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|  | NFC Entry and Starting  <<Feature>> | | |  |
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| Document Owner | **Aaron Bonnell-Kangas (abonnel1)**  **Aaron DeLong (adelong2)**  **Farhan Ehsan (fehsan1)**  **Eugene Karpinsky (ekarpins)**  **Reinaldo Sepulveda (spepulv6)**  **Jonathon Wolf (jwolf53)** | | |  |
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|  | | | | |
| Document Approval | | | | |
| Person | Role | | Email Confirmation | Date |
|  |  | |  |  |
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# Introduction

## Document Purpose

A Feature Document (FD) document specifies **what** the feature shall do and how it shall behave from customer perspective. It should also provide reasoning and background **why** we have the feature in the vehicle.

The FD also serves as an Item Definition as defined by ISO26262 for those features, which follow the Ford Functional Safety process.

To get more information about the concept of feature, function and component level abstraction refer to the [Ford RE Wiki](http://wiki.ford.com/display/RequirementsEngineering/Requirements+Engineering+for+SW+Enabled+Features). For details on the Ford Functional Safety (ISO26262) process refer to the [Ford Functional Safety Sharepoint](https://pd3.spt.ford.com/sites/GlobalFunctionalSafety/Pages/default.aspx).

## Document Scope

This Feature Document (FD) specifies the following features:

|  |  |  |  |
| --- | --- | --- | --- |
| **Feature ID** | **Feature Name** | **Owner** | **Reference** |
| F002070  <http://x.ford.com/FeatureID> | NFC Entry and Starting | Aaron Bonnell-Kangas (abonnel1)  Reinaldo Sepulveda (rsepulv6)  Aaron DeLong (adelong2)  Farhan Ehsan (fehsan2)  Eugene Karpinsky (ekarpins)  Jonathon Wolf (jwolf53) | F002070 |

Table 1: Features described in this FD

## Document Audience

The FD is written by the feature owners of Aaron Bonnell-Kangas, Reinaldo Sepulveda, Aaron DeLong, Farhan Ehsan, Eugene Karpinsky and Jonathon Wolf. All Stakeholders, i.e., all people who have a valid interest in the feature should read and, if possible, review the FD. It needs to be guaranteed, that all stakeholders have access to the currently valid version of the FD.

### Stakeholder List

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **CDSID** | **Org.** | **Title** | **Project Role** |
| John Van Wiemeersch | jvanviem | RA&E, Adv. Feat. Development | Supervisor | Design Support |
| Aaron DeLong | adelong2 | RA&E, Adv. Feat. Development | Research Engineer | Research Design Lead |
| Vivek Elangovan | velango5 | RA&E, Adv. Feat. Development | Research Engineer | Design Support |
| Rita Trupiano | mtrupia1 | PD, Sys. Eng.,  Distributed Feat. | Feature Owner Supervisor | Feature Owner Supervisor |
| Eugene Karpinsky | ekarpins | PD, Sys. Eng.,  Distributed Feat. | Core Feature Owner | Production Design Lead and Feature Owner |
| Farhan Ehsan | fehsan2 | PD, Sys. Eng.,  Distributed Feat. | Core Feature Owner | Production Design Lead and Feature Owner |
| Aaron Bonnell-Kangas | Abonnel1 | PD, Sys. Eng.,  Distributed Feat. | Core Feature Owner | Production Design Lead and Feature Owner |
| Reinaldo Sepulveda | Rsepulv6 | PD, Sys. Eng.,  Distributed Feat. | Core Feature Owner | Production Design Lead and Feature Owner |
| Matt Swis | mswis | PD, EESE, Body & Security Elec. | Core Security & RF Supervisor | NFC System Owner Supervisor |
| Nisha Patel | npate152 | PD, EESE, Body & Security Elec. | Core NFC Engineer | NFC System Owner |
| David Hernandez | dhern138 | PD, EESE, Body & Security Elec. | Core NFC Engineer | NFC System Owner |
| Suthagaran Nagarasa | snagaras | PD, EESE, Body & Security Elec. | Core NFC Engineer | NFC System Owner |
| Kevin Hille | khille | PD, EESE, Body & DAT SW | Technical Specialist – Immob. | NFC Immobilizer Function Owner, Design Support |
| John Ricks | jricks7 | PD, EESE, Body & DAT SW | Software Supervisor | Software Supervisor |
| John Popovecz | jpopovec | PD, EESE, Body & DAT SW | Body Module SW Supervisor | Body Module SW Supervisor |
| Hosam Irsheid | hirsheid | PD, EESE, Body & DAT SW | Software Engineer | Software Design |
| Sam Mehdi | hmehdi | PD, EESE, Body & DAT SW | Product Design Engineer | Software Design |
| Vishala Pasala | vpasala | PD, EESE, Body & DAT SW | Software Engineer | Software Design |
| Maeen Mawari | mmawari | PD, EESE, Body & DAT SW | MBSE Engineer | Software Design |
| Eric Reed | ereed2 | PD, EESE, Body & DAT SW | VSC SW Engineer | Software Design |
| Ahmad Sabri | asabri3 | PD, EESE, Body & DAT SW | PD Engineer | Software Design |
| Jeff Lossing | jlossing | PD, EESE, Body & DAT SW | Software Engineer | Software Design |
| Andrew Hall | ahall185 | PD, EESE, Body & DAT SW | Design Engineer, BCM Software | Software Design |
| Sachin Magar | smagar | PD, EESE, Body & DAT SW | Design Engineer, BCM Software | Software Design |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Akshita Kulkarni | akulka2 | PD, EESE, Body & DAT SW | Design Engineer, BCM Software | Software Design |
| Adithya Ramachandran | aramac11 | PD, EESE, Body & DAT SW | Software Engineer | Software Design |
| S Bagga | sbagga11 | PD, EESE, Body & DAT SW | Software Engineer | Software Design |
| Gail Cheng | gcheng | PD, In-Vehicle Infotainment & Connectivity | Infotainment Systems Supervisor | Infotainment System Design Supervisor |
| Matthew Borrelli | mborrel4 | PD, In-Vehicle Infotainment & Connectivity | Infotainment Systems Engineer | Infotainment System Design |
| Laura Check | lburek | PD, In-Vehicle Infotainment & Connectivity | SYNC Supervisor | SYNC System Supervisor |
| Iqbal Faheem Sayyed | isayyed | PD, In-Vehicle Infotainment & Connectivity | SYNC Technical Program Manager | SYNC Technical Program Manager |
| Scott Watkins | swatkins | PD, In-Vehicle Infotainment & Connectivity | DI Technical Expert | Driver Information Design Support |
| Stavros Dionyssopoulos | sdionyss | PD, CIED | DI HMI Engineer | Driver Information HMI Support |
| Nicholas Davio | ndavio | PD, CIED | HMI Supervisor | HMI Support Supervisor |
| Mack Dobbie | mdobbie | PD, CIED | HMI Designer | HMI Support |
| Montana Pruett | mpruett2 | PD, CIED | I&E Engineer | I&E Support |
| Patrick Brautigan | pbrautig | PD, CIED | UX Engineer | UX Support |
| Jeffrey Hamel | jhamel7 | PD, Enterprise Connectivity | Product Owner, TPM | Ford Mobile App Design |
| Michael Martinez | mmart664 | PD, Mobility | Product Manager | Ford Mobile App Design |
| Bruce Williams | bwilli28 | PD, EESE, Netcom Core | Product Design Engineer | Electrical Architecture Consult |
| Jim Lawlis | jlawlis | PD, EESE, Advanced Netcom | Technical Specialist - Netcom | Electrical Architecture Consult |
| Nhi Torres | ntorres5 | PD, EESE, Netcom Diag. | Supervisor | Electrical Architecture Consult |
| Eric Paton | epaton | PD, EESE, Netcom Diag. | Engineer | Electrical Architecture Consult |
| Ankita Vyas | avyas8 | PD, EESE, Functional Safety | Functional Safety Engineer | Functional Safety Consult |
| Juan Tejada | jtejeda6 | PD, EESE, MBSE | Modelling Expert | Modelling Support |
| Ahmet Cinar | acinar1 | PD Europe, Underbody EESE | Tech. Expert – Closure Electronics | Closure Design Consult |
| Uwe Zank | uzank | PD Europe, Underbody EESE | Supervisor, Security Electronics | Security Design Consult |
| Denney Vellaramkalayil | dvellara | PD Europe, Underbody EESE | System Engineer, Locking Application | Locking Design Support |
| Henry Popow | hpopow | Quality, EESE | Quality Engineer | Quality Coach |
| Gerard Szczepaniak | gszczepa | Quality, EESE | Quality Engineer | Quality Coach |
| Christina Bloxsom | cbloxsom | SE&SE, ASO, Adv. Policy | Subject Matter Expert | Safety & Regulations Consult |
| Mike Westra | mwestra | IT, Cybersecurity | Technical Leader – Security | Cybersecurity Consult |
| Jochen Schubert | jschub1 | IT, Cybersecurity | Cybersecurity Engineer | Cybersecurity Design Support |
| Dan Zajac | dzajac8 | IT, Cybersecurity | Cybersecurity Supervisor | Cybersecurity Supervisor |
| Jacob Nelson | jnels148 | IT, Cybersecurity | Cybersecurity Engineer | Cybersecurity Design Support |
| Xin Ye | xye7 | IT, Cybersecurity | Technical Specialist - Security | Cybersecurity Consult |
| Simon Hurr | shurr | IT, Cybersecurity | Security Application Specialist | Cybersecurity Consult |
| Mike Simons | msimon78 | IT, CVP&P, PaaK | Systems Engineer | Off Board Function Owner Lead |
| Faten Fawaz | ffawaz | IT, CVP&P, Basic Design | Basic Design Architect | Backend Infrastructure Design Lead |
| Steve Craig | scraig33 | IT, CVP&P, Integration | Technical Program Manager | Backend Infrastructure Design Support |
| Yona Shaposhnik | yshaposh | IT, MPS, Mobility Arch. | Solution Architect | Backend Infrastructure Design Support |
| Michelle Moody | mmoody1 | IT, Mobility, FCS | Director | Project Champion – Fleet |
| Robert Johnson | rjohns75 | IT, Mobility, FCS | Product Marketing Manager | Project Champion – Fleet |
| Mustapha Elkhatib | melkhat1 | IT, Mobility, FCS | Product Manager | Fleet Infrastructure Design Support |
| Geoffrey Scofield | gscofiel | IT, Mobility, FCS | Product Engineer | Fleet Infrastructure Design Support |
| Jennifer Oak | joak | MS&S, US Marketing | Connected Marketing Manager | Project Champion – Retail |
| Timothy Son Hing | tsonhin1 | MS&S, US Marketing | Marketing Manager | Project Champion – Retail |

## Document Organization

### Document Context

Refer to the [Specification Structure page](http://wiki.ford.com/display/RequirementsEngineering/Specification+templates) in the [Ford RE Wiki](http://wiki.ford.com/display/RequirementsEngineering/Requirements+Engineering+for+SW+Enabled+Features) to understand how the FD relates to other Ford Requirements Documents and Specifications.

### Document Structure

The structure of this document is explained below:

**Section 1** – Introduction how to use this document including responsibilities and requisite documents. Explains the terminology. Gives a clarification of the definitions, concepts and abbreviations used in the document.

**Section 2** – Feature Description. States briefly the background and the purpose of the feature, feature variants and corresponding regions and markets. Also includes input requirements, assumptions and constraints.

**Section 3** – Feature Context describes all external entities, which have an influence on the feature.

**Section 4** – Feature Modeling. Contains Use Case, Driving Scenarios, State Charts to describe the functional behavior of the feature.

**Section 5** – Safety. Lists System Behaviors and Safety Goals of the feature.

**Section 6** – Feature Requirements. Lists functional and non-functional requirements of the feature.

**Section 7** – Architecture. Shows the coarse architecture, which the feature requirements are deployed to. Describes the elements and the boundary of the feature as well as the decomposition and distribution of associated functions.

**Section 8** – List of Open Concerns

**Section 9** – Document Change History including a list of new or modified requirements. The requirements in this document are tagged, and this section contains different types of tables listing all, new, or changed requirements by their title and page no.

**Section 10** – Appendix

## Document Conventions

### Requirements Templates

Each requirement, use case or scenario in this specification shall follow the corresponding template given in the document template *Specification\_Macros.dotm* at [RE Wiki - Specification Templates](http://wiki.ford.com/display/RequirementsEngineering/Specification+templates?src=contextnavpagetreemode).

#### Identification of requirements

#### Requirements Attributes

The templates provided by *Specification\_Macros.dotm* define a list of attributes for each requirement. This helps to classify the requirement. The attributes are explained at [RE Wiki - Requirements Attributes](http://wiki.ford.com/display/RequirementsEngineering/Requirements+Attributes?src=contextnavpagetreemode).

# Feature Overview

## Purpose and Description of Feature

NFC Entry & Starting enables a customer to unlock and start their vehicle using an NFC-enabled device (e.g. key card or smartphone) as a vehicle key. To unlock the vehicle, the customer holds their NFC-enabled device near an exterior NFC reader of the vehicle. To authorize start and drive-away, the customer holds their NFC-enabled device near, or places it on, an interior NFC reader of the vehicle.

## Feature Variants

|  |  |  |
| --- | --- | --- |
| **Variant Name** | **Variant Description** | **Remarks** |
| **NFC Access Cards** | Entering and starting a vehicle using Ford-provided NFC smart cards ("NFC access cards"). |  |
| **NFC Phone / Smart Device** | Entering and starting a vehicle using a smartphone or other smart device (smartwatch, etc) that has NFC digital key capability. |  |

### Regions & Markets

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Market /**  **Region**  Variant Name | **North America** | **South America** | **Europe** | **Middle East/Africa** | **Asia / Pacific** | **China** |
| **NFC Access Cards** | Optional | Optional | Optional | Optional | Optional | Optional |
| **NFC Phone / Smart Device** | Optional | Optional | Optional | Optional | Optional | Optional |

Table 2: Regions & Markets

## Input Requirements

### Legal Requirements

* : ECE-116 Vehicle Alarm and Immobilizer
* : Legal & Insurance Requirements
* : USA/CAN NHTSA Driver Distraction Guidelines
* : USA/CDN F/CMVSS 114 Theft Protection and Rollaway Prevention

### Trustmark Requirements

* : Controls/Features Layout & Behavior
* : Identification of Security Functions - Cyber Security
* : Key Device Programming Instructions
* : Key In Reminder Chime
* : Labeling Methods and Types
* : Logic of Operation: Feedback
* : Logic of Operation: Interpretation
* : Logic of Operation: Interruptibility
* : Logic of Operation: Not Intended For Use While Driving
* : Logic of Operation: Use of Systems with Visual Displays
* : Logic of Operation: Visual Information
* : Operational Stereotypes
* : Secure Idle Control Function
* : Symbols Usage and Legibility
* : Usability of In-Vehicle Systems / Components

### Industry Standards

* ISO / IEC 14443 : Contactless Proximity Technology
  + Standard for contactless proximity technology.
  + Subset of RFID, limited to 13.56 MHz frequency
  + Active action required
  + Short range (several cm)
* : P2P and Card Emulation Modes
* : Smartphone as a Key Technology
* : Standard for Functional Safety

## Lessons Learned

1. NFC readers should be packaged close enough to an A-surface to allow for a 5-10cm read range from that A-surface.
2. NFC readers should be packaged at least 20mm away from sheet metal or other similar interfering materials.
3. NFC Logo should withstand recurring contact from NFC Device, as this will happen a lot
4. NFC Card dimensions should match the NFC Reader dimensions for best read performance.
5. NFC Logo should be on readers to indicate to the user where to scan

## Assumptions

• For vehicles with FNV3+ vehicle architecture.

• Feature is to be available on both Ford and Lincoln vehicles.

• Feature is to be offered as a standalone, that can be added to vehicles with Full PEPs, Partial PEPs, PaaK or combination

• Feature is to implement requirements of the Car Connectivity Consortium’s Digital Key standard.

• Vehicles with feature will have two NFC key cards programmed from the factory.

• Vehicles with feature will have at least one exterior NFC reader and at least one interior NFC reader.

Constraints:

• Vehicle must be equipped with a start/stop button.

• Vehicle must be equipped with an embedded modem.

• Vehicle must be equipped with SYNC.

• Feature will only support Android and iOS devices that are CCC compliant.

• User must have Internet connectivity to program an NFC-enabled device as a key.

• Ford backend systems must support User Roles.

# Feature Context

## Feature Context Diagram

Feature Context of Near Field Communication

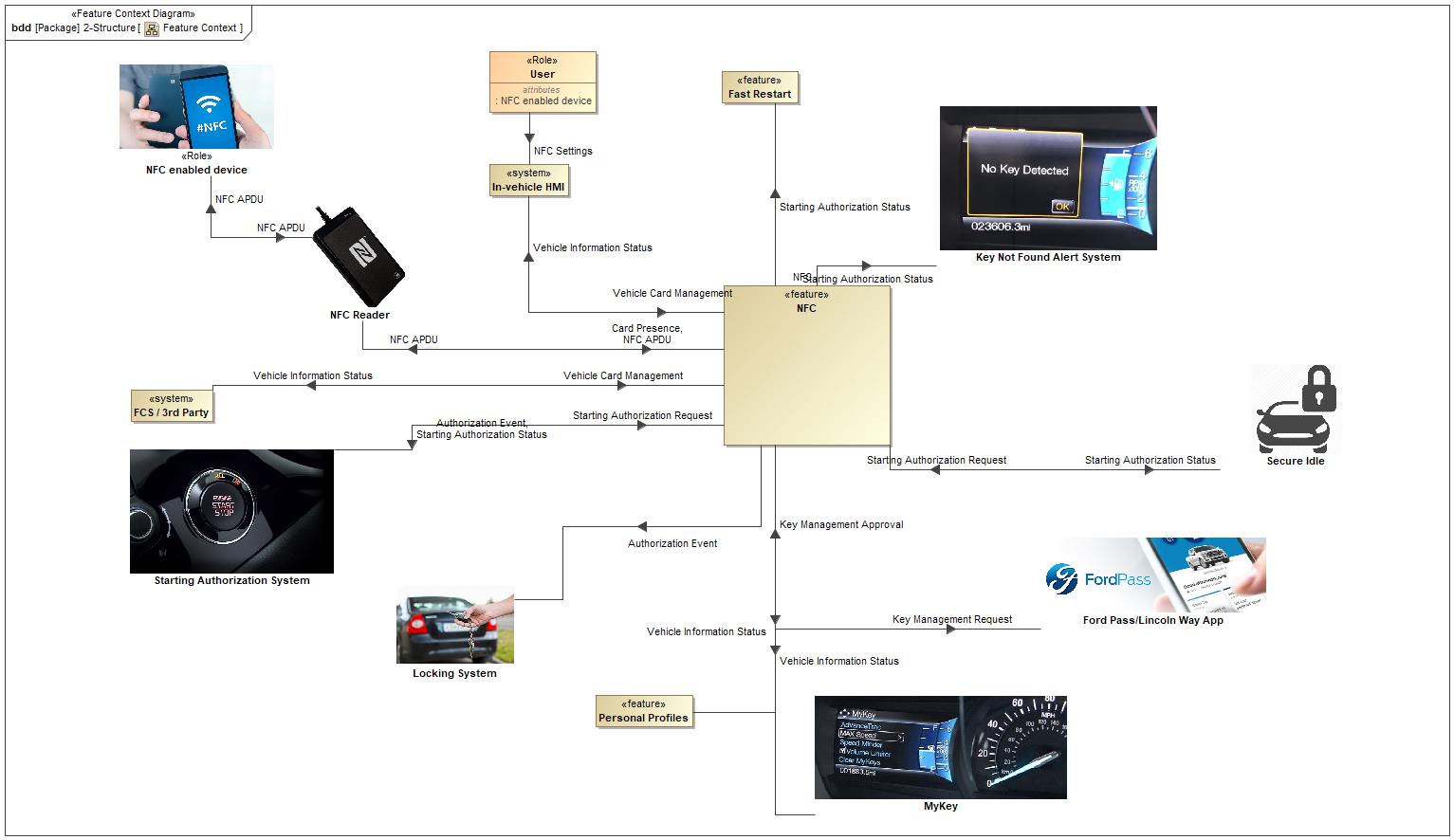


Figure 1: Feature Context

## List of Influences

|  |  |
| --- | --- |
| **ID** | **External Entity** |
| Authorization Event | NFC To Locking System |
| NFC To Starting Authorization System |
| Card Presence | NFC Reader To NFC |
| Key Management Approval | Ford Pass/Lincoln Way App To NFC |
| Key Management Request | NFC To Ford Pass/Lincoln Way App |
| NFC APDU | NFC Reader To NFC |
| NFC Reader To NFC enabled device |
| NFC To NFC Reader |
| NFC enabled device To NFC Reader |
| NFC Settings | User To |
| Starting Authorization Request | Secure Idle To NFC |
| Starting Authorization System To NFC |
| Starting Authorization Status | NFC To Fast Restart |
| NFC To Key Not Found Alert System |
| NFC To Secure Idle |
| NFC To Starting Authorization System |
| Vehicle Card Management |  |
| Vehicle Information Status | NFC To |
| NFC To MyKey |
| NFC To Personal Profiles |

