendix C: References

Organization	Standard	Purpose
American National Standards Institute (ANSI) http://webstore.ansi.org/	ANSI INCITS 4–1986 (R2012), American National Standard for Information Systems—Coded Character Sets—7-Bit American National Standard Code for Information Interchange (7-Bit ASCII), approved June 14, 2007, IBR in section 4.8.2.1, Appendix A to subpart B.	Defines valid character encoding for the ELD Output File.
ANSI	ANSI INCITS 446–2008 (R2013), American National Standard for Information Technology—Identifying Attributes for Named Physical and Cultural Geographic Features (Except Roads and Highways) of the United States, Territories, Outlying Areas, and Freely Associated Areas, and the Waters of the Same to the Limit of the Twelve-Mile Statutory Zone, approved October 28, 2008, IBR in section 4.4.2, Appendix A to subpart B.	Used in the ELD print/display to translate coordinate positions into human readable values.
Bluetooth SIG, Inc. **https://www.bluetooth.org/Technical/Specifications/adopted.htm**	Bluetooth SIG, Inc., Specification of the Bluetooth System: Wireless Connections Made Easy, Covered Core Package version 2.1 + EDR, volumes 0 through 4, approved July 26, 2007, IBR in sections 4.9.1, 4.9.2, 4.10.1.4, 4.10.2, Appendix A to subpart B.	Used to support the Bluetooth data transfer option.
Institute of Electrical and Electronic Engineers (IEEE) Standards Association **http://standards.ieee.org/index.html**	IEEE Std 1667–2009, IEEE Standard for Authentication in Host Attachments of Transient Storage Devices, approved 11 November 2009, IBR in section 4.10.1.3, Appendix A to subpart B.	Used to support the USB option.
Internet Engineering Task Force (IETF) **https://www.ietf.org/**	IETF RFC 3565, Use of the Advanced Encryption Standard (AES) Encryption Algorithm in Cryptographic Message Syntax (CMS), approved July 2003, IBR in section 4.10.1.2, Appendix A to subpart B.	Used in all telematics and Bluetooth transfer options.
IETF	IETF RFC 4056, Use of the RSASSA–PSS Signature Algorithm in Cryptographic Message Syntax (CMS), approved June 2005, IBR in section 4.10.1.2, Appendix A to subpart B.	Used in all telematics and Bluetooth transfer options.
IETF	IETF RFC 5246, The Transport Layer Security (TLS) Protocol Version 1.2, approved August 2008, IBR in section 4.10.1.1, Appendix A to subpart B.	Used in all telematics and Bluetooth transfer options.
IETF	IETF RFC 5321, Simple Mail Transfer Protocol, approved October 2008, IBR in section 4.10.1.2, Appendix A to subpart B.	Used in email transfer option.

Organization	Standard	Purpose
IETF	IETF RFC 5322, Internet Message Format, approved October 2008, IBR in section 4.10.1.2, Appendix A to subpart B.	Used in email transfer option.
IETF	IETF RFC 5751, Secure/ Multipurpose Internet Mail Extensions (S/MIME) Version 3.2, Message Specification, approved January 2010, IBR in section 4.10.1.2, Appendix A to subpart B.	Used in email transfer option.
IETF	IETF RFC 7230, Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing, approved June 2014, IBR in section 4.10.1.1, Appendix A to subpart B.	Used in web service and Bluetooth® transfer options.
IETF	IETF RFC 7231, Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content, approved June 2014, IBR in section 4.10.1.1, Appendix A to subpart B.	Used in web service and Bluetooth® transfer options.
National Institute of Standards and Technology (NIST) http://www.nist.gov/	Federal Information Processing Standards Publication (FIPS PUB) 197, Advanced Encryption Standard (AES), approved November 26, 2001, IBR in sections 4.10.1.2 and 4.10.1.3, Appendix A to subpart B.	Used in all telematics and Bluetooth® transfer options.
NIST	SP 800–32, Introduction to Public Key Technology and the Federal PKI Infrastructure, approved February 26, 2001, IBR in section 4.10.1.2, Appendix A to subpart B.	Used in all telematics and Bluetooth® transfer options.
Universal Serial Bus Implementers Forum (USBIF) http://www.usb.org/	USB Implementers Forum, Inc., Universal Serial Bus Specification, Revision 2.0, approved April 27, 2000, as revised through April 3, 2015, IBR in sections 4.9.1, 4.9.2, 4.10.1.3, and 4.10.2, Appendix A to subpart B.	Used in USB transfer option.
World Wide Web Consortium (W3C) http://www.w3.org/	W3C Recommendation 27, SOAP Version 1.2 Part 1: Messaging Framework (Second Edition), including errata, approved April 2007, IBR in section 4.10.1.1, Appendix A to subpart B.	Used in web service and Bluetooth® transfer options.

Federal Motor Carrier Safety Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

855-368-4200
www.fmcsa.dot.gov

John A. Volpe National Transportation Systems Center
55 Broadway
Cambridge, MA 02142-1093

617-494-2000
www.volpe.dot.gov

U.S. Department of Transportation
Federal Motor Carrier Safety Administration