Table 3: List of Influences

# Feature Modeling

## Use Cases

### Use Case Diagram

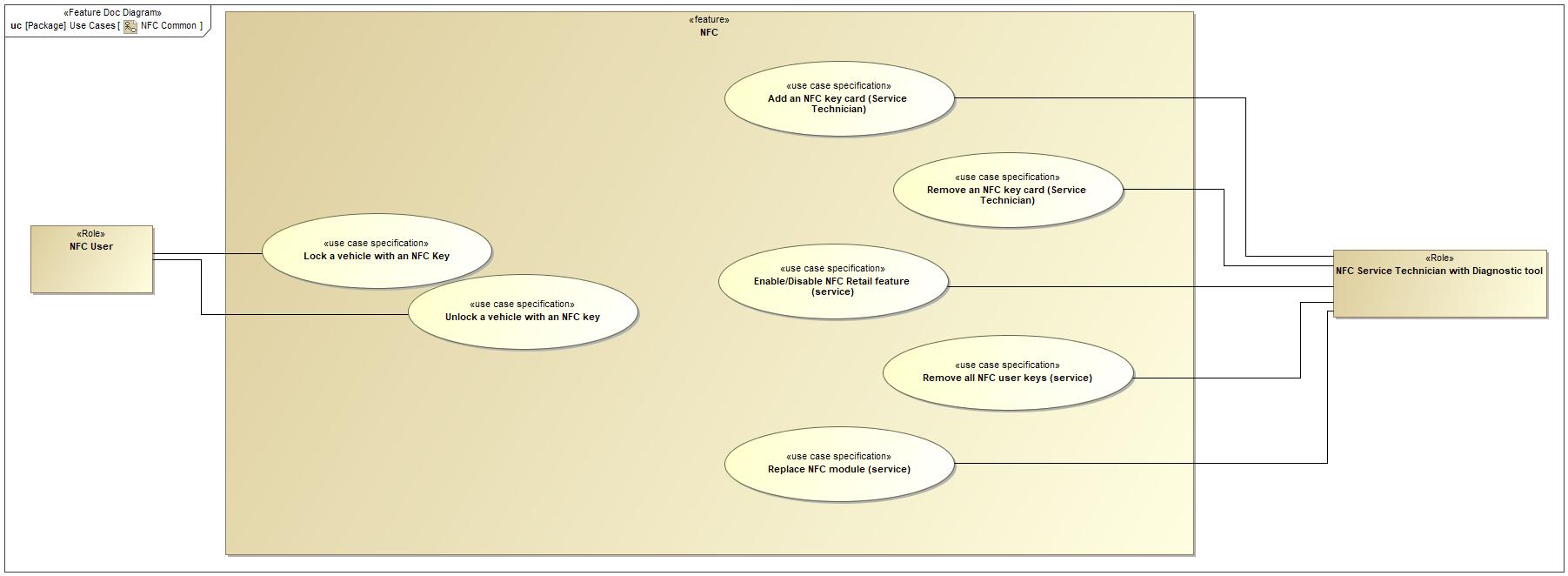


Figure 2: NFC Common

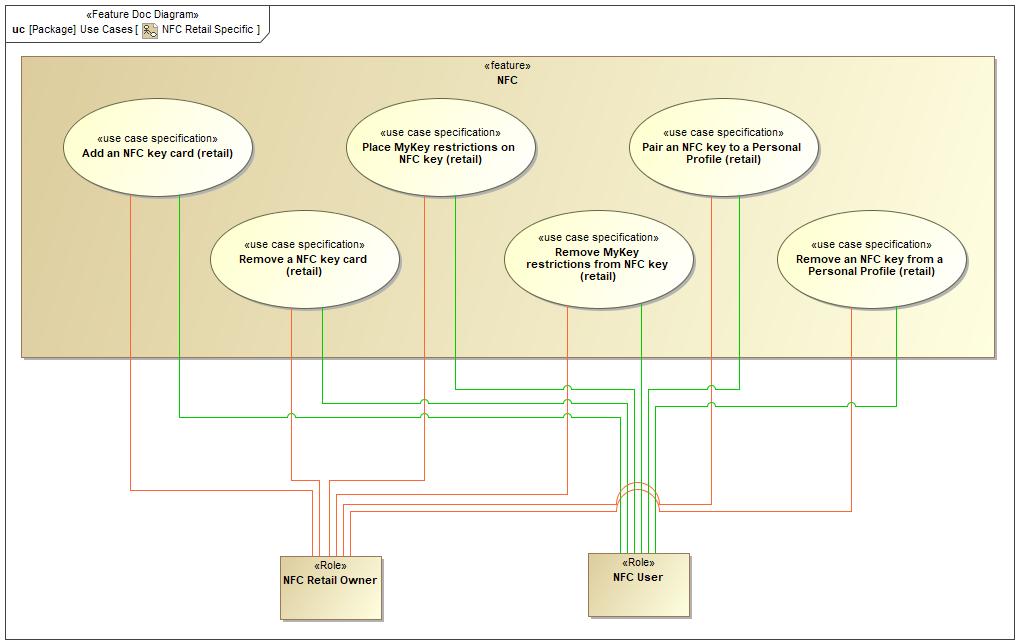


Figure 3: NFC Retail Specific

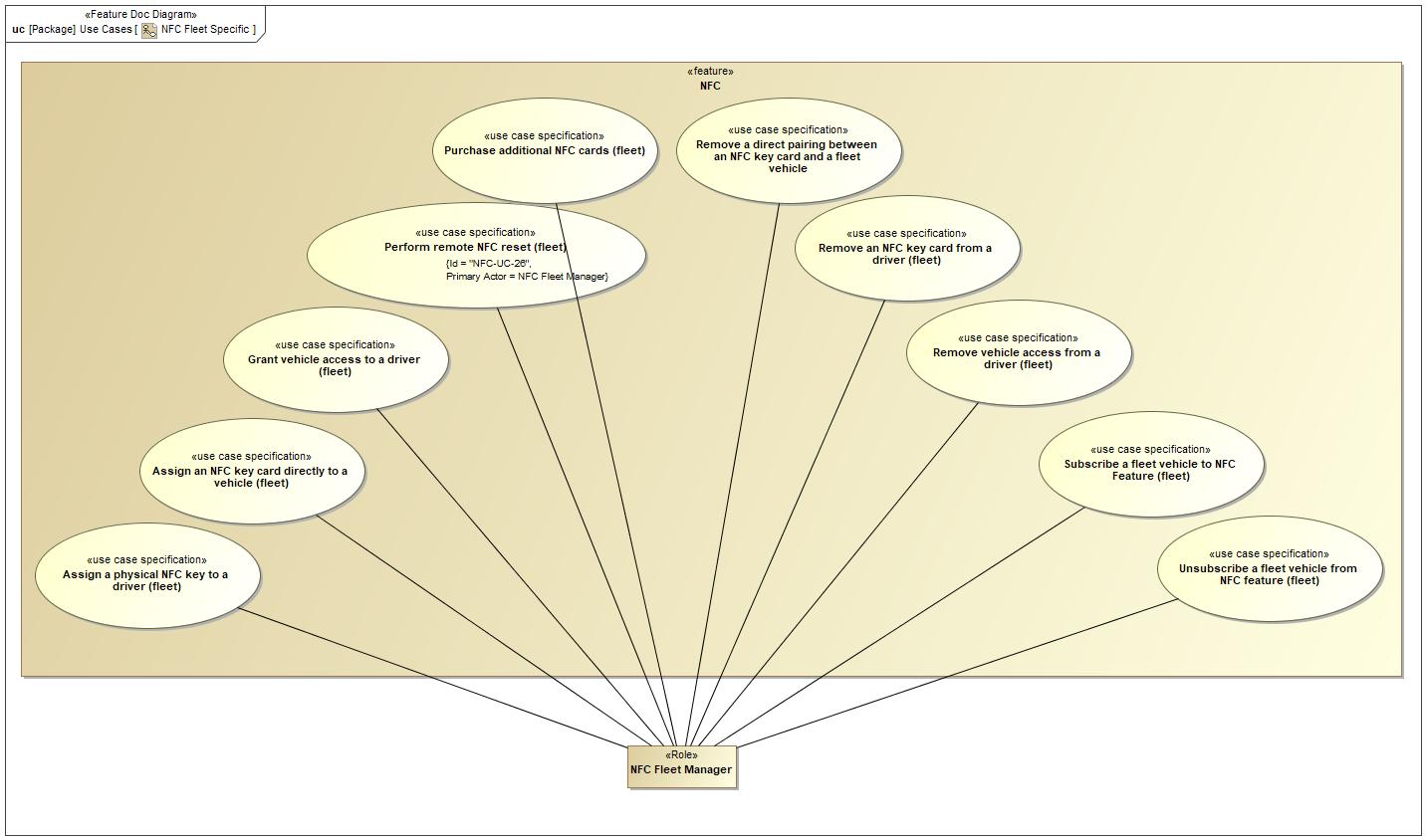


Figure 4: NFC Fleet Specific

### Actors

| **Actor** | **Description** |
| --- | --- |
| NFC Fleet Manager | The manager of an FCS fleet which has NFC-capable vehicles that are subscribed to the fleet NFC management feature. |
| NFC Retail Owner | The owner of an NFC-enabled vehicle who has authorized the vehicle's modem and uses the FordPass or Lincoln Way app to interact with their vehicle. |
| NFC Service Technician with Diagnostic tool | A service technician who needs to service or replace components of NFC-capable vehicles. |
| NFC User | Any user of an NFC-capable vehicle who uses an NFC access card or NFC smart device to open and/or start the vehicle. |

Table 4: List of Actors

### Use Case Descriptions

NFC-UC-GE2-1 Start a DCO vehicle using exterior NFC authorization

|  |  |  |
| --- | --- | --- |
| **Actors** |  |  |
| **Description** |  |  |
| **Preconditions** | PreC1 | All vehicle doors are locked. |
| PreC2 | Exterior NFC Starting Authorization is enabled. |
| PreC3 | NFC feature is enabled. |
| PreC4 | There is no PEPS keyfob in the vehicle. |
| PreC5 | There is no PaaK device in the vehicle, or the vehicle does not have PaaK enabled. |
| PreC6 | User has an NFC device with access to this vehicle. |
| PreC7 | Vehicle battery is not completely discharged. |
| PreC8 | Vehicle is off. |
| **Main Flow Description** |  | To start the vehicle quickly after unlocking it. |
| **Main Flow** | M1 | User places NFC device near NFC reader at driver door. |
| M2 | Vehicle unlocks. |
| M3 | User enters vehicle. |
| M4 | In-vehicle HMI displys message: To Drive Press Brake Pedal and Select Gear (or equivalent) |
| M5 | User holds brake pedal and Shifts into "D" or "R" on gear selector before exterior starting authorization timeout has expired. |
| M6 | Vehicle starts and enters motive state |
| **Alternative Flow Description** |  | Exterior starting authorization timeout expires before user presses brake and selects gear. |
| **Alternative Flow Steps** | A1 | After user enters vehicle: in-vehicle HMI displays message: To Drive Press Brake Pedal and Select Gear (or equivalent) |
| A2 | User does not follow instructions before exterior starting authorization timeout expires |
| A3 | In-vehicle HMI indicates: To Drive Scan Digital Key (or equivalent) |
| A4 | User presses brake pedal and selects gear |
| A5 | In-vehicle HMI displays message: No Key Found / Scan Digital Key to Drive (or equivalent) |
| A6 | User scans NFC device at interior reader. |
| A7 | User presses brake pedal and selects "D" or "R" gear position |
| **Postconditions** | PostC1 | Vehicle is started. |

NFC-UC-GE2-2 Start a DCO vehicle using interior NFC authorization

|  |  |  |
| --- | --- | --- |
| **Actors** |  |  |
| **Description** |  |  |
| **Preconditions** | PreC1 | NFC Retail/Fleet feature is enabled. |
| PreC2 | User has an NFC key to this vehicle. |
| PreC3 | Vehicle is off. |
| **Main Flow Description** |  | To start the vehicle when the vehicle is already unlocked or when the user is already inside. |
| **Main Flow** | M1 | User holds NFC card near interior NFC reader. |
| M2 | In-vehicle HMI displys message: To Drive Press Brake Pedal and Select Gear (or equivalent) |
| M3 | User holds brake pedal and shifts into "D" or "R" on gear selector before interior scan timer expires |
| M4 | Vehicle starts. |
| **Alternative Flow Description** |  | User waits for longer than the interior starting authorization timeout duration before entering vehicle into motive state |
| **Alternative Flow Description** |  | User waits for longer than the interior NFC scanning timeout (~30 minutes) without triggering a bus wakeup (pressing brake pedal, opening/closing doors, etc) |
| **Alternative Flow Steps** | A1 | User waits after scanning NFC key card for longer than the interior starting authorization timeout duration before attempting to start vehicle: |
| A2 | After in-vehicle HMI displays OK-to-start message: User does not start vehicle within the NFC system starting authorization timeout duration (~20 sec) |
| A3 | After NFC system starting authorization timeout expires: in-vehicle HMI no longer displays OK-to-start message |
| A4 | User holds brake pedal and select "D" or "R" gear |
| A5 | Vehicle does not start. In-vehicle HMI displays message: No Key Found / Scan NFC Key (or equivalent) |
| A6 | Remainder of steps are main success scenario steps. |
| A7 | - |
| A8 | User waits for longer than the interior NFC scanning timeout (~30 minutes) without triggering bus wakeup: |
| A9 | After the interior NFC scanning timeout has expired: The vehicle's interior NFC reader stops actively detecting NFC key cards. |
| A10 | User holds NFC card near interior NFC reader. |
| A11 | NFC key card is not detected. Nothing happens. |
| A12 | User triggers vehicle wake-up: selects "D"/"R" gear, or presses brake pedal, or opens vehicle door. |
| A13 | In-vehicle HMI displays message: No Key Found / Scan NFC Key or equivalent |
| A14 | Remainder of steps are main success scenario steps. |
| **Postconditions** | PostC1 | Vehicle is started. |

NFC-UC-GE2-3 Enter Motive State with an NFC Key following DCO vehicle Remote Start

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| --- | --- | --- |
| **Actors** |  |  |
| **Description** |  |  |
| **Preconditions** | PreC1 | User has an NFC key (NFC key card or NFC smart device) to this vehicle. |
| PreC2 | Vehicle is locked. |
| PreC3 | Vehicle is running in non-motive state due to Remote Start |
| **Main Flow Description** |  | To transition vehicle into motive state with an NFC key following a Remote Start event |
| **Main Flow** | M1 | User holds NFC key near exterior NFC reader. |
| M2 | Vehicle unlocks. |
| M3 | User enters vehicle. |
| M4 | In-vehicle HMI displays message: To Drive Press Brake Pedal and Select Gear |
| M5 | User presses brake pedal and selects "D" or "R" gear |
| **Alternative Flow Description** |  | User waits for longer than exterior NFC starting authorization timeout duration before pressing brake pedal and selecting gear |
| **Alternative Flow Steps** | A1 | Same as alternative flow steps for Start a vehicle with exterior NFC authorization. |
| **Postconditions** | PostC1 | Vehicle can now be driven. |

NFC-UC-GE2-4 Exit Secure Idle with an NFC Key on DCO vehicles

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| **Actors** |  |  |
| **Description** |  |  |
| **Preconditions** | PreC1 | NFC feature is enabled. |
| PreC2 | User has NFC key to this vehicle. |
| PreC3 | Vehicle is in Secure Idle state (engine running, non-motive) |
| **Main Flow Description** |  | To transition vehicle out of Secure Idle state with an NFC key . |
| **Main Flow** | M1 | User attempts to drive vehicle (e.g. pushes brake pedal). |
| M2 | In-vehicle HMI displays message: No Key Found / Scan NFC Key To Drive (or equivalent) |
| M3 | User places NFC key near interior NFC reader. |
| M4 | In-vehicle HMI displays message: OK To Drive (or equivalent) |
| **Postconditions** | PostC1 | Vehicle can now be shifted out of park and driven. |

NFC-UC-02 Add an NFC key card (Service Technician)

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| --- | --- | --- |
| **Actors** | Primary | NFC Service Technician with Diagnostic tool |
| **Subject** |  | Enabling/disabling the NFC Retail feature via Service tool |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | NFC Retail Feature is enabled. |
| PreC2 | Service technician has a service tool that supports NFC key card add/delete. |
| PreC3 | Service technician has access to vehicle's OBD-II port. |
| PreC4 | Service technician has an NFC key card that has not been programmed to this vehicle. |
| PreC5 | Service technician has valid credentials to service backend system. |
| PreC6 | Service tool has connectivity. |
| **Main Flow Description** |  | To add a new physical NFC key to the vehicle as a service technician. |
| **Main Flow** | M1 | Service technician selects "add NFC key card" operation on service tool. |
| M2 | Service technician selects operation parameters (add factory key vs. add user key), then enters their credentials, vehicle VIN, key friendly name, and FESN of card to be added |
| M3 | Service tool connects to service backend and obtains command package using details entered by technician. |
| M4 | Service tool transmits command package to NFC system and verifies successful command execution. |
| M5 | Service tool displays success message. |
| M6 | Service tool sends message to Ford backend reporting that key add has been completed. |
| M7 | Service tool prompts for connection to vehicle. |
| **Exceptional Flow Description** |  | Service technician chooses to add a factory key, but vehicle already has two factory keys programmed. |
| **Exceptional Flow Description** |  | Service tool unable to connect to Ford backend to obtain command package. |
| **Exceptional Flow Description** |  | Service tool unable to connect to vehicle or unable to communicate with NFC system on vehicle. |
| **Exceptional Flow Description** |  | Service tool loses connectivity after receiving key add command package |
| **Exceptional Flow Description** |  | Technician connects service tool to vehicle, but after a delay longer than the command package expiration time |
| **Exceptional Flow Description** |  | Malicious technician receives key add command package and extracts package from service tool, then attempts to transmit command package to vehicle using third-party tool after a delay longer than the command package timeout |
| **Exceptional Flow Steps** | E1 | After service tool connects to service backend and obtains command package using details entered by technician: Service backend replies and provides valid command package, along with excess factory key warning |
| E2 | Service tool displays warning that vehicle already has maximum number of factory keys, with option to attempt key add anyway |
| E3 | Service tool detects failed command package execution and displays error message |
| E4 | - |
| E5 | Service tool unable to connect to Ford backend to obtain command package: |
| E6 | After service technician selects operation parameters and enters credentials: Service tool attempts to contact Ford backend and fails |
| E7 | Service tool displays error message indicating that connection failed |
| E8 | - |
| E9 | Service tool unable to connect to vehicle or unable to communicate with NFC system on vehicle: |
| E10 | After technician connects service tool to vehicle: service tool attempts to communicate with NFC system and fails |
| E11 | Service tool displays connection error message |
| E12 | - |
| E13 | Service tool loses connectivity after receiving key add command package: |
| E14 | After service tool transmits command package to NFC system and verifies successful command execution: Service tool displays success message |
| E15 | Service tool attempts to deliver message to Ford backend reporting successful key add, but fails |
| E16 | Service tool stores key add success message indefinitely and waits for return of connectivity |
| E17 | - |
| E18 | Malicious technician receives key add command package, extracts it from service tool, then attempts to use third-party tool to transmit key add package to vehicle after key add package timeout |
| E19 | After service tool connects to service backend and obtains command package using details entered by technician: Technician extracts command package from service tool using some unsupported method |
| E20 | Some amount of time passes (longer than command package expiration) |
| E21 | Malicious technician connects to vehicle with third-party tool and attempts to transmit service package to NFC system |
| E22 | NFC system refuses to execute command package |
| E23 | After service tool prompts for connection to vehicle: Some time passes (longer than command package expiration time) |
| E24 | If technician chooses to try key add anyway: Service tool prompts for connection to vehicle |
| E25 | Technician connects service tool to vehicle, but after a delay longer than the command package expiration time: |
| E26 | Technician connects service tool to vehicle |
| E27 | Service technician chooses to add a factory key, but vehicle already has two factory keys programmed: |
| E28 | - |
| E29 | NFC system refuses to execute command package because two factory keys are already present |
| E30 | Service tool displays error message to technician indicating that command package has expired |
| E31 | After command package expiration time expires: Service tool deletes command package from internal memory |
| E32 | Service tool transmits command package to NFC system |
| **Postconditions** | PostC1 | Ford backend key pairing records are updated to reflect new key pairing. |
| PostC2 | If vehicle is subscribed to NFC fleet management feature: New NFC key card appears in "Keys with access to this vehicle" list of vehicle information page on FFM portal |
| PostC3 | New NFC key card can now be used to access and start this vehicle. |

NFC-UC-03 Assign a physical NFC key to a driver (fleet)

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| **Actors** | Primary | NFC Fleet Manager |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Fleet manager has an NFC Key Card that is not assigned to any other driver in that fleet |
| PreC2 | Fleet manager has created a driver in the fleet |
| **Main Flow Description** |  | To assign an NFC Key Card to a specific driver in a fleet. |
| **Main Flow** | M1 | Fleet manager accesses fleet management web portal and selects the driver in question |
| M2 | Fleet manager selects operation: "Assign NFC Key Card" |
| M3 | Fleet manager selects the NFC Key Card to be assigned by selecting it from a list of available keys |
| M4 | Fleet manager confirms operation ("are you sure?") |
| **Exceptional Flow Description** |  | Fleet manager selects an NFC key card that is currently assigned to another driver in the same fleet |
| **Exceptional Flow Steps** | E1 | After fleet manager selects the NFC key card to be assigned: FCS portal displays error message indicating that key card has already been assigned to another driver |
| **Postconditions** | PostC1 | FCS portal creates pairings between the specified NFC key card and any vehicles that the driver has been assigned access to |
| PostC2 | Specified NFC key card appears on driver's information page in FCS portal, as key card assigned to driver |
| PostC3 | Specified NFC key card is assigned to specified driver. |
| PostC4 | The specified NFC key card appears on the vehicle information page for any vehicle the driver has access to, in the list of NFC key cards that can access the vehicle (first as pending, then as complete) |

NFC-UC-04 Assign an NFC key card directly to a vehicle (fleet)

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| --- | --- | --- |
| **Actors** | Primary | NFC Fleet Manager |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Fleet manager has possession of an NFC key card that is not a member of another fleet. |
| PreC2 | Vehicle in question has an active subscription to the NFC fleet management feature. |
| **Main Flow Description** |  | To pair an NFC card with a fleet vehicle directly (without first associating the key card with a fleet driver) |
| **Main Flow** | M1 | Fleet manager accesses FFM portal and navigates to the vehicle information page for the vehicle in question. |
| M2 | Fleet manager selects operation: "Add Key" (or equivalent) |
| M3 | Fleet manager selects the NFC key card they want to add by typing in the card FESN directly, or by choosing it from a list of NFC key cards in their fleet |
| M4 | Fleet manager confirms operation ("are you sure?") |
| M5 | NFC key card appears on vehicle information page in FFM portal for the vehicle in question in the "Cards that can access this vehicle" list, with "Pending" label |
| M6 | FFM backend requests pairing from Ford backend |
| M7 | Ford backend generates command package and transmits it to vehicle |
| M8 | Vehicle adds pairing with specified NFC key card and confirms completion to backend |
| M9 | "Pending" label no longer appears next to NFC key card on vehicle information page |
| **Exceptional Flow Description** |  | Same exceptional flows and exceptional flow steps as "Grant access to a driver (fleet)". |
| **Postconditions** | PostC1 | NFC key card appears on the vehicle information page in FFM portal for the vehicle in question, in the "Cards that can access this vehicle" list |
| PostC2 | NFC key card can be used to enter and start the vehicle in question |

NFC-UC-05 Digital Key - Change Owner Device

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Digital Key feature has been activated on this vehicle. |
| PreC2 | Retail Vehicle Owner has a Ford web account. |
| PreC3 | Retail Vehicle Owner has a factory (physical) key to their vehicle. |
| PreC4 | Retail Vehicle Owner has activated connectivity (i.e. authorized vehicle modem) on their vehicle via their Ford account, which makes their account the primary account to the vehicle. |
| PreC5 | Retail Vehicle Owner has added vehicle to Ford web account garage (VIN#). |
| PreC6 | Retail Vehicle Owner has the Ford mobile app installed on their phone. |
| PreC7 | Retail Vehicle Owner is logged into primary account on the Ford mobile app on a device that is not the owner device for the vehicle in question. |
| PreC8 | Retail Vehicle Owner’s phone has network connectivity. |
| PreC9 | Retail Vehicle Owner’s phone is CCC-compliant (Digital Key applet is on device). |
| PreC10 | Vehicle has network connectivity. |
| **Main Flow Description** |  | Tranfer key to a new CCC enabled owner device |
| **Main Flow** | M1 | In Ford mobile app, Retail Vehicle Owner (signed in as primary account) selects to change owner/primary device. |
| M2 | Ford mobile app informs user that this action will delete current owner key once completed, but friend keys will remain active, and prompts them to continue. |
| M3 | User selects to continue. |
| M4 | Continue from setp M2 in Main Flow of "Digital Key - Pair Owner Device" |
| M5 | Before M6 of "Digital Key - Pair Owner Device" the previous Owner Key shall be terminated |
| **Alternative Flow Description** |  | Start "change owner device" from in-vehicle HMI. |
| **Alternative Flow Steps** | A1 | From in-vehicle HMI, Retail Vehicle Owner selects to change device. |
| A2 | In-vehicle HMI prompts user to scan new phone at reader (for BLE/UWB: prompts user to accept pairing). |
| A3 | Retail Vehicle Owner scans new phone at reader. |
| A4 | If Ford mobile app is installed on user’s phone, phone opens it up. |
| A5 | If user is logged into Primary account in Ford mobile app, mobile app prompts user to name digital key (prepopulated with device name). |
| A6 | Continue from step M3 in Main Flow of “Digital Key - Pair Owner Device“ use case. |
| A7 | Before M6 of "Digital Key - Pair Owner Device" the previous Owner Key shall be terminated |
| **Postconditions** | PostC1 | Retail Vehicle Owner can use their new phone to access and start this vehicle via NFC. |
| PostC2 | Retail Vehicle Owner’s new phone has a digital key to this vehicle, which can be seen in the native app and the Ford app on their device. |
| PostC3 | Retail Vehicle Owner’s new phone is now the owner/primary device for this vehicle, according to CCC DK definition. |
| PostC4 | Retail Vehicle Owner’s old phone no longer has a digital key to this vehicle and can no longer be used to access and start the vehicle. |

NFC-UC-06 Digital Key - Friend Key Expires

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | User’s phone is a friend device for this vehicle (per CCC Digital Key definition). |
| **Main Flow Description** |  | Friend digital key is removed from the vehicle and friend device. |
| **Main Flow** | M1 | TBD |
| **Postconditions** | PostC1 | User’s phone can no longer be used to access and start the vehicle. |

NFC-UC-07 Digital Key - Garage Service Process

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| --- | --- | --- |
| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Retail Vehicle Owner’s phone is the owner device for this vehicle (per CCC Digital Key definition). |
| PreC2 | User’s phone is a friend device for this vehicle (per CCC Digital Key definition). |
| **Main Flow Description** |  | Owner and Friend digital keys are removed from the vehicle and device. |
| **Main Flow** | M1 | Service technician runs module decommissioning routine. |
| M2 | Owner and Friends receive notifications of their keys being terminated. |
| **Postconditions** | PostC1 | Retail Vehicle Owner’s phone can no longer be used to access and start the vehicle. |
| PostC2 | User's phone can no longer be used to access and start the vehicle. |

NFC-UC-08 Digital Key - Owner Device is Wiped Locally

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Retail Vehicle Owner’s phone is the owner device for this vehicle (per CCC Digital Key definition). |
| **Main Flow Description** |  | Owner's digital key is removed from the vehicle and friend device. |
| **Main Flow** | M1 | On owner/primary device, Retail Vehicle Owner selects to wipe their device. |
| **Postconditions** | PostC1 | Owner's phone can no longer be used to access and start the vehicle. |

NFC-UC-09 Digital Key - Owner Device is Wiped Remotely

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Retail Vehicle Owner’s phone is the owner device for this vehicle (per CCC Digital Key definition). |
| **Main Flow Description** |  | Owner's digital key is removed from the vehicle and friend device. |
| **Main Flow** | M1 | In Device OEM portal, User selects to wipe their device remotely. |
| **Postconditions** | PostC1 | Owner's phone can no longer be used to access and start the vehicle. |

NFC-UC-10 Digital Key - Owner Terminate Friend Key in Vehicle

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Retail Vehicle Owner’s phone is the owner device for this vehicle (per CCC Digital Key definition). |
| PreC2 | User’s phone is a friend device for this vehicle (per CCC Digital Key definition). |
| **Main Flow Description** |  | Friend digital key is removed from the vehicle and friend device. |
| **Main Flow** | M1 | Retail Vehicle Owner starts vehicle with owner/primary device. |
| M2 | From in-vehicle HMI, Retail Vehicle Owner selects to view the list of keys. |
| M3 | In-vehicle HMI displays the list of keys. |
| M4 | Retail Vehicle Owner selects to delete a friend key. |
| M5 | In-vehicle HMI prompts user to confirm deletion of friend key. |
| M6 | Retail Vehicle Owner selects to confirm deletion of friend key. |
| M7 | In-vehicle HMI displays message saying friend key has been deleted. |
| M8 | Primary account holder is notified of key deletion via email. |
| M9 | With a native app/Ford mobile app message, Friend is notified of key deletion. |
| M10 | With a native app/Ford mobile app message, Owner is notified of key deletion from friend device. |
| **Postconditions** | PostC1 | User’s phone can no longer be used to access and start the vehicle. |

NFC-UC-11 Digital Key - Owner Terminates Owner Key in Native App

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Retail Vehicle Owner’s phone is the owner device for this vehicle (per CCC Digital Key definition). |
| **Main Flow Description** |  | Owner's digital key is removed from the vehicle and friend device. |
| **Main Flow** | M1 | In native app, Retail Vehicle Owner selects vehicle. |
| M2 | Native app displays the list of keys. |
| M3 | Retail Vehicle Owner selects to delete their key. |
| M4 | Native app prompts user to confirm deletion of their key. |
| M5 | Retail Vehicle Owner selects to confirm deletion of their key. |
| M6 | With a native app/Ford mobile app message, Owner is notified of key deletion. |
| **Postconditions** | PostC1 | Owner's phone can no longer be used to access and start the vehicle. |

NFC-UC-12 Digital Key - Pair Owner Device

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Retail Vehicle Owner has a Ford/Lincoln web account. |
| PreC2 | Retail Vehicle Owner has a factory key to their vehicle. |
| PreC3 | Retail Vehicle Owner has activated connectivity (i.e. authorized vehicle modem) on their vehicle via their Ford/Lincoln account, which makes their account the Primary account to the Vehicle. |
| PreC4 | Retail Vehicle Owner has added vehicle to Ford web account garage (VIN#). |
| PreC5 | Retail Vehicle Owner has the Ford/Lincoln mobile app installed on their phone. |
| PreC6 | Retail Vehicle Owner's phone has network connectivity. |
| PreC7 | Retail vehicle Owner's phone is CCC-compliant (Digital Key applet is on device). |
| PreC8 | Vehicle does not have a CCC Owner devce paired. |
| PreC9 | Vehicle has network connectivity. |
| **Main Flow Description** |  | To pair a NFC connected device with a retail vehicle. |
| **Main Flow** | M1 | In Ford/Lincoln mobile app, Retail Vehicle Owner (signed in as the Primary account) selects to pair an NFC connected device key. |
| M2 | Ford/Lincoln mobile app prompts user to name the connected device key (prepopulated with device name). |
| M3 | Retail Vehicle Owner names digital key in Ford/Lincoln mobile app. |
| M4 | Ford/Lincoln mobile app tells user to start vehicle with factory key if not already started, tap Start Pairing/Next (on device), and follow instructions on device. |
| M5 | Retail Vehicle Owner starts vehicle with a factory key. |
| M6 | Retail Vehicle Owner selects Next in Ford/Lincoln mobile app. |
| M7 | Phone UI changes from Ford mobile app to native app (device OS specific). |
| M8 | Native app instructs user to place device on/near reader. |
| M9 | Retail Vehicle Owner places devices on/near reader. |
| M10 | In-vehicle HMI displays pairing progress. |
| M11 | In-vehicle HMI displays a success message if pairing process completes within 5 seconds. |
| M12 | Native app display success message if pairing process completes within 5 seconds, else it displays message saying “Retry” or “Cancel” (Apple, current state) or TBD (Samsung). |
| M13 | If native app displays successful message, user can select continue and be taken back to Ford/Lincoln mobile app for final messaging. |
| **Alternative Flow Description** |  | Start setup from in-vehicle HMI settings menu |
| **Alternative Flow Description** |  | Start setup from in-vehicle setup guide (rocket setup) |
| **Alternative Flow Steps** | A1 | 1.1 From in-vehicle HMI, Retail Vehicle Owner selects to set up phone as a key.  1.2 In-vehicle HMI prompts user to scan phone at reader.  1.3 Retail Vehicle Owner scans phone at reader.  1.4 If Ford/Lincoln mobile app is installed on user’s phone, phone opens it up.  1.5 If user is logged into Primary account in Ford mobile app, mobile app prompts user to name digital key (prepopulated with device name). |
| A2 | 2.1 Retail Vehicle Owner starts in-vehicle setup guide.  2.2 In-vehicle setup guide asks user if they want to set up a phone as a key.  2.3 Retail Vehicle Owner selects to set up phone as a key. |
| **Exceptional Flow Description** |  | If KTS attestation is not received within 5 seconds |
| **Exceptional Flow Steps** | E1 | M11. In-Vehicle HMI displays message directing user back to device to check key status. |
| E2 | M12. Native (and Ford) app displays message saying “key is pending – need network connectivity”. |
| **Postconditions** | PostC1 | Retail Vehicle Owner can use their phone to access and start this vehicle via NFC. |
| PostC2 | Retail Vehicle Owner’s phone has a digital key to this vehicle, which can be seen in the native app and the Ford/Lincoln app on their device. |
| PostC3 | Retail Vehicle Owner’s phone is now the Owner device for this vehicle, according to CCC DK definition. |
| PostC4 | connected device is now paired to the vehicle with a digital key. |

NFC-UC-13 Digital Key - Security Breach on Friend Device

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | User’s phone is a friend device for this vehicle (per CCC Digital Key definition). |
| **Main Flow Description** |  | Friend digital key is removed from the vehicle and device. |
| **Main Flow** | M1 | With a native app/Ford mobile app message, Owner is notified of key deletion from friend device. |
| **Postconditions** | PostC1 | User's phone can no longer be used to access and start the vehicle. |

NFC-UC-14 Digital Key - Security Breach on Owner Device

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Retail Vehicle Owner’s phone is the Owner device for this vehicle (per CCC Digital Key definition). |
| **Main Flow Description** |  | Owner digital key is removed from the vehicle and device. |
| **Main Flow** | M1 | With a native app/Ford mobile app message, Friend(s) are notified of key deletion. |
| **Postconditions** | PostC1 | Retail Vehicle Owner’s phone can no longer be used to access and start the vehicle. |
| PostC2 | User's phone can no longer be used to access and start the vehicle. |

NFC-UC-15 Digital Key - Vehicle Removed From Primary Account

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Retail Vehicle Owner’s phone is the owner device for this vehicle (per CCC Digital Key definition). |
| **Main Flow Description** |  | Owner and Friend digital keys are removed from the vehicle and device. |
| **Main Flow** | M1 | Retail Vehicle Owner (signed in as primary account) selects to remove vehicle from Ford mobile app garage. |
| M2 | Ford mobile app informs user that this action will delete all digital keys and prompts user to confirm. |
| M3 | Retail Vehicle Owner confirms. |
| M4 | With a native app/Ford mobile app message, Friend(s) are notified of key deletion. |
| M5 | With a native app/Ford mobile app message, Owner is notified of key deletion. |
| **Postconditions** | PostC1 | Retail Vehicle Owner’s phone can no longer be used to access and start the vehicle.Retail Vehicle Owner’s phone no longer has a digital key to this vehicle and can no longer be used to access and start the vehicle. |
| PostC2 | User’s phone can no longer be used to access and start the vehicle.User’s phone no longer has a digital key to this vehicle and can no longer be used to access and start the vehicle. |

NFC-UC-16 Digital Key - Vehicle Removed From Secondary Account

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | User’s phone is a friend device for this vehicle (per CCC Digital Key definition). |
| **Main Flow Description** |  | Friend digital keyremains on vehicle and friend device. |
| **Main Flow** | M1 | Retail Vehicle User (signed in as secondary account) selects to remove vehicle from Ford mobile app garage. |
| M2 | Ford mobile app presents discalimer. |
| M3 | Retail Vehicle User confirms. |
| M4 | Vehicle is removed from Retail Vehicle User's garage but the Key is still active on the Device and Vehicle. |
| **Postconditions** | PostC1 | User’s phone can still be used to access and start the vehicle. |

NFC-UC-17 Digital Key -out of scope- Owner Terminates Friend Key in Ford app

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| **Actors** |  |  |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Retail Vehicle Owner’s phone is the owner device for this vehicle (per CCC Digital Key definition). |
| PreC2 | User’s phone is a friend device for this vehicle (per CCC Digital Key definition). |
| **Main Flow Description** |  | Friend digital key is removed from the vehicle and friend device. |
| **Main Flow** | M1 | In Ford mobile app, Retail Vehicle Owner selects vehicle. |
| M2 | Retail Vehicle Owner selects to view the list of keys. |
| M3 | Ford mobile app display list of keys. |
| M4 | Retail Vehicle Owner selects to delete a friend key. |
| M5 | Ford mobile app prompts user to confirm deletion of friend key. |
| M6 | Retail Vehicle Owner selects to confirm deletion of friend key. |
| M7 | UNDER REVIEW - Ford mobile app displays message saying key deletion request has been sent, but key will not be deleted until the vehicle is started with another key. |
| M8 | With a native app/Ford mobile app message, Friend is notified of pending key deletion. |
| M9 | UNDER REVIEW - Vehicle is started with a key other than the one being deleted. |
| M10 | With a native app/Ford mobile app message, Friend is notified of key deletion. |
| M11 | With a native app/Ford mobile app message, Owner is notified of key deletion from friend device. |
| **Postconditions** | PostC1 | User’s phone can no longer be used to access and start the vehicle. |

NFC-UC-18 Enable NFC Feature (manufacturing)

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| **Actors** |  |  |
| **Subject** |  | Enabling/disabling the NFC Retail feature via EOL tool |
| **Description** |  |  |
| **Preconditions** | PreC1 | NFC Retail feature is disabled on impacted modules |
| PreC2 | Vehicle has arrived at EOL and is connected to EOL tool |
| PreC3 | Vehicle is equipped with all modules necessary for NFC Entry and Starting |
| **Main Flow** | M1 | EOL tool confirms expected part numbers for modules are present on vehicle |
| M2 | EOL tool confirms that NFC system is enabled internally |
| M3 | EOL tool sets configuration bits on all impacted modules |
| **Exceptional Flow Description** |  | EOL tool does not detect all expected part numbers/modules, or detects incorrect NFC module state |
| **Exceptional Flow Steps** | E1 | EOL tool detects that NFC is disabled, or EOL tool does not detect expected part numbers on vehicle |
| E2 | EOL tool does not set config bits on impacted modules |
| E3 | EOL tool displays error indicating disabled NFC system, config load fail |
| **Postconditions** | PostC1 | NFC Retail feature is enabled on all impacted modules |

NFC-UC-19 Enable/Disable NFC Retail feature (service)

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| --- | --- | --- |
| **Actors** | Primary | NFC Service Technician with Diagnostic tool |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Service Technician has a service tool with backend connectivity and NFC service capabilities. |
| PreC2 | Service Technician has valid credentials to authorize themselves to Ford Backend. |
| PreC3 | Vehicle is equipped with NFC system. |
| **Main Flow Description** |  | To enable NFC Retail feature for a vehicle. |
| **Main Flow** | M1 | Technician queries the NFC module via diagnostic tool |
| M2 | Diagnostic tool detects NFC module. |
| M3 | Service technician selects module and provides credentials |
| M4 | Service tool compiles credentials and vehicle/module, transmits to service backend |
| M5 | Service Backend authenticates credentials and transmits module unlock key to service tool |
| M6 | Service technician uses module unlock key to unlock module and requests NFC Feature to be enabled or disabled on target module. |
| M7 | Service tool sets appropriate flags on other impacted vehicle systems to match enabled or disabled state |
| **Exceptional Flow Description** |  | No NFC module detected |
| **Exceptional Flow Description** |  | Service tool not connected to vehicle |
| **Exceptional Flow Description** |  | Configuring other modules on vehicle fails |
| **Exceptional Flow Steps** | E1 | Service tool cannot connect to service cloud backend |
| E2 | Service tool indicates that it cannot retrieve module unlock key due to connectivity issues |
| E3 | Service tool does not detect NFC module. |
| E4 | Service tool indicates to technician that operation cannot be completed due to lack of communication with NFC Module |
| E5 | Service tool fails to set approprate configuration parameter bits/flags on impacted modules to match new NFC System state (enabled/disabled) |
| E6 | Service tool indicates error in setting configuration parameter values on impacted modules |
| E7 | Service tool fails to set approprate config bits/flags on impacted modules to match new NFC System state (enabled/disabled) |
| E8 | Service tool fails to set approprate config bits/flags on impacted modules to match new NFC System state (enabled/disabled) |
| **Postconditions** | PostC1 | If new state is disabled: NFC System no longer polls for devices or communicates with rest of vehicle. Other modules ignore communication from NFC System. |
| PostC2 | If new state is enabled: NFC System is polling for devices and communicates with rest of vehicle. Impacted modules accept communications from NFC system. |
| PostC3 | NFC Retail feature is enabled/disabled, according to technician command |

NFC-UC-22 Grant vehicle access to a driver (fleet)

|  |  |  |
| --- | --- | --- |
| **Actors** | Primary | NFC Fleet Manager |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Fleet manager has already added vehicle and driver to fleet |
| PreC2 | Fleet manager has already paired an NFC key card to the driver in question |
| PreC3 | Vehicle has backend connectivity |
| PreC4 | Vehicle is subscribed to NFC fleet feature and a member of the fleet in question |
| **Main Flow Description** |  | To grant access to one or more vehicles to a specific driver, using the driver information page. |
| **Main Flow** | M1 | Fleet manager accesses FFM portal and navigates to the information page for the driver in question. |
| M2 | Fleet manager selects operation: "Grant Access" |
| M3 | Fleet manager selects the vehicle(s) from a list of all eligible vehicles in that fleet |
| M4 | Fleet manager confirms operation ("are you sure?") |
| M5 | Driver appears in the "Drivers with Access" list for selected vehicle(s), with "Pending" label |
| M6 | FFM backend requests key add commands be issued to the vehicle(s) in question for the NFC key card(s?) assigned to the driver in question |
| M7 | Vehicle(s) receive and execute key add command |
| **Alternative Flow Description** |  | To grant specific vehicle access to one or more fleet drivers, using the vehicle information page. |
| **Alternative Flow Steps** | A1 | Fleet manager accesses FFM portal and navigates to the information page for the vehicle in question. |
| A2 | Fleet manager selects operation: "Grant Access" |
| A3 | Fleet manager selects the driver(s) from a list of all eligible drivers in that fleet |
| A4 | Fleet manager confirms operation ("are you sure?") |
| A5 | Driver(s) appear in the "Drivers with access" list for selected vehicle, with "Pending" label |
| A6 | FFM backend requests key add commands be issued to the vehicle in question for the NFC card(s) associated with the selected driver(s) |
| A7 | Vehicle receives and executes key add command(s) |
| **Exceptional Flow Description** |  | Vehicle loses connectivity before key add request is received and remains offline |
| **Exceptional Flow Description** |  | Vehicle receives key add request, but fails to execute the request |
| **Exceptional Flow Description** |  | Fleet manager attempts to grant access to a vehicle which already has the maximum number of drivers assigned to it |
| **Exceptional Flow Steps** | E1 | Vehicle loses connectivity before key add request is received and remains offline: |
| E2 | After FFM backend requests key add requests be issued to the vehicle(s) in question: Driver appears in "drivers with access" list for specified vehicle with "pending" label, and vehicle appears in "vehicles this driver can access" list for specified driver with "pending" label |
| E3 | Backend continues to retry transmission of key add request until retry limit/timeout expires |
| E4 | If backend retry timeout expires: warning is added to vehicle information page ("cannot contact vehicle, key add unsuccessful") |
| E5 | If backend retry timeout expires: vehicle appears in "vehicles this driver can access" list on driver information page in FFM portal with "Error" label |
| E6 | If backend retry timeout expires: driver appears in "Drivers with access" list, and driver's NFC key card appears in "Keys with access" list on vehicle information page in FFM portal, both with "Error" label |
| E7 | - |
| E8 | Vehicle receives key add request, but fails to execute the request: |
| E9 | After vehicle(s) receive key add command: vehicle(s) attempt key add command execution, fail, and notify backend of failure |
| E10 | Warning is added to vehicle information page for vehicle(s) reporting key add failure ("error adding key to vehicle") |
| E11 | Vehicle(s) appear in "vehicles this driver can access" list on driver information page in FFM portal with "Error" label |
| E12 | Driver appears in "drivers with access" list, and driver's assigned NFC card appears in "Keys with access" list on vehicle page in FFM portal, both with "Error" label |
| E13 | - |
| E14 | Fleet manager attempts to grant access to a vehicle which already has the maximum number of drivers assigned: |
| E15 | After fleet manager selects the vehicle from a list of all eligible vehicles in the fleet: FFM portal displays error ("That vehicle has already been assigned the maximum number of drivers") |
| **Postconditions** | PostC1 | Driver(s) to which access has been granted appear in "Drivers that can access this vehicle" list on vehicle information page(s) in FFM portal (first with "Pending" label, then without) |
| PostC2 | NFC key card(s) assigned to driver(s) to whom access has been granted appear in "Key card that can access this vehicle" list(s) of the vehicle information page(s) of the vehicle(s) in question in the FFM portal |
| PostC3 | Specified driver(s) can now use their assigned NFC key card(s) to open and start the vehicle(s) in question. |
| PostC4 | Vehicle(s) to which access has been granted appear in "Vehicles this driver can access" list on the driver information page of FFM portal (first with "Pending" label, then without) |

NFC-UC-23 Lock a vehicle with an NFC Key

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| --- | --- | --- |
| **Actors** | Primary | NFC User |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Any vehicle door is unlocked. |
| PreC2 | NFC feature is enabled. |
| PreC3 | User has an NFC device that is paired with the vehicle. |
| PreC4 | Vehicle battery is not completely discharged. |
| PreC5 | Vehicle driver door is closed. |
| **Main Flow Description** |  | To lock the vehicle via exterior NFC reader. |
| **Main Flow** | M1 | User places NFC device near exterior NFC reader at driver door. |
| M2 | All vehicle doors lock. |
| **Alternative Flow Description** |  | To double-lock the vehicle (when the vehicle is configured to allow double-locking). |
| **Alternative Flow Steps** | A1 | User places NFC device near exterior NFC reader at driver door. |
| A2 | All vehicle doors lock. |
| A3 | User continues to hold NFC device near exterior NFC reader at driver door for a few seconds. |
| A4 | All vehicle doors double-lock. |
| **Postconditions** | PostC1 | Vehicle is locked (or double-locked, if configured and user performs long tap) |

NFC-UC-24 Pair an NFC key to a Personal Profile (retail)

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| --- | --- | --- |
| **Actors** | Primary | NFC Retail Owner |
|  | NFC User |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | User has an NFC key (NFC smart device key or NFC key card) that is paired with the vehicle. |
| **Main Flow Description** |  | To pair an NFC key to a Personal Profile. |
| **Main Flow** | M1 | User navigates to Personal Profiles menu in in-vehicle HMI. |
| M2 | User selects to edit their personal profile. |
| M3 | User selects operation: pair key to profile. |
| M4 | In-vehicle HMI displays list of keys. |
| M5 | User chooses the desired key from the HMI list of keys. |
| **Postconditions** | PostC1 | The vehicle will automatically sign into this profile when the vehicle is started with this NFC key. |
| PostC2 | User’s NFC key is paired to selected Personal Profile. |

NFC-UC-25 Pair NFC key card(s) (manufacturing)

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| --- | --- | --- |
| **Actors** |  |  |
| **Description** |  |  |
| **Preconditions** | PreC1 | Components used for technician feedback (e.g., lights, turn signals, cluster display) must be installed and operational. |
| PreC2 | NFC Module must be in factory pairing mode (never installed in a vehicle previously). |
| PreC3 | NFC Reader(s) and NFC Module must be installed in vehicle and powered. |
| **Main Flow** | M1 | Technician picks up an unpaired NFC Key Card and holds it against one of the vehicle's NFC readers. |
| M2 | NFC system detects key card and adds pairing. |
| M3 | Vehicle gives technician feedback to indicate successful pairing (flashes turn signal, cycles door locks, displays message on cluster, etc) |
| M4 | Technician removes first NFC Key Card from reader and sets it aside. |
| M5 | Technician picks up another unpaired NFC Key Card and holds it against one of the vehicle's NFC readers. |
| M6 | NFC system detects key card, adds pairing, and exits factory pairing mode. |
| M7 | Vehicle gives technician feedback to indicate successful pairing (flashes turn signal, cycles door locks, displays message on cluster, etc) |
| M8 | Technician removes second NFC Key Card from reader and places both cards in the vehicle for later use. |
| **Alternative Flow Description** |  | Vehicle configuration only includes one NFC Key Card |
| **Alternative Flow Steps** | A1 | After technician removes first NFC Key Card from reader: Technician picks up NFC Manufacturing Control Card and holds it against interior reader. |
| A2 | Technician presses vehicle START/STOP button while holding NFC Manufacturing Control Card against interior reader. |
| A3 | NFC System detects NFC Manufacturing Control Card and exits factory programming mode. |
| A4 | Vehicle gives technician feedback to indicate successful exit from factory programming mode (cluster message, turn signal flash, door lock cycle, etc) |
| A5 | Technician places single paired NFC Key Card in vehicle for later use. |
| **Exceptional Flow Description** |  | Fault in NFC Key Card results in unsuccessful pairing |
| **Exceptional Flow Description** |  | Both NFC Key Cards are lost after being paired |
| **Exceptional Flow Steps** | E1 | Vehicle does not provide technician with feedback after technician holds unpaired NFC Key Card against reader. |
| E2 | Technician sets defective card aside, picks up another unpaired NFC card, and holds it against one of the vehicle's NFC readers |
| E3 | NFC System detects key card and adds pairing |
| E4 | Remainder of flow steps unchanged |
| **Postconditions** | PostC1 | NFC System is no longer in factory pairing mode. |
| PostC2 | The NFC Key Card(s) are paired with the vehicle as NFC Factory Keys. |
| PostC3 | The NFC Key Card(s) can be used to lock, unlock, and start the vehicle. |

NFC-UC-26 Perform remote NFC reset (fleet)

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| --- | --- | --- |
| **Actors** | Primary | NFC Fleet Manager |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** |  |  |

NFC-UC-27 Place MyKey restrictions on NFC key (retail)

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| --- | --- | --- |
| **Actors** | Primary | NFC Retail Owner |
|  | NFC User |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | User has a different vehicle key (any type) that is not a MyKey. |
| PreC2 | User has an NFC key (NFC key card or NFC smart device) that they want to make a MyKey. |
| **Main Flow Description** |  | To make an NFC key a MyKey. |
| **Main Flow** | M1 | User starts the vehicle with a key other than the key they want to make a MyKey. |
| M2 | User navigates to MyKey menu in in-vehicle HMI. |
| M3 | User selects operation: "create a MyKey" |
| M4 | In-vehicle HMI prompts user to scan the key they want to make a MyKey. |
| M5 | User holds NFC key card they want to make a MyKey near the interior NFC reader. |
| M6 | In-vehicle HMI detects NFC key card and confirms MyKey creation. |
| **Postconditions** | PostC1 | The vehicle will automatically set MyKey restrictions when the vehicle is started with this physical NFC key. |
| PostC2 | User’s physical NFC key is now a MyKey. |

NFC-UC-28 Purchase additional NFC cards (fleet)

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| --- | --- | --- |
| **Actors** | Primary | NFC Fleet Manager |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Fleet manager has an active FCS fleet. |
| PreC2 | Fleet manager has one or more NFC-capable vehicles in their fleet subscribed to the NFC fleet management feature. |
| **Main Flow Description** |  | To allow a fleet manager to order additional NFC key card(s) through their active fleet account, |
| **Main Flow** | M1 | Fleet manager contacts dealer and requests a specific number of cards. |
| M2 | Dealer uses internal ordering system to place order for cards, and flags the order as being associated with a specific fleet |
| M3 | Purchased cards appear in fleet manager's FCS account in "keys associated with this fleet" list |
| M4 | Fleet manager physically receives purchased cards |
| **Alternative Flow Description** |  | Fleet manager orders cards and dealer fulfills order from inventory on hand. |
| **Alternative Flow Steps** | A1 | Fleet manager contacts dealer and requests a specific number of cards. |
| A2 | Dealer chooses to satisfy order from card inventory on hand. |
| A3 | Dealer uses a software tool to associate the purchased cards with the fleet manager's account. |
| A4 | Purchased cards appear in fleet manager's FCS account in "keys associated with this fleet" list. |
| A5 | Dealer physically delivers purchased cards to fleet manager. |
| **Postconditions** | PostC1 | Purchased NFC key cards appear in the fleet manager's FFM portal in the "keys associated with this fleet" list. |
| PostC2 | Purchased NFC key cards are physically in possession of fleet manager (or their designee). |
| PostC3 | Purchased NFC key cards can be assigned to fleet drivers or fleet vehicles. |

NFC-UC-29 Remove a direct pairing between an NFC key card and a fleet vehicle

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| --- | --- | --- |
| **Actors** | Primary | NFC Fleet Manager |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | A direct pairing between an NFC key card and the vehicle in question has already been created (by fleet manager or using service tool) |
| PreC2 | Vehicle is currently subscribed to NFC fleet management feature. |
| **Main Flow Description** |  | A fleet manager is able to remove a direct pairing between an NFC key card and a fleet vehicle in their fleet. |
| **Main Flow** | M1 | Fleet manager accesses FFM portal. |
| M2 | Fleet manager navigates to vehicle information page for the vehicle in question. |
| M3 | Fleet manager locates the NFC card to be removed in the "Keys that can access this vehicle" list and selects "Remove" operation (or equivalent). |
| M4 | Fleet manager confirms operation ("are you sure?") |
| M5 | NFC key card still appears in "Keys that can access this vehicle" list, with "Pending removal" label |
| M6 | FFM backend issues request to Ford backend for key deletion command. |
| M7 | Ford backend generates key deletion command and transmits to vehicle. |
| M8 | Vehicle executes key deletion command and confirms completion to Ford backend. |
| M9 | NFC key card no longer appears in "Keys that can access this vehicle" list on vehicle information page in FFM portal. |
| **Exceptional Flow Description** |  | Fleet manager attempts to remove factory card pairing. |
| **Exceptional Flow Steps** | E1 | After fleet manager navigates to vehicle information page for vehicle in question: Fleet manager selects a factory card in the "Keys that can access this vehicle" list. |
| E2 | Fleet manager is unable to remove pairing - FFM portal does not allow operation. |
| **Postconditions** | PostC1 | Specified NFC key card can no longer be used to open or start the vehicle in question. |
| PostC2 | Specified NFC key card no longer appears in the "Keys that can access this vehicle" list of the vehicle information page in FFM portal. |

NFC-UC-30 Remove a NFC key card (retail)

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| --- | --- | --- |
| **Actors** | Primary | NFC Retail Owner |
|  | NFC User |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | NFC key card that the user wants to delete is programmed to the vehicle and not a factory key |
| PreC2 | User has a key that can start the vehicle and it is not a MyKey or the key the user wants to delete |
| PreC3 | Vehicle has connectivity |
| PreC4 | Vehicle's modem is authorized |
| PreC5 | Vehicle's retail owner has Ford/Lincoln mobile app installed on their smartphone |
| **Main Flow Description** |  | To remove an NFC key card from the vehicle |
| **Main Flow** | M1 | User starts vehicle with a key other than the one they want to delete |
| M2 | Using in-vehicle HMI, user navigates to list of paired keys and chooses the "delete" option for the key they want to delete |
| M3 | In-vehicle HMI confirms user intent ("are you sure?") |
| M4 | In-vehicle HMI builds key delete command request and sends it to Ford backend |
| M5 | Vehicle deletes pairing with specified key |
| M6 | Retail owner approves deletion request by entering in the last four consecutive characters of the NFC Key Card FESN specific to the delete request |
| M7 | Retail Admin(s) receive request to delete NFC Key card in Ford/Lincoln App |
| M8 | Retail Admin(s) receive notification indicating an NFC Card was deleted from their vehicle |
| M9 | In-vehicle HMI displays approval confirmation immediately if vehicle is running, at next start otherwise |
| M10 | In-vehicle HMI displays message indicating that key delete request has been sent to vehicle Admins for approval |
| **Alternative Flow Description** |  | Vehicle loses network connectivity after key delete request has been sent, but regains connectivity before backend delivery timeout |
| **Alternative Flow Description** |  | Vehicle Admin(s) dismisses NFC Card Add approval request, and approves it at a later time |
| **Alternative Flow Steps** | A1 | After Retail Admin approves request: Backend attempts to deliver key delete command package to vehicle, and fails because vehicle is not connected |
| A2 | Vehicle regains connectivity before backend delivery timeout expires |
| A3 | Key delete command package is successfully transmitted to vehicle |
| A4 | In-vehicle HMI displays delete approval confirmation immediately if vehicle is running, at next start otherwise |
| A5 | Retail Admin(s) receive notification indicating an NFC Card was deleted from their vehicle |
| A6 | - |
| A7 | Retail admin(s) dismiss delete approval request |
| A8 | Retail admin navigates to pending requests page in Ford/Lincoln Mobile app and approves delete request by entering in last four consecutive characters of NFC Card FESN |
| A9 | In-vehicle HMI displays approval confirmation immediately if vehicle is running, at next start otherwise |
| A10 | Retail Admin(s) receive notification indicating an NFC Card was deleted from to their vehicle |
| **Exceptional Flow Description** |  | Retail Admin denies key delete request |
| **Exceptional Flow Description** |  | Vehicle loses network connectivity before key delete request is sent |
| **Exceptional Flow Description** |  | Vehicle loses network connectivity after key delete request is sent, and never regains connectivity |
| **Exceptional Flow Description** |  | Retail Admin does not or physically cannot respond to delete requested within allotted time |
| **Exceptional Flow Steps** | E1 | Retail Admin denies key delete request: |
| E2 | After retail owner receives request to delete NFC key card: Retail owner denies request. |
| E3 | In-vehicle HMI displays message indicating that key delete request has been denied (immediately if running, at next start otherwise). |
| E4 | Retail Admin(s) receive notification indicating an NFC Card delete request was rejected for their vehicle |
| E5 | - |
| E6 | Vehicle loses network connectivity before key delete request is sent: |
| E7 | After uses in-vehicle HMI to select an NFC Device to delete: In-vehicle HMI displays message indicating that network connectivity is required to delete a key. |
| E8 | - |
| E9 | Vehicle loses network connectivity after key delete request is sent, and never regains connectivity |
| E10 | After retail owner approves request: Backend attempts to deliver key delete command until re-delivery timeout has elapsed |
| E11 | In-vehicle HMI displays message indicating that key delete request has timed out (immediately if vehicle is running, at next start otherwise) |
| E12 | Notification is sent to retail Admin(s) phone indicating that key delete command was not delivered successfully |
| E13 | - |
| E14 | Retail Admin does not or cannot use smartphone to approve or deny the delete request: |
| E15 | Retail Admin's device does not or cannot respond to key delete request before delivery timeout expires |
| E16 | In-vehicle HMI displays message indicating that key delete request has timed out (immediately if vehicle is running, at next start otherwise) |
| E17 | Retail Admin(s) receive notification indicating an NFC Card delete request was rejected for their vehicle |
| **Postconditions** | PostC1 | The specified NFC key card can no longer be used to open or start the vehicle |

NFC-UC-31 Remove all NFC user keys (service)

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| --- | --- | --- |
| **Actors** | Primary | NFC Service Technician with Diagnostic tool |
| **Description** |  |  |
| **Preconditions** | PreC1 | NFC Retail Feature is enabled. |
| PreC2 | Service Technician has a key to this vehicle. |
| **Main Flow Description** |  | To remove all physical NFC keys from the vehicle as a service technician. |
| **Main Flow** | M1 | M1 Service Technician connects diagnostic tool to the vehicle. |
| M2 | M2 Service Technician obtains security credentials to unlock NFC module. |
| M3 | M3 Service Technician unlocks NFC module. |
| M4 | M4 Service Technician initiates diagnostic routine to remove all physical NFC keys. |
| M5 | M5 Diagnostic tool informs service technician of successful physical key removal. |
| **Postconditions** | PostC1 | Programmed physical NFC keys can no longer be used to access and start this vehicle. |

NFC-UC-32 Remove an NFC key card (Service Technician)

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| --- | --- | --- |
| **Actors** | Primary | NFC Service Technician with Diagnostic tool |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | NFC feature is enabled. |
| PreC2 | Service technician has a service tool that supports NFC key add/delete operations. |
| PreC3 | Service technician has access to vehicle's OBD-II port. |
| PreC4 | Service technician has valid credentials to service backend. |
| PreC5 | Service tool has connectivity. |
| **Main Flow Description** |  | To remove a paired NFC key card from a vehicle. |
| **Main Flow** | M1 | Service technician connects service tool to vehicle. |
| M2 | Service tool retrieves list of paired NFC key cards from NFC system and displays them to service technician. |
| M3 | Technician notes the FESN of the key card they want to remove. |
| M4 | Technician selects "remove NFC key card" operation on service tool. |
| M5 | Technician selects operation parameters (VIN, FESN of card to be removed) and enters credentials. |
| M6 | Service tool connects to service backend and obtains command package using technician credentials and parameters. |
| M7 | Service tool transmits command package to NFC system and verifies successful execution. |
| M8 | Service tool displays success message. |
| M9 | Service tool sends message to Ford backend reporting that key deletion has been completed successfully. |
| **Exceptional Flow Description** |  | See "Add an NFC key card (Service Technician)" - same exceptional flows |
| **Postconditions** | PostC1 | Ford backend key pairing records are updated to reflect key deletion. |
| PostC2 | If vehicle is subscribed to NFC fleet management feature: deleted keys no longer appear in "Keys with access to this vehicle" list in vehicle information page of FFM portal |
| PostC3 | Specified NFC access card can no longer be used to open and start the vehicle. |

NFC-UC-33 Remove an NFC key card from a driver (fleet)

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| --- | --- | --- |
| **Actors** | Primary | NFC Fleet Manager |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Driver already has an NFC card associated with them in FFM |
| PreC2 | Fleet manager has already created this driver in this fleet |
| **Main Flow Description** |  | To remove the association between a fleet driver and an NFC key card. |
| **Main Flow** | M1 | Fleet manager accesses FFM portal and selects driver in question |
| M2 | Fleet manager selects operation: "Unassign NFC Key Card" |
| M3 | Fleet manager confirms operation ("Are you sure?") |
| **Postconditions** | PostC1 | FFM portal initiates key deletion requests for any vehicles that the driver was granted access to, except vehicles where the just-removed NFC key card was manually associated with a vehicle directly |
| PostC2 | NFC key card continues to appear in "Keys that can access this vehicle" lists for vehicles that the driver had access to, with "deletion pending" labels |
| PostC3 | NFC key card in question is no longer associated with driver in question |
| PostC4 | NFC key card in question no longer appears on driver's information page in FFM portal |
| PostC5 | Once key deletions are successfully executed and confirmed by vehicles, NFC key card no longer appears in "Keys that can access this vehicle" lists for vehicles the driver had access to |

NFC-UC-34 Remove an NFC key from a Personal Profile (retail)

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| --- | --- | --- |
| **Actors** | Primary | NFC Retail Owner |
|  | NFC User |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | The NFC key must have previously been added to the Personal Profile. |
| **Main Flow Description** |  | To remove an NFC key from a Personal Profile. |
| **Main Flow** | M1 | User navigates to Personal Profiles menu in in-vehicle HMI. |
| M2 | User chooses to edit personal profile. |
| M3 | Profile edit screen displays keys that are currently paired with the profile. |
| M4 | User selects operation: "remove key" and specifies the NFC key they want to remove. |
| **Postconditions** | PostC1 | NFC key is removed from selected Personal Profile. |
| PostC2 | The vehicle will no longer sign into this profile when the vehicle is started with this NFC key. |

NFC-UC-35 Remove MyKey restrictions from NFC key (retail)

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| --- | --- | --- |
| **Actors** | Primary | NFC Retail Owner |
|  | NFC User |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | User has a key to the vehicle (any type) that is not a MyKey. |
| **Main Flow Description** |  | To remove MyKey restrictions that have been placed on an NFC device (NFC key card or NFC smart device). |
| **Main Flow** | M1 | User starts vehicle with a key that is not a MyKey. |
| M2 | User navigates to MyKey menu in in-vehicle HMI. |
| M3 | User selects operation: clear MyKeys |
| M4 | User confirms operation. |
| M5 | In-vehicle HMI displays success message. |
| **Exceptional Flow Description** |  | User attempts to clear MyKey restrictions after starting the vehicle with a key that is a MyKey |
| **Exceptional Flow Steps** | E1 | User starts the vehicle with a key that is a MyKey. |
| E2 | User attempts to navigate to MyKey menu in in-vehicle HMI. |
| E3 | MyKey menu, or "clear MyKeys" operation, is inaccessible. |
| **Postconditions** | PostC1 | All MyKey restrictions are now removed from all keys. |

NFC-UC-36 Remove vehicle access from a driver (fleet)

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| --- | --- | --- |
| **Actors** | Primary | NFC Fleet Manager |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Fleet Admin has added user to fleet. |
| PreC2 | Fleet Admin has enrolled vehicle in NFC Fleet feature. |
| PreC3 | Fleet Admin has granted vehicle access to user. |
| **Main Flow Description** |  | To remove a specific fleet driver's access to a specific vehicle using the driver's information page. |
| **Main Flow** | M1 | Fleet manager accesses FFM portal and navigates to driver information page for driver in question. |
| M2 | Fleet manager locates vehicle in "Vehicles this driver can access" list and selects "Remove access" operation |
| M3 | Fleet manager confirms operation ("are you sure?") |
| M4 | Driver appears in "Drivers with access" list with "Pending Removal" label |
| M5 | FFM requests key deletion command from Ford backend for the NFC card associated with the driver in question |
| M6 | Ford backend generates key deletion command and sends to vehicle |
| M7 | Vehicle receives key deletion command, executes, and confirms execution to Ford backend |
| **Alternative Flow Description** |  | To remove a specific fleet driver's access to a specific vehicle using the vehicle's information page. |
| **Alternative Flow Steps** | A1 | Fleet manager accesses FFM portal and navigates to vehicle information page for the vehicle in question. |
| A2 | Fleeet manager locates driver in "Drivers with access" list and selects "Remove access" operation. |
| A3 | Fleet manager confirms operation ("are you sure?") |
| A4 | Driver appears in "Drivers with access" list with "Pending Removal" label |
| A5 | FFM requests key deletion command from Ford backend for the NFC card associated with the driver in question |
| A6 | Ford backend generates key deletion command and sends to vehicle |
| A7 | Vehicle receives key deletion command, executes, and confirms execution to Ford backend |
| **Exceptional Flow Description** |  | Same exception flows as "Grant vehicle access to a driver", except "Fleet manager attempts to grant access to a vehicle which already has the maximum number of keys paired" |
| **Postconditions** | PostC1 | After confirmed successful key deletion, the driver and card no longer appear on the vehicle's information page in the FFM portal, and the vehicle no longer appears on the driver information page of the FFM portal |
| PostC2 | Fleet driver can no longer use their assigned NFC key card to access and drive the specified vehicle, unless a direct pairing between key card and vehicle has been created separately. |
| PostC3 | Fleet driver continues to appear in "Drivers with access" list of the vehicle in question, and driver's key card continues to appear in the "Keys with access" list of the vehicle in question, both with "Pending Removal" labels, until the key delete command is confirmed by the vehicle |
| PostC4 | Vehicle continues to appear in the "Vehicles this driver can access" list of the driver information page for the driver in question in the FFM portal, with a "Pending Removal" label, until the vehicle confirms successful key deletion |

NFC-UC-37 Replace NFC module (service)

|  |  |  |
| --- | --- | --- |
| **Actors** | Primary | NFC Service Technician with Diagnostic tool |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** |  |  |
| **Main Flow Description** |  | Allow a service technician to replace a defective NFC module on an NFC-capable vehicle. |
| **Main Flow** | M1 | Technician connects service tool to vehicle and ensures the vehicle is in START or RUN. |
| M2 | Service tool prompts for credentials and VIN of vehicle in which module is installed. |
| M3 | Technician enters their credentials and vehicle VIN. |
| M4 | Service tool requests and receives "wipe pairings" command. |
| M5 | Service tool transmits wipe commands to existing NFC module. |
| M6 | Technician removes defective NFC module and installs replacement. |
| M7 | Technician goes through TRON procedure to update module CMA keys. (MORE DETAIL NEEDED) |
| M8 | Technician enters their credentials and vehicle VIN. |
| M9 | Service tool requests and receives pairing creation commands for the pairings that were present on the previous module. |
| M10 | Service tool transmits all pairing creation commands to the replacement NFC module over CAN. |
| M11 | Service tool sends backend notification of successful key additions. |
| M12 | Service tool displys success message. |
| M13 | Technician physically accesses and replaces NFC module. |
| M14 | Technician connects service tool to vehicle and selects "replace NFC module" operation (or equivalent). |
| M15 | Technician enters credentials. Service tool detects VIN and FESN of new NFC module. |
| M16 | Service tool displays progress indicator and warning not to disconnect from vehicle during operation. |
| M17 | Service tool relays key add commands to vehicle and confirms their successful execution. |
| M18 | Service tool transmits "replace NFC module" command to backend. |
| M19 | Backend updates internal records, determines which keys need to be re-loaded on replacement NFC module, and transmits appropriate key add commands to service tool. |
| **Alternative Flow Description** |  | Service tool loses connection to backend during flow. |
| **Alternative Flow Description** |  | Service tool loses connection to vehicle during flow. |
| **Alternative Flow Steps** | A1 | Service tool loses connection to backend during flow: |
| A2 | After technician enters credentials and service tool detects VIN and FESN of new NFC module: Connection to backend is lost at some point during following main flow steps. |
| A3 | Service tool displays error: "Network connection lost - network connection required to complete this operation" (or equivalent) |
| A4 | Technician takes actions to restore network connectivity to device. |
| A5 | Technician restarts main flow at "connects service tool to vehicle and selects 'replace NFC module'" step. |
| A6 | Remaining flow is main flow. |
| A7 | - |
| A8 | Service tool loses connection to vehicle during flow: |
| A9 | After technician enters credentials and service tool detects VIN and FESN of new NFC module: Connection to vehicle is lost at some point during subsequent flow steps. |
| A10 | Service tool displays error: "Connection to vehicle lost - operation incomplete" (or equivalent) |
| A11 | Technician restores connection between service tool and vehicle. |
| A12 | Technician restarts main flow at "connects service tool to vehicle and selects 'replace NFC module'" step. |
| A13 | Remaining flow is main flow. |
| **Exceptional Flow Description** |  | NFC module not detected by service tool. |
| **Exceptional Flow Description** |  | NFC module fails to successfully execute "add key" commands sent by Ford backend. |
| **Exceptional Flow Steps** | E1 | NFC module not detected by service tool: |
| E2 | After technician connects service tool to vehicle and selects "replace NFC module" operation: Service tool fails to detect NFC module |
| E3 | Service tool displays error message: "NFC module not found" (or equivalent) |
| E4 | - |
| E5 | NFC module fails to successfully execute "add key" commands sent by Ford backend: |
| E6 | After service tool displays progress indicator and warning not to disconnect from vehicle during operation: |
| E7 | Service tool relays key add commands to vehicle. One or more key add commands are not successfully executed by NFC module. |
| E8 | Service tool displays error message: "key reloading unsuccessful" (or equivalent) |
| **Postconditions** | PostC1 | All NFC Key Cards that were paired with previous NFC module still work to open/start vehicle |
| PostC2 | Ford backend has recorded module swap event and new association between vehicle and module |
| PostC3 | Pairings with mobile devices are removed and not restored |
| PostC4 | Vehicle has replacement NFC module |

NFC-UC-40 Subscribe a fleet vehicle to NFC Feature (fleet)

|  |  |  |
| --- | --- | --- |
| **Actors** | Primary | NFC Fleet Manager |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Fleet Manager has consented/taken ownership of the vehicle in FFM portal |
| PreC2 | Vehicle exists in Fleet Manager's fleet account (FFM Portal) |
| PreC3 | Vehicle has backend connectivity |
| **Main Flow Description** |  | To enable NFC feature on a fleet vehicle. |
| **Main Flow** | M1 | Fleet Manager selects desired vehicle(s) in FFM portal |
| M2 | Fleet Manager selects NFC feature and subscribes to that product |
| M3 | Fleet backend records new vehicle state (subscribed) and requests that Ford backend push new feature package to vehicle |
| M4 | Ford backend pushes new feature package to vehicle, vehicle applies new feature package |
| M5 | Vehicle deletes all NFC user keys that were created by retail users |
| M6 | Vehicle confirms application of feature package to Ford backend |
| **Postconditions** | PostC1 | All user keys, if programmed, are removed from vehicle |
| PostC2 | Factory key(s) remain paired with vehicle |
| PostC3 | Fleet Manager can use FFM portal (or third-party portal) to manage NFC keys on vehicle |
| PostC4 | NFC Fleet feature is enabled on this vehicle. |
| PostC5 | SYNC menus allowing Master Reset are disabled/inaccessible |
| PostC6 | SYNC menus/screens for in-vehicle key management are disabled/inaccessible |
| PostC7 | Vehicle appears in FFM under list of vehicles subscribed to NFC Fleet Feature |

NFC-UC-41 Unlock a vehicle with an NFC key

|  |  |  |
| --- | --- | --- |
| **Actors** | Primary | NFC User |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | All vehicle doors are locked. |
| PreC2 | NFC feature is enabled. |
| PreC3 | User has an NFC device that is paired with the vehicle. |
| PreC4 | Vehicle battery is not completely discharged. |
| **Main Flow Description** |  | To unlock the vehicle using an NFC device at exterior reader. |
| **Main Flow** | M1 | User places NFC device near exterior NFC reader at driver door. |
| M2 | The driver door unlocks, or all of the vehicle doors unlock, depending on the vehicle's configuration. |
| **Alternative Flow Description** |  | To unlock all of the doors of a vehicle when two-stage unlocking is enabled. |
| **Alternative Flow Steps** | A1 | User places NFC device near exterior NFC reader at driver door. |
| A2 | Driver door unlocks. |
| A3 | User continues to hold NFC device near exterior NFC reader at driver door for a few seconds. |
| A4 | All doors unlock. |
| **Postconditions** | PostC1 | Driver door is unlocked, or all doors are unlocked, depending on vehicle configuration. |

NFC-UC-42 Unsubscribe a fleet vehicle from NFC feature (fleet)

|  |  |  |
| --- | --- | --- |
| **Actors** | Primary | NFC Fleet Manager |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Vehicle has backend connectivity. |
| PreC2 | Vehicle is subscribed to NFC Fleet feature. |
| **Main Flow Description** |  | To disable NFC Fleet feature on a vehicle. |
| **Main Flow** | M1 | Fleet Manager selects desired vehicle(s) to be unsubscribed and issues "unsubscribe" command |
| M2 | FFM portal requests Ford backend send unenrollment package to vehicle |
| M3 | Ford backend sends unenrollment package to vehicle |
| M4 | Vehicle applies unenrollment package |
| M5 | Vehicle deletes all paired NFC user keys that were added by the NFC Fleet feature |
| M6 | Vehicle sends confirmation of unenrollment back to Ford backend |
| **Postconditions** | PostC1 | All user keys that were added by the NFC Fleet Feature are removed from vehicle |
| PostC2 | Any user keys that were added by a service technician remain on vehicle |
| PostC3 | FCS Portal/3rd party system cannot add, remove, or change NFC Keys from unsubscribed vehicle |
| PostC4 | Factory key(s) remain on vehicle |
| PostC5 | NFC Fleet feature is disabled on this vehicle. |
| PostC6 | SYNC menus allowing Master Reset are enabled/accessible |
| PostC7 | SYNC menus/screens for in-vehicle key management are enabled/accessible |
| PostC8 | Vehicle no longer appears in FFM under list of vehicles subscribed to NFC Fleet Feature |

NFC-UC-43 Use NFC Key Card to Drive Vehicle During Manufacturing

|  |  |  |
| --- | --- | --- |
| **Actors** |  |  |
| **Description** |  |  |
| **Preconditions** | PreC1 | NFC key card(s) have been paired to vehicle. |
| PreC2 | NFC system is no longer in factory pairing mode. |
| PreC3 | Vehicle is otherwise able to be driven (critical components installed) |
| **Main Flow** | M1 | Same flow as "Start a vehicle using interior NFC authorization". |

NFC-UC-44 View Current Pairings

|  |  |  |
| --- | --- | --- |
| **Actors** |  |  |
| **Description** |  |  |
| **Preconditions** | PreC1 | Service technician has a Ford NFC-aware service tool |
| PreC2 | Vehicle is in ACC or RUN ignition states |
| PreC3 | Vehicle's NFC Feature is installed and enabled |
| **Main Flow Description** |  | Technician is able to view a list of all the cards paired with the vehicle. |

NFC-UC-48 Add an NFC key card (retail)

|  |  |  |
| --- | --- | --- |
| **Actors** | Primary | NFC Retail Owner |
|  | NFC User |
| **Subject** |  | NFC |
| **Description** |  |  |
| **Preconditions** | PreC1 | Modem has been authorized on this vehicle |
| PreC2 | Retail Admin(s) have Ford/Lincoln mobile app installed on their smart device(s). |
| PreC3 | Retail owner’s smart device has network connectivity. |
| PreC4 | User has a key to this vehicle that is not a MyKey. |
| PreC5 | User has a physical NFC key that has not been programmed to this vehicle. |
| PreC6 | Vehicle has network connectivity. |
| **Main Flow Description** |  | To add a physical NFC key to the vehicle as a user. |
| **Main Flow** | M1 | User starts vehicle with any key. |
| M2 | User selects to add NFC key card from in-vehicle HMI. |
| M3 | In-vehicle HMI prompts user to scan new NFC key card. |
| M4 | User places new NFC key card near interior NFC reader. |
| M5 | In-vehicle HMI prompts user to enter name for new key |
| M6 | User enters key name using in-vehicle HMI |
| M7 | In-vehicle HMI displays message indicating that key add request has been sent to vehicle Admins for approval. |
| M8 | Retail Admin(s) receive request to add NFC key card in Ford/Lincoln mobile app. |
| M9 | A Retail Admin approves the request by entering in last four consecutive characters of NFC Key Card FESN specific to the add request |
| M10 | In-vehicle HMI displays approval confirmation immediately if vehicle is running, at next start otherwise |
| M11 | Retail Admin(s) receive notification indicating an NFC Card was added to their vehicle |
| **Alternative Flow Description** |  | Vehicle loses network connectivity after key add request has been sent, but regains connectivity before backend delivery timeout |
| **Alternative Flow Description** |  | Vehicle Admin(s) dismisses NFC Card Add approval request, and approves it at a later time |
| **Alternative Flow Steps** | A1 | After Retail Admin approves request: Backend attempts to deliver key add command package to vehicle, and fails because vehicle is not connected |
| A2 | Vehicle regains connectivity before backend delivery timeout expires |
| A3 | Key add command package is successfully transmitted to vehicle |
| A4 | In-vehicle HMI displays approval confirmation immediately if vehicle is running, at next start otherwise |
| A5 | Retail Admin(s) receive notification indicating an NFC Card was added to their vehicle |
| A6 | - |
| A7 | Retail admin(s) dismiss add approval request |
| A8 | Retail admin navigates to "pending requests" page in Ford/Lincoln Mobile app and approves request by entering in last four consecutive characters of NFC Card FESN |
| A9 | In-vehicle HMI displays add approval confirmation immediately if vehicle is running, at next start otherwise |
| A10 | Retail Admin(s) receive notification indicating an NFC Card was added to their vehicle |
| **Exceptional Flow Description** |  | Retail Admin denies key add request |
| **Exceptional Flow Description** |  | Vehicle loses network connectivity before key add request is sent |
| **Exceptional Flow Description** |  | Vehicle loses network connectivity after key add request is sent, and never regains connectivity |
| **Exceptional Flow Description** |  | Retail Admin does not or physically cannot respond to add requested within allotted time |
| **Exceptional Flow Steps** | E1 | Retail Admin denies key add request: |
| E2 | After retail owner receives request to add NFC key card: Retail owner denies request. |
| E3 | In-vehicle HMI displays message indicating that key add request has been denied (immediately if running, at next start otherwise). |
| E4 | Retail Admin(s) receive notification indicating an NFC Card add request was rejected for their vehicle |
| E5 | - |
| E6 | Vehicle loses network connectivity before key add request is sent: |
| E7 | After user places new NFC key card near interior NFC reader: In-vehicle HMI displays message indicating that network connectivity is required to add a key. |
| E8 | - |
| E9 | Vehicle loses network connectivity after key add request is sent, and never regains connectivity |
| E10 | After retail owner approves request: Backend attempts to deliver key add command until re-delivery timeout has elapsed |
| E11 | In-vehicle HMI displays message indicating that key add request has timed out (immediately if vehicle is running, at next start otherwise) |
| E12 | Notification is sent to retail Admin(s) phone indicating that key add command was not delivered successfully |
| E13 | - |
| E14 | Retail Admin does not or cannot use smartphone to approve or deny the add request: |
| E15 | Retail Adminr's device does not or cannot respond to key add request before delivery timeout expires |
| E16 | In-vehicle HMI displays message indicating that key add request has timed out (immediately if vehicle is running, at next start otherwise) |
| E17 | Retail Admin(s) receive notification indicating an NFC Card add request was rejected for their vehicle |
| **Postconditions** | PostC1 | New physical NFC key can now be used to access and start this vehicle. |

# Feature Requirements

## Functional Requirements

**R\_F\_NFC Entry & Starting\_2 Fleet NFC management subscription - vehicle capability while fleet subscription is active**

While a vehicle is subscribed to the fleet NFC Management feature, it shall enable the following capability unique from the Retail feature capability:

1a. in-vehicle HMI related add/delete menus shall be removed

1b. In-vehicle HMI shall still be capable of displaying its active NFC key list

2a. Vehicle shall support "Master Reset" via in-vehicle HMI, and "Remote Master Reset" via a Cloud request

2b. Vehicle shall not delete any of the Fleet user pairings when a "Master Reset" or "Remote Master Reset" occurs.

2c. Vehicle shall not deauthorize its modem on either "Master Reset" or "Remote Master Reset" actions

3a. Ford Pass app shall not allow a user to add this vehicle to their FordPass app account as an authorized user.

3c. Previous FordPass app authorized users are removed/deauthorized from the vehicle

**R\_F\_NFC Entry & Starting\_3 NFC key cards - lanyard attachment**

Ford-provided NFC key cards should include a means for connecting them to a badge lanyard (cutout slot, carrier sleeve, etc).

**Rationale**: We expect fleet customers to provide these cards to their employees to be carried along with their employee ID badge - these badges are commonly carried on badge lanyards, so it should be convenient to carry the Ford NFC key card this way as well

**R\_F\_NFC Entry & Starting\_4 Changes to pairings - error indication**

If a fleet manager creates a pairing between an NFC key card and a vehicle (directly or indirectly), and any of the following errors occur:

- Vehicle is at full key storage capacity at the time of request

- The vehicle is offline or otherwise unreachable, and cannot be contacted for 24 hours following the pairing being created

- A system failure on the vehicle causes the pairing not to be created

then the fleet manager shall receive a notification or indication that the pairing has failed in the fleet management portal (web interface).

**Rationale**: Fleet managers should be notified if an action they expect to be complete is not completed

**R\_F\_NFC Entry & Starting\_5 Changes to pairings - execution time**

When a fleet manager takes an action in the fleet NFC management portal that changes an on-vehicle pairing, including:

- granting or removing vehicle access from a driver who has an NFC card assigned to them

- creating or deleting a direct pairing between an NFC key card and a vehicle

- unsubscribing a fleet vehicle from the fleet NFC management feature

the required changes on the vehicle (adding or deleting NFC key card pairings) shall be executed and confirmed promptly, and shall not take longer than five minutes from the time the changes are made in the fleet NFC management interface, as long as the vehicle is functional and has cellular connectivity when the changes are made in the fleet NFC management interface.

**Rationale**: First guess at acceptable system performance

**R\_F\_NFC Entry & Starting\_6 Direct pairings between NFC cards and vehicles - creating**

A fleet manager shall be able to pair an NFC key card to a fleet vehicle when the following conditions are true:

- The target vehicle is enrolled in that fleet manager's fleet and subscribed to the fleet NFC management product

- The NFC key card is already associated with that fleet

- The vehicle has fewer than the maximum number of keys paired

When a fleet manager assigns an NFC key card directly to a vehicle in the fleet management interface, the fleet system shall cause the pairing to be created and transmitted to the vehicle.

This functionality shall be available whether or not the NFC card in question has been associated with a fleet driver.

**Rationale**: Core feature behavior. Fleets may have use cases where they want to have a dedicated vehicle key that is not associated with a specific driver (pool vehicle, etc)

**R\_F\_NFC Entry & Starting\_7 Direct pairings between NFC cards and vehicles - deleting**

A fleet manager shall be able to remove a direct pairing between an NFC key card and a fleet vehicle using the fleet NFC management interface, if all of the following are true:

- The vehicle in question is subscribed to the fleet NFC management feature;

- A direct pairing between the vehicle and the NFC key card has previously been created;

- The NFC key card in question is not a factory card

**Rationale**: If the fleet manager can make direct pairings, they should also be able to remove direct pairings.

If a driver has been granted access separately, the fleet manager may not intend to remove that driver's access.

**R\_F\_NFC Entry & Starting\_8 Fleet drivers - un-assigning NFC card removes indirect pairings**

When a fleet manager removes the association between a fleet driver and an NFC key card, the pairing(s) between that driver's NFC key card and any vehicles the driver can access shall be deleted, unless a separate, direct pairing has been created between that vehicle and that NFC key card.

**Rationale**: Vehicle state should reflect the intended state from the fleet management interface

*This requirement references the following elements:*

* -1901886539.jpg [Remove an NFC key card from a driver (fleet)](#_2822972c575874fd4247dcd94bebf0e5) (Use Case Specification)
* -1901886539.jpg [Assign an NFC key card directly to a vehicle (fleet)](#_11f01b2eb790c8e47141a269d2baf308) (Use Case Specification)

**R\_F\_NFC Entry & Starting\_9 Fleet NFC management interface - view associated NFC devices**

A fleet manager shall be able to use the fleet NFC management interface to view a list of the NFC key cards that are associated with their fleet. An NFC key card is associated with a fleet if any of the following is true:

- The NFC key card is paired with one or more vehicles in the fleet

- The NFC key card was paired with one or more vehicles in the fleet, and the pairing was deleted by the fleet manager, but the on-vehicle pairing has not yet been deleted

- The NFC key card is associated with a driver in the fleet

- The NFC key card was purchased on an order associated with that fleet, and it has not been manually removed from that fleet

- The NFC key card was manually associated with the fleet, and it has not been manually removed from the fleet

**Rationale**: Customer want (fleet) - should be able to view and manage the NFC cards in their fleet

**R\_F\_NFC Entry & Starting\_14 Fleet NFC management interface**

Fleet managers shall have access to a web-based management interface that allows them to perform NFC management functions as defined in the fleet-related NFC functional requirements.

**R\_F\_NFC Entry & Starting\_15 Fleet NFC management interface - assign NFC device directly to vehicle**

The fleet NFC management interface shall provide a method for fleet managers to create pairings directly between NFC cards and vehicles in the fleet.

This functionality shall be available whether or not the NFC card in question has been associated with a fleet driver.

**Rationale**: Fleet customer want - fleet managers should be able to manage device pairings remotely, with or without a driver association

**R\_F\_NFC Entry & Starting\_16 Fleet NFC management interface - provide status of previously-created pairings**

The fleet NFC management interface shall provide fleet managers with the status of pairings that have previously been created using the management interface - whether directly (by associating an NFC device with a vehicle) or indirectly (by associating an NFC device with a driver, then associating the driver with a vehicle).

The status provided shall be one of the following:

- Pending (pairing created in management interface, but not yet successfully created on vehicle)

- Successful (pairing has been created on vehicle)

- Failed (vehicle was offline for longer than pairing creation timeout, pairing not created due to internal vehicle error, etc)

**Rationale**: Fleet customer want - managers should be able to confirm that pairings have been created

**R\_F\_NFC Entry & Starting\_17 Fleet NFC management subscription - actions after subscription is activated**

When a fleet manager subscribes an NFC-capable fleet vehicle to the fleet NFC management feature:

1. Existing NFC Retail User device pairings shall be deleted

2. Existing NFC Factory device pairings shall remain but shall be deleted via offboard commands

3. Sync related add/delete menus shall be disabled

4. Previous FordPass app authorized users are removed/deauthorized from the vehicle

**Rationale**: Clear vehicle state when transitioning between retail mode and fleet mode - prevents unintentional pairings sticking around

**R\_F\_NFC Entry & Starting\_18 Fleet NFC management subscription - unsubscribing deletes all fleet-added keys**

When a fleet manager unsubscribes an NFC-capable fleet vehicle from the fleet NFC management feature:

- All NFC fleet user keys shall be deleted from the vehicle, leaving only the expected number of factory keys programmed to the vehicle

**Rationale**: Clear vehicle state when transitioning between retail and fleet modes - prevents fleet vehicles from being released/sold with fleet pairings still active

**R\_F\_NFC Entry & Starting\_19 Indirect pairings - conditions for creation**

A fleet manager shall be able to use the fleet NFC management interface to grant a fleet driver access to an NFC-enabled vehicle if:

- The target vehicle is enrolled in that fleet manager's fleet and subscribed to the fleet NFC management feature

- The target vehicle has not reached the maximum number of NFC device pairings

**R\_F\_NFC Entry & Starting\_20 Indirect pairings - granting access causes pairing to be created**

If a fleet driver has an NFC key card associated with them, granting vehicle access to the driver shall create a pairing ("indirect pairing") between the target vehicle and that driver's assigned NFC key card.

**Rationale**: Fleet customer want: shall be able to manage drivers remotely

*This requirement references the following elements:*

* -1901886539.jpg [Grant vehicle access to a driver (fleet)](#_f1de7bd57d815a453b634deba57b5151) (Use Case Specification)

**R\_F\_NFC Entry & Starting\_21 Indirect pairings - removing access causes pairing to be deleted**

When a fleet manager removes vehicle access from a driver using the fleet manager's web portal, and that fleet driver has an NFC key card associated with them, the pairing between that driver's NFC key card and that vehicle shall be deleted, unless a separate direct pairing has been created between the NFC key card and the vehicle.

**Rationale**: Feature behavior - NFC card pairings update automatically to reflect driver access grants

**R\_F\_NFC Entry & Starting\_22 Master Reset - fleet pairings not deleted**

When a Master Reset is triggered on a vehicle, whether through the in-vehicle HMI or remotely, and that vehicle is subscribed to the fleet NFC management feature, NFC pairings that were created through the fleet NFC management interface shall not be deleted.

**Rationale**: Users of fleet vehicles should not be able to override pairings created by fleet managers; users of fleet vehicles should not be able to strand themselves by deleting their cards

**R\_F\_NFC Entry & Starting\_23 NFC key cards - can manually add to fleet**

The fleet NFC management interface shall provide a method for fleet managers to manually associate any NFC key card with their fleet by typing in the unique identifier printed on the card.

**Rationale**: Fleet managers may acquire Ford NFC key cards through a channel that does not automatically associate them with the fleet

**R\_F\_NFC Entry & Starting\_24 NFC key cards - can manually remove from fleet**

The fleet NFC management interface shall provide a method for fleet managers to manually disassociate any NFC key card from their fleet, if all of the following are true:

- The key card was previously added to their fleet (from a fleet-associated vehicle purchase, a fleet-associated key card order, manual association, or some other method)

- The key card is not associated with any drivers in the fleet

- The key card is not paired with any vehicles in the fleet

- If the key card was paired with one or more fleet vehicles, and those pairing(s) have been removed using the fleet NFC management interface, those deletions have been completed and confirmed on-vehicle

**Rationale**: If we have a way to add them, should have a way to remove them

**R\_F\_NFC Entry & Starting\_25 Number of key pairings**

Vehicles with the NFC Entry and Starting feature shall support the simultaneous pairing of at least 100 NFC devices.

**Rationale**: Ask from fleet customers

**R\_F\_NFC Entry & Starting\_27 Overlapping pairings**

An overlapping pairing exists when the same NFC device is paired to a vehicle through two or more paths simultaneously: for example, when an NFC device is assigned to a driver who has been granted access to a vehicle, and also assigned directly to that same vehicle.

When an overlapping pairing exists, the fleet NFC management system shall transmit only the first pairing to the vehicle (subsequent pairings are redundant).

When one of the paths of an overlapping pairing is deleted, the fleet NFC management system shall not delete the pairing from the vehicle unless no other paths exist (for example, if the direct pairing in the example is deleted, the fleet NFC management system shall not remove the pairing from the vehicle until the device-driver relationship or the driver-vehicle relationship is deleted)

**Rationale**: Design decision - we need to either prevent overlapping pairings from ever being created, or we need to determine how to handle them when they do exist

**R\_F\_NFC Entry & Starting\_28 Purchasing additional cards for fleet - view order status**

A fleet manager shall be able to use the fleet NFC management interface to view the status of a previously-placed order for additional NFC key cards. The order status shall include:

- Number of cards ordered

- Delivery address

- Expected delivery date, or expected delivery date/time if available

**Rationale**: Domino's does it, why can't we

**R\_F\_NFC Entry & Starting\_29 Purchasing additional NFC cards for a fleet - new cards appear in list of associated cards**

When a fleet manager orders additional NFC cards, through the fleet NFC management interface or through their Ford dealer, the individual NFC cards that are delivered to the fleet manager shall appear in that fleet's list of fleet-associated NFC key cards before the physical cards are delivered to the fleet manager.

**Rationale**: FCS want: fleet managers shouldn't have to type in the individual card numbers

**R\_F\_NFC Entry & Starting\_30 Purchasing additional NFC cards for a fleet - through dealer**

A fleet manager shall be able to order additional NFC cards by contacting their existing Ford dealer and requesting that an order be created, if:

- The fleet manager has an existing fleet account (FIN code)

- The fleet manager has at least one vehicle that is subscribed to the fleet NFC management feature

**Rationale**: To allow a fleet manager to order additional NFC key card(s) through their active fleet account

**R\_F\_NFC Entry & Starting\_31 Purchasing additional NFC cards for a fleet - with NFC management interface**

A Fleet Manager shall be able to order additional NFC Card(s) using the fleet NFC management interface, if:

- The fleet manager has an existing fleet account (FIN code)

- The fleet manager has at least one vehicle that is subscribed to the fleet NFC management feature

**Rationale**: To allow a fleet manager to order additional NFC key card(s) through their active fleet account

**R\_F\_NFC Entry & Starting\_32 Fleet NFC management subscription - Conditions for activating subscribing**

Fleet managers shall be able to use the fleet management web interface to subscribe individual vehicles in their fleet to the fleet NFC management feature, if all of the following are true:

- The vehicle to be subscribed is a member of that fleet manager's fleet

- The fleet manager has moved that vehicle into their consented list

**Rationale**: Makes it convenient for fleet managers to start using the product

**R\_F\_NFC Entry & Starting\_33 Fleet NFC management subscription - Conditions for deactivating subscription**

Fleet managers shall be able to use the fleet management web interface to unsubscribe individual vehicles in their fleet from the fleet NFC management feature when he following conditions are true:

- The vehicle has the expected number of factory cards present on the vehicle

**Rationale**: If you can subscribe, you should be able to unsubscribe

**R\_F\_NFC Entry & Starting\_34 Fleet drivers - assigning NFC key cards**

Fleet managers shall be able to use the fleet NFC management interface to associate an NFC key card to a driver in their fleet if:

- The NFC key card is already associated with the fleet

- The NFC key card is not already associated with another driver in that fleet

If the NFC key card is already associated with another driver in the fleet, the fleet NFC management interface shall not allow the association to occur.

**Rationale**: Fleet customer want: fleet managers should be able to manage driver associations

**R\_F\_NFC Entry & Starting\_35 Fleet drivers - un-assigning NFC key cards**

Fleet managers shall be able to use the fleet NFC management interface to disassociate an NFC card from a driver in their fleet, if the NFC card was previously assigned to that driver.

**Rationale**: If you can assign, you should be able to un-assign

**R\_F\_NFC Entry & Starting\_36 Indirect pairings**

Fleet managers shall be able to use the fleet NFC management interface to add or remove specific fleet drivers' access to specific vehicles in their fleet.

**R\_F\_NFC Entry & Starting\_37 Retail HMI elements disabled when fleet management feature active**

When a vehicle is subscribed to the fleet NFC management feature, the NFC key management features of the in-vehicle HMI (add key, delete key) shall be inaccessible or disabled.

**R\_F\_NFC Entry & Starting\_38 Long tap at exterior reader is equivalent to double fob button press**

A long tap of an authorized NFC device at an exterior reader shall cause the same effects as a double press of the "unlock" or "lock" button on a keyfob, depending on the vehicle's locking state.

If all of the vehicle's doors are locked, the long tap shall have the same effects as a double press of the "unlock" button. Otherwise, the long tap shall have the same effects as a single press of the "lock" button.

For the purposes of this requirement, "double press" means pressing the same button on a keyfob two times within a two-second interval.

A long tap may cause additional effects beyond what would occur with a keyfob button press (for example, authorizing vehicle start for a short time).

**Rationale**: We want to mirror behaviors that the user already understands whenever possible. Making a short tap equal to a single button press allows us to re-use the existing locking system behavior design.

**R\_F\_NFC Entry & Starting\_39 NFC devices can be paired to multiple vehicles**

Users shall be able to pair a single supported NFC device to multiple NFC-equipped Ford vehicles simultaneously.

**Rationale**: Core feature behavior

**R\_F\_NFC Entry & Starting\_40 Fleet NFC management subscription - deactivating subscription post conditions**

When a fleet manager un-subscribes their NFC-capable fleet vehicle from the fleet NFC management feature the following shall occur:

1. The vehicle's modem shall be de-authorized.

2a. All NFC Fleet User devices shall be deleted

2b. The vehicle shall have the expected number of factory cards

3. Vehicle shall reenable all of in-vehicle HMI and pop-ups tied to NFC Device management

4. Vehicle shall allow a user to authorize themselves/their device to the vehicle's modem.

**R\_F\_NFC Entry & Starting\_41 Starting a vehicle using exterior NFC authorization**

When a user unlocks a locked vehicle using an authorized NFC device at the driver's door exterior reader, the vehicle shall be able to be started once for a short period of time. During this time, the vehicle shall start without noticeable delay when the user presses the start/stop button. This shall be called Unlock and Go.

Note: Exterior starting capability is dependent on a market configuration. Vehicles sold in EU market or in the market required to meet Thatcham specification will not have exterior starting.

**Rationale**: Makes vehicle entry and starting convenient for NFC card users (eliminates second card scan at interior reader)

**R\_F\_NFC Entry & Starting\_42 Starting a vehicle using interior NFC authorization**

When the user places an authorized NFC device near the interior NFC reader of the vehicle, the vehicle shall be able to be started once for a short period of time. During this time, the vehicle shall start without noticeable delay when the user presses the start/stop button.

**Rationale**: Needed to allow vehicle operation using NFC cards

**R\_F\_NFC Entry & Starting\_43 Pairing an NFC device to a Personal Profile**

Users shall be able to pair an NFC key to a Personal Profile from the in-vehicle HMI.

When an NFC device is paired to a Personal Profile, that Personal Profile shall be activated when the paired NFC device is used to start the vehicle.

**Rationale**: NFC devices should work with the Personal Profiles feature just like any other key type.

**R\_F\_NFC Entry & Starting\_44 Removing an NFC key from a Personal Profile**

Users shall be able to remove an NFC key from a Personal Profile from the in-vehicle HMI.

**Rationale**: Needed to support Personal Profiles feature

**R\_F\_NFC Entry & Starting\_45 NFC devices with MyKey restrictions - creation**

Users shall be able to use the in-vehicle HMI to apply MyKey restrictions to an NFC key card.

**Rationale**: Needed to support MyKey feature

**R\_F\_NFC Entry & Starting\_46 NFC devices with MyKey restrictions - removing restrictions**

Retail users shall be able to remove MyKey restrictions from an NFC device using the in-vehicle HMI.

**Rationale**: Needed to support MyKey feature

**R\_F\_NFC Entry & Starting\_47 Moving a vehicle out of Secure Idle state with an NFC key**

Users shall be able transition vehicle out of Secure Idle state by placing an authorized NFC device near the interior NFC reader.

**Rationale**: Needed to allow vehicle operation using NFC cards

**R\_F\_NFC Entry & Starting\_48 Moving a vehicle into motive state with an NFC key following Remote Start event**

Users shall be able transition vehicle into motive state by placing an authorized NFC device near the interior NFC reader following a Remote Start event.

**Rationale**: Needed to allow vehicle operation using NFC cards

**R\_F\_NFC Entry & Starting\_49 Polling for NFC keys**

When the vehicle has been parked and off for 14 days, the exterior NFC reader shall stop polling for NFC keys. When the user activates the door switch or door keypad, the vehicle shall re-enable polling for NFC keys.

**R\_F\_NFC Entry & Starting\_50 Short tap at exterior reader is equivalent to lock or unlock request**

A short tap of an NFC device at an exterior reader shall cause the same effects as a single lock or unlock request, depending on the vehicle's locking state.

If all of the vehicle's doors are locked, the short tap shall have the same effects as a "unlock" request. Otherwise, the short tap shall have the same effects as a "lock" request.

**Rationale**: We want to mirror behaviors that the user already understands whenever possible. Making a short tap equal to a single button press allows us to re-use the existing locking system behavior design.

**R\_F\_NFC Entry & Starting\_51 Support CCC-compliant NFC devices**

The NFC Entry and Starting feature shall support the use of CCC-compliant NFC smart devices (phones, smart watches, other wearables, etc) for accessing and starting vehicles.

**R\_F\_NFC Entry & Starting\_52 Support NFC cards**

The NFC Entry and Starting feature shall support the use of Ford-supplied or Ford-authorized NFC key cards, but no other NFC key cards, for accessing and starting vehicles.

**R\_F\_NFC Entry & Starting\_53 Adding and removing NFC key cards**

Retail users shall be able to initiate adding or removing NFC User key cards from the vehicle by using the in-vehicle HMI. A vehicle Admin (user authorized to the vehicle's modem) is then required to approve the request from their FordPass or Lincoln Way mobile apps by correctly entering in the last four consecutive characters of the NFC User Key Card's Ford-Electronic-Serial-Number (as printed on the card itself).

**R\_F\_NFC Entry & Starting\_54 Adding/Deleting NFC key cards - information presented to Admin for approval**

When a requests adding or deleting an NFC User card using the in-vehicle HMI and the approval request for that pairing is sent to the vehicle's retail admin(s) of the vehicle, the approval request prompt within the Mobile App shall display:

- The friendly name of the NFC User card;

- Details about the vehicle that the card is to be paired with or deleted from (name, VIN, etc).

- Instructions on having to enter the last four consecutive characters of the NFC User Key Card's FESN as part of approving the request

**Rationale**: Providing the card name is a convenient way for users to identify the request being made. Showing the card serial number allows the approving user to confirm that the card request corresponds to the card they think it does. Showing the vehicle details allows the approving user to distinguish between requests if they have multiple NFC-enabled vehicles in their garage.

**R\_F\_NFC Entry & Starting\_55 Adding NFC key cards - not possible if user is restricted**

When the vehicle has been started with a key that has MyKey restrictions applied to it, the HMI actions for adding and removing NFC key cards shall be inaccessible or disabled.

**Rationale**: We define MyKey users as lacking privileges to add or remove new NFC keys.

**R\_F\_NFC Entry & Starting\_56 Adding NFC key cards - requires scanning key card to request pairing**

The process for adding a new NFC key card to the vehicle (pairing) shall require the user to present the new key card at the in-vehicle NFC reader before the approval request is sent to the retail owner.

**Rationale**: Scanning the card at the reader positively identifies the key card to be added, avoids possible errors from manually typing the identifying number on the card, and verifies that the new card is functional.

**R\_F\_NFC Entry & Starting\_57 Adding NFC key cards - user can assign card name**

In the process for adding a new NFC key card to the vehicle, the user shall be able to enter a custom name for the card, which will be used to identify it in the user interface later on.

The name entry for the card shall occur before the pairing approval request is sent to the retail owner.

**Rationale**: Users that have several NFC key cards may have difficulty distinguishing them by the card serial numbers alone.

**R\_F\_NFC Entry & Starting\_58 Adding/removing NFC key cards - in-vehicle notification of success/failure**

When a retail user requests an NFC card pairing/deletion through the in-vehicle HMI, and the retail owner approves or denies that request, a textual notification shall appear on the in-vehicle HMI including:

- The request type (pair, delete)

- The user-defined name and/or serial number of the NFC key card to be paired/deleted

- The status of the request (approved/completed, denied, timed out/failed)

If the vehicle is running when this notification is received, it shall be displayed immediately.

If the vehicle is not running when the notification is received, it shall be displayed at the next vehicle start.

**Rationale**: Give confirmation to the retail user that their request has been acted upon

**R\_F\_NFC Entry & Starting\_59 Adding/removing NFC key cards - owner approval timeout**

Approval requests (for pairings or deletions) shall expire after 5 days (configurable duration). If after this time, the retail owner has not acted on the approval request, or if the approval request could not be delivered to the retail owner's smartphone, the request shall be invalidated, with the same side effects as a denied request.

**Rationale**: Lack of response to an approval prompt needs to mean approval is denied - establish a fixed timeout to prevent requests from accumulating over time

**R\_F\_NFC Entry & Starting\_60 Adding/removing NFC key cards - requires owner approval**

When a user adds or removes a key pairing using the in-vehicle HMI, the pairing shall not be created until a retail admin of the vehicle approves the add/delete request using the mobile app by entering in the last four characters of the target NFC Card's FESN

**Rationale**: Provides security against untrusted users who have vehicle access adding another key that they control

**R\_F\_NFC Entry & Starting\_61 Master Reset - inaccessible when vehicle was started with NFC user key**

If the key that authorized the starting of a vehicle was an NFC user key (not a factory key), the option to trigger a Master Reset in the in-vehicle HMI shall be inaccessible or disabled until the vehicle is started with a different key type.

**Rationale**: Prevents users from stranding themselves (Master Reset deletes all NFC user keys)

**R\_F\_NFC Entry & Starting\_62 Mobile app - method for approving or denying NFC requests**

The Ford/Lincoln mobile app shall provide a means for vehicle admin(s) to approve or deny requests to add or remove NFC key cards from a vehicle that they control. The admin(s) user should be able to do by replying directly to a push notification or being able to pull up the request from a pending list within the app.

**Rationale**: Needed for NFC key card management.

**R\_F\_NFC Entry & Starting\_63 Removing NFC key cards**

Retail users can select to unpair a non-Factory NFC Key Card by selecting the specific NFC Key within the in-vehicle HMI and requesting for it to be "Removed". A vehicle Admin (user authorized to the vehicle's modem) is then required to approve the request from their FordPass or Lincoln Way mobile apps by correctly entering in the last four consecutive characters of the NFC User Key Card's Ford-Electronic-Serial-Number (as printed on the card itself).

Factory NFC cards are excepted from this requirement. It shall not be possible to add or remove NFC factory key cards using the in-vehicle HMI.

*This requirement references the following elements:*

* -1901886539.jpg [Remove a NFC key card (retail)](#_24f96a2bdd34f1b67624357cfca3534c) (Use Case Specification)

**R\_F\_NFC Entry & Starting\_64 Master Reset - NFC system behavior**

When a retail user performs a Master Reset using the in-vehicle HMI, and the vehicle is not subscribed to the fleet NFC management feature, the NFC system shall delete all NFC user key pairings.

**Rationale**: Provides a convenient way to remove a large number of keys at once (for example, before a vehicle is sold).

Master Reset also resets vehicle modem authorization, which prevents key add/delete requests from occurring - so if keys were not deleted, there would be no way for retail users to remove them until the modem was re-authorized

**R\_F\_NFC Entry & Starting\_76 Location of interior and exterior NFC readers**

The location of the interior and exterior NFC readers shall meet the applicable logical findability, reachability, and visibility requirements.

**R\_F\_NFC Entry & Starting\_77 Vehicle NFC Readers**

Vehicles with NFC Entry & Start shall have at least one exterior NFC reader to enable unlocking and locking and one interior NFC reader near the start/stop button to enable start and drive-away. Depending on vehicle program needs we may have more than one exterior reader. Exterior readers for other access locations ( front passenger door, rear cargo door, sliding door, etc.) can also be implemented.

**R\_F\_NFC Entry & Starting\_89 setup methods**

The vehicle owner shall be able to start setup of Digital Key from the Ford mobile app or from the in-vehicle HMI. If setup is started from the in-vehicle HMI, users shall be directed to the Ford mobile app.

**Rationale**: Owner Pairing

**R\_F\_NFC Entry & Starting\_95 Locking a vehicle with an NFC key**

The NFC system shall provide a method for locking the vehicle's doors using an NFC device.

**Rationale**: Core feature behavior

**R\_F\_NFC Entry & Starting\_101 No Fast Restart for NFC key cycles**

If the vehicle was started with an NFC key, then users shall be not be able to perform a Fast Restart.

**Rationale**: Needed to prevent user confusion / annoyance

**R\_F\_NFC Entry & Starting\_102 Exterior NFC Authorization Configuration**

The NFC system shall have an Exterior NFC Authorization configuration.

This configuration shall be based on the market the vehicle is sold.

For NA market the configuration shall be set to "enabled" and for European markets or in the market required to meet Thatcham specification this configuration shall be set to "disabled".

For European markets or the markets with Thatcham specification an Interior reader must be scanned prior to push button start being active.

Note: When configuration is set = "enabled" it means when vehicle is unlocked with scanning an NFC device on exterior reader, the vehicle can be started by pressing the brake pedal and start button or shifting out of park within the specified time.

When configuration is set = "disabled" it means when vehicle is unlocked with scanning an NFC device on exterior reader, the user needs to scan the interior reader before being authorized to start the vehicle.

**R\_F\_NFC Entry & Starting\_103 No Slam Lock**

The user shall not be able to lock the vehicle if any door is open.

**Rationale**: If slam lock is allowed, user could accidentally lock themselves out / lock card in (a potential cause of TGWs)

**R\_F\_NFC Entry & Starting\_104 Unlocking a vehicle with an NFC key**

The NFC system shall provide a method for unlocking the vehicle's doors using an NFC device. Depending on vehicle program needs we may have 1 (one) exterior reader for the driver door or multiple exterior readers for other access locations (front passenger door, rear cargo, sliding door, etc.)

**Rationale**: Core feature behavior

**R\_F\_NFC Entry & Starting\_105 self-deletion permission and methods**

Friend users shall be able to delete their own key from the Ford mobile app or the native digital key app on their device.

Note: Owner can delete their key in native app but is out of FORD scope.

**Rationale**: Key Termination

**R\_F\_NFC Entry & Starting\_110 setup condition – online registration required before use**

The user’s device shall not be allowed to unlock or start the vehicle unless their key has been registered in Ford’s servers.

**Rationale**: Owner Pairing

**R\_F\_NFC Entry & Starting\_111 setup condition – owner authentication**

The vehicle will allow NFC connected device setup to be completed only if it has been started with a unrestricted (not a MyKey) factory key.

**Rationale**: Owner Pairing

**R\_F\_NFC Entry & Starting\_112 setup condition – owner presence**

The Users shall be required to complete setup of NFC connected device from inside the vehicle.

**Rationale**: Owner Pairing

**R\_F\_NFC Entry & Starting\_113 setup condition – time to hold device**

The user must not have to hold their device up to the reader for more than TBD seconds if the vehicle has a vertical reader.

**Rationale**: Owner Pairing

**R\_F\_NFC Entry & Starting\_115 setup permission**

Only the vehicle owner shall be able to set up Digital Key on a vehicle and set up their device as the owner/primary device for the vehicle.

**Rationale**: Owner Pairing

**R\_F\_NFC Entry & Starting\_116 owner/primary device change – key sync**

Before starting owner device change, the mobile app shall enforce that no keys (Owner or Friend) are on the new device.

**Rationale**: Owner Device Change

**R\_F\_NFC Entry & Starting\_117 owner/primary device change – remove old owner key**

The incoming owner digital key shall not be allowed to pair until sequentially:

- Creation data is present on both the vehicle and device, AND

- the former key is deleted from the vehicle and, if possible, the former device.

**Rationale**: Owner Device Change

**R\_F\_NFC Entry & Starting\_119 owner/primary device change condition – must complete owner pairing**

The user shall be required to complete the full owner pairing process when changing their owner/primary device

**Rationale**: Owner Device Change

**R\_F\_NFC Entry & Starting\_120 owner/primary device change methods**

The vehicle owner shall be able to start a change of owner/primary device from the Ford mobile app.

**Rationale**: Owner Device Change

**R\_F\_NFC Entry & Starting\_122 Number of digital keys allowed on vehicle**

The vehicle owner shall be able to share up to TBD keys to a vehicle.

**Rationale**: Key Sharing

**R\_F\_NFC Entry & Starting\_124 sharing permission**

The vehicle owner shall only be able to share digital keys from the device set up as the owner/primary device.

**Rationale**: Key Sharing

**R\_F\_NFC Entry & Starting\_125 Viewing digital keys**

The vehicle owner shall be able to view a list of active digital keys for a vehicle

- from the native digital key app on the owner device

- from the Ford mobile app on any device that the owner is logged in as the primary account for said vehicle

- from the in-vehicle HMI when the vehicle has been started with the owner device or factory key

**Rationale**: Key Sharing

**R\_F\_NFC Entry & Starting\_127 Friend key termination from owner device**

When the vehicle owner terminates a friend key from the owner device, said key shall not be terminated until the vehicle is started with another key.

**Rationale**: Key Termination

**R\_F\_NFC Entry & Starting\_128 Sharing methods**

The vehicle owner shall be able to share digital keys from the Ford mobile app or the native digital key app on the owner device.

**Rationale**: Key Sharing

**R\_F\_NFC Entry & Starting\_129 Friend key deletion permission and methods for owner**

The vehicle owner shall be able to delete friend keys via

- the Ford mobile app on the owner device

- the native digital key app on the owner device

- the in-vehicle HMI when the vehicle has been started with the owner/primary device.

**Rationale**: Key Termination

**R\_F\_NFC Entry & Starting\_130 Vehicle removal from primary account behavior**

When the owner removes the vehicle from their Ford account in the Ford mobile app, all digital keys on the vehicle shall be deleted.

**Rationale**: Key Termination

**R\_F\_NFC Entry & Starting\_137 Master Reset behavior**

When a Master Reset is executed from the in-vehicle HMI, all digital keys on the vehicle shall be deleted.

**Rationale**: Key Termination

**R\_F\_NFC Entry & Starting\_140 Using exterior NFC authorization when Secure Idle is active**

If exterior NFC authorization (Unlock and Go) is enabled, Secure Idle is active on the vehicle, and the vehicle is locked, the user shall be able to unlock the vehicle via the driver door exterior reader and drive away without having to scan again at the interior reader.

**Rationale**: This improves UX when using NFC and Secure Idle becomes active.

**R\_F\_NFC Entry & Starting\_141 NFC feature management conditions**

The user shall only be allowed to manage the NFC feature (e.g. add or remove cards) when the vehicle is on/started.

**Rationale**: This prevents unauthorized changes to the NFC feature.

**R\_F\_NFC Entry & Starting\_142 Logic for Selecting & Authenticating NFC devices at multiple NFC reader locations simultaneously**

When an NFC device is detected simultaneously at more than one NFC reader location, then an NFC system shall attempt to process and complete a transaction with only one device at a time by using first come, first serve logic.

While processing first detected device an NFC system shall continue to poll all NFC readers per defined polling configuration, but it shall not attempt to initiate a transaction with any additional device until a device being processed is authenticated or its transaction is interrupted. Once device is authenticated, then an NFC system shall attempt to process any additional device, one by one.

**Rationale**: Describes logic how to select and authenticate devices when devices detected at more than one reader location

**R\_F\_NFC Entry & Starting\_143 NFC System Perceived Latency**

When user is attempting to unlock, lock, double lock or start a vehicle with an authorized and previously paired NFC device, then resulting action of unlocking/locking a door or transitioning from off to on state shall be perceived as quick, without noticeable delays and shall not exceed 800 ms

**Rationale**: This provides perceived latency expectations for NFC system

**R\_F\_NFC Entry & Starting\_150 Maximum number of pairings - remotely configurable**

The maximum number of pairings that an NFC-capable vehicle will accept shall be configurable to any integer value less than or equal to the physical storage capacity of the supporting hardware.

This configuration shall be updateable remotely (for example, as part of a feature package deployment).

**R\_F\_NFC\_GE2\_1 Starting a vehicle using exterior NFC authorization DCO**

When a user unlocks a locked vehicle using an authorized NFC device at the driver's door exterior reader, the vehicle shall be able to be started once for a short period of time. During this time, the vehicle shall start without noticeable delay when the user presses the brake pedal and shifts into "P" or "R" for vehicles equipped with DCO. This shall be called Unlock and Go.

Note: Exterior starting capability is dependent on a market configuration. Vehicles sold in EU market or in the market required to meet Thatcham specification will not have exterior starting.

**Rationale**: Drive Control Optimization (DCO) experience requires there to no longer be a start button

**R\_F\_NFC\_GE2\_2 Starting a vehicle using interior NFC authorization DCO**

When the user places an authorized NFC device near the interior NFC reader of the vehicle, the vehicle shall be able to be started once for a short period of time. During this time, the vehicle shall start without noticeable delay when the user presses the brake pedal and shifts into "D" or "R" for vehicles with DCO.

**Rationale**: Drive Control Optimization (DCO) experience requires there to no longer be a start button

## Non-Functional Requirements

### Security

**R\_F\_NFC Entry & Starting\_99 NFC devices scan only inside 15cm range**

The NFC system shall not authenticate devices that are more than 15 cm away from the reader surface.

**R\_F\_NFC Entry & Starting\_132 NFC key cards - globally unique**

NFC key cards shall be globally unique (there shall be no method of cloning NFC cards, and no duplicate cards shall ever be manufactured)

### Reliability

**R\_F\_NFC Entry & Starting\_96 Feature Reliability**

NFC keys should be reliably read when placed near vehicle NFC readers in various parallel or near-parallel orientations.

**R\_F\_NFC Entry & Starting\_98 Alternative means of vehicle entry/starting**

Vehicles equipped with the NFC Entry and Starting feature shall be equipped with at least one alternative means of vehicle entry/starting that does not depend on NFC technology (for example, keyfob(s), phone-as-a-key technology, bladed key(s), etc)

**Rationale**: Several Cybersecurity threat mitigations depend on this

## HMI Requirements

**R\_F\_NFC Entry & Starting\_1 NFC key cards - cards can be identified without electronic reader**

NFC key cards shall include some printed feature that allows a user to identify a specific NFC key card by examination alone, without using any electronic interface.

**Rationale**: Users should be able to differentiate between cards which otherwise look identical.

**R\_F\_NFC Entry & Starting\_10 Fleet NFC management interface - HMI - assigning an NFC device to a driver**

The fleet NFC management interface should allow fleet managers to assign an NFC device to a driver in either of the following ways:

- Selecting a driver from the Fleet Drivers list, then selecting the NFC device to be assigned from the Fleet NFC Devices list

- Selecting an NFC device from the Fleet NFC Devices list, then selecting the driver from the Fleet Drivers list

**Rationale**: FO understanding of current interface layout from FCS

**R\_F\_NFC Entry & Starting\_11 Fleet NFC management interface - HMI - creating a direct pairing**

The fleet NFC management interface should allow fleet managers to create direct pairings between vehicles and NFC devices in either of the following ways:

- Selecting an NFC device from the Fleet NFC Devices list, then selecting a target vehicle from the Fleet NFC Vehicles list

- Selecting a vehicle from the Fleet NFC Vehicles list, then selecting a target NFC device from the Fleet NFC Devices list

**Rationale**: FO understanding of current interface layout from FCS

**R\_F\_NFC Entry & Starting\_12 Fleet NFC management interface - HMI - granting a driver access to a vehicle**

The fleet NFC management interface should allow fleet managers to grant drivers access to vehicles in either of the following ways:

- Selecting a vehicle from the Fleet NFC Vehicles list, then selecting a driver or drivers from the Fleet Drivers list

- Selecting a driver or drivers from the Fleet Drivers list, then selecting a vehicle from the Fleet NFC Vehicles list

**Rationale**: FO understanding of current interface layout from FCS

**R\_F\_NFC Entry & Starting\_13 Fleet NFC management interface - HMI - views provided**

The fleet NFC management interface shall provide the following user-facing views:

- List of all NFC devices associated with the fleet ("Fleet NFC Devices list")

- List of all fleet vehicles subscribed to the fleet NFC management feature ("Fleet NFC Vehicles list")

- List of all drivers in the fleet ("Fleet Drivers list")

**Rationale**: FO understanding of current interface layout from FCS

**R\_F\_NFC Entry & Starting\_65 Exterior NFC target**

The vehicle exterior shall have a visual target indicating where users must place their NFC key for locking and unlocking.

**R\_F\_NFC Entry & Starting\_66 Interior NFC instruction**

The in-vehicle HMI shall instruct the user how to use interior NFC reader when the user attempts to start the vehicle and the start authorization has recently expired and no valid key is detected.

**R\_F\_NFC Entry & Starting\_67 Start authorization indication**

While the start authorization period is active, the in-vehicle HMI shall inform the user that the vehicle may be started.

**R\_F\_NFC Entry & Starting\_68 In-vehicle HMI for active key list**

The in-vehicle HMI shall provide a means for the user to view a list of all active keys on a vehicle. The HMI shall show which key authorized the start of the vehicle.

**R\_F\_NFC Entry & Starting\_69 In-vehicle HMI for adding NFC key cards**

The in-vehicle HMI shall provide a means for the user to add a physical NFC key to the vehicle. The HMI shall guide the user through the process of adding a physical NFC key.

**R\_F\_NFC Entry & Starting\_70 In-vehicle HMI for removing keys**

The in-vehicle HMI shall provide a means for the user to delete any non-factory NFC keys.

**R\_F\_NFC Entry & Starting\_71 In-vehicle HMI for Master Reset**

The in-vehicle HMI shall make it clear that a Master Reset will deactivate the Digital Key feature and delete all digital keys.

**R\_F\_NFC Entry & Starting\_72 In-vehicle HMI for MyKey**

The in-vehicle HMI shall provide a means for the user to make a physical NFC key a MyKey.

**R\_F\_NFC Entry & Starting\_73 In-vehicle HMI for Personal Profiles**

The in-vehicle HMI shall provide a means for the user to pair a physical NFC key or digital key to a Personal Profile.

**R\_F\_NFC Entry & Starting\_74 In-vehicle HMI for Secure Idle**

The in-vehicle HMI shall provide an indication to the user to scan an NFC key when the vehicle is in Secure Idle and the user attempts to drive the vehicle.

**R\_F\_NFC Entry & Starting\_75 In-vehicle HMI for Remote Start**

The in-vehicle HMI shall provide an indication to the user to scan an NFC key when the vehicle is in a non-motive, Remote Start state and the user attempts to drive the vehicle.

**R\_F\_NFC Entry & Starting\_144 Admin User Phone App: NFC Specific notification prior to removing vehicle from Garage**

An Admin User shall be informed that if they decide to deauthorize themselves from the vehicle (remove it from their garage) and no other users are authorized to the vehicle, all Retail User NFC Cards shall be deleted (inoperable) from the vehicle at the time of the last Admin User's deauthorization.

**R\_F\_NFC Entry & Starting\_145 Admin User Phone App: HMI for Responding to Approval Requests**

An Admin User with an NFC Feature Equipped vehicle within their garage shall be able to receive NFC Retail User Card add and delete approval requests. The request shall come in as a notification that lets the Admin User be able to accept, deny, or dismiss (for later action) the request

**R\_F\_NFC Entry & Starting\_146 Admin User Phone App: HMI Screen for approving an NFC Card add/delete request**

When an Admin User receives a request to approve a NFC Retail User Card add/delete to/from their vehicle on their mobile app phone app, the notification shall display the information about the vehicle, and the "friendly name" of the specific NFC Retail User Card. The notification shall also provide directions on and a method for requiring the user to enter in the last four characters of the NFC Card's FESN in order to approve the request

**R\_F\_NFC Entry & Starting\_147 Admin User Phone App: NFC Card add/delete FESN entry retry strategy**

The phone app shall allow an Admin User an unlimited number of retries for entering in the correct last four characters of the NFC Card's FESN in order to approve the request; either until they deny the request, dismiss it for later, or the time for them to approve (24 hours) expires.

Note: Denying or Dismissing a Approval Request requires no additional actions besides making the selection

**R\_F\_NFC Entry & Starting\_148 Admin User Phone App: Viewing pending Approval Requests**

An Admin User shall be able to navigate to a page within their Mobile app that shows all pending approval requests. Organized by Vehicle, and Device Friendly Name. User shall be able to select a specific pending request within the list and be able to either approve (by providing last four characters of NFC Card FESN) or reject the request. On timeout, a pending request will get removed from the pending list to the approval history list and labeled as "Timedout" and moved to the

## Other Requirements

### Manufacturing Requirements

**R\_F\_NFC Entry & Starting\_78 Pairing during manufacturing**

The system shall provide a method for previously-unassociated NFC key cards to be paired with a vehicle during vehicle manufacturing.

**Rationale**: Because the NFC cards and NFC modules may be sourced from different suppliers and/or manufactured in different locations, we want to avoid requiring that the module and its cards are pre-paired (which would require keeping the module and the cards together until they get to the vehicle).

**R\_F\_NFC Entry & Starting\_79 Pairing during manufacturing - no connectivity required**

The method for programming the NFC key cards during manufacturing shall not require cloud or offsite server connectivity.

**Rationale**: We can't count on connectivity being available at plants during manufacturing.

**R\_F\_NFC Entry & Starting\_80 Pairing during manufacturing - possible to pair one or two keys**

The method for programming the NFC key cards during manufacturing shall allow either one or two cards to be programmed as factory cards.

**Rationale**: Some vehicles ship with two factory cards, some will ship with one

**R\_F\_NFC Entry & Starting\_81 Enabling/disabling the NFC Retail feature via EOL tool**

The vehicle shall have a configuration parameter to selectively enable or disable the NFC Retail feature.

When the NFC Retail feature is disabled, the NFC system shall no longer poll for devices, or accept any commands to add or delete nfc devices

*This requirement references the following elements:*

* -1901886539.jpg [Enable NFC Feature (manufacturing)](#_c971b9d60880769bddf479c5077e7e4a) (Use Case Specification)
* -1901886539.jpg [Enable/Disable NFC Retail feature (service)](#_f5436b3e71209a18a531a6268d17ad43) (Use Case Specification)

**R\_F\_NFC Entry & Starting\_83 Usable to drive vehicle during manufacturing**

Manufacturing employees shall be able to use the NFC system to start and drive the car during vehicle assembly.

**Rationale**: Needed for plant operations if vehicles can be configured with only NFC keys

### Service Requirements

**R\_F\_NFC Entry & Starting\_84 Add/remove NFC keys with service tool has timeout**

If the service tool allows technicians to request a privileged vehicle command (add/remove key, clear all, restore keys) while the tool is not connected to the vehicle, the authorization provided by the Ford backend shall expire after some time period less than 48 hours from the time of the request.

**Rationale**: Prevents malicious actors from pre-emptively requesting commands for a vehicle and storing them for later use, possibly after their credentials have expired

*This requirement references the following elements:*

* -1901886539.jpg [Enable/Disable NFC Retail feature (service)](#_f5436b3e71209a18a531a6268d17ad43) (Use Case Specification)
* -1901886539.jpg [Add an NFC key card (Service Technician)](#_d14a34d5aeb6c674a39d20ae30c74dbd) (Use Case Specification)
* -1901886539.jpg [Remove all NFC user keys (service)](#_42dc5e6851aae169d6c7833cd821fa82) (Use Case Specification)

**R\_F\_NFC Entry & Starting\_85 Enabling/disabling NFC system with service tool - roll back changes on error**

If the service tool does not meet the required preconditions or cannot complete the required operations at the time of attempting to configure the vehicle to enable the NFC Feature, the service tool tool shall display an error message indicating it wasn’t able to complete the request. The service tool should then undo any changes that had occurred part way through the request and revert the feature to its previous setting.

**R\_F\_NFC Entry & Starting\_86 Enabling/disabling the NFC Retail feature via Service tool**

The Service tool shall be capable of configuring a vehicle and all of its impacted systems to either enable or disable the NFC Feature when the following conditions are true:

- Service tool is connected to the vehicle

- Service tool detects all impacted modules are present and communicating on the vehicle

- The service technician and service tool have authorized themselves to Ford IT/Backend

- The Ford IT/Backend has provided the individual system unlock keys to allow the service tool to directly configure the target system

If the feature is set to enabled, then the vehicle will enable NFC Device detection (polling), Authentication, the ability to request vehicle locking control and starting authorization, and enable the in-vehicle HMI to view/display NFC feature specific menus and pop-ups"

*This requirement references the following elements:*

* -1901886539.jpg [Enable/Disable NFC Retail feature (service)](#_f5436b3e71209a18a531a6268d17ad43) (Use Case Specification)

**R\_F\_NFC Entry & Starting\_87 Method for adding/removing NFC keys locally**

Service technicians shall be able to add and remove individual NFC key card pairings, and clear all, restore factory card and restore user card pairings from a vehicle using a Ford-provided service tool that is physically connected to the vehicle.

**Rationale**: Needed for servicing NFC system.

**R\_F\_NFC Entry & Starting\_88 Method for adding/removing NFC keys locally - service tool can create factory cards**

The service tool shall allow an authorized service technician to create both NFC user key pairings and NFC factory card pairings. The service technician shall select the type of pairing to be created as an input to the service tool pairing process.

**Rationale**: Needed for lost, damaged, or stolen factory card replacement

**R\_F\_NFC Entry & Starting\_90 Service tool - module replacement**

There shall be a method for a service technician to replace a defective NFC control module in a vehicle. The installed NFC system shall satisfy all of the feature behavior requirements after the module swap is performed.

**Rationale**: Need to be able to replace modules if they fail.

**R\_F\_NFC Entry & Starting\_91 Service tool - module replacement - possible if existing NFC module is completely broken**

Replacing the NFC module using the service technician tool/procedure shall be possible even if the NFC module installed in the vehicle is completely nonfunctional, destroyed, or missing.

**Rationale**: The service procedure needs to be able to address all field failures - we can't assume anything about a defective module.

**R\_F\_NFC Entry & Starting\_92 Service tool - module replacement - restore NFC card pairings**

When the NFC system control module is replaced using the appropriate service procedure, all of the NFC card pairings that were present on the vehicle before the module swap shall be re-added after the module swap. This includes pairings created using the fleet management interface, NFC card pairings created using the retail interface, and factory NFC card pairings. It does not include pairings with NFC phones/smart devices.

**Rationale**: The vehicle should come out of the module swap with all the same keys paired that were paired before the module swap. NB: It may not be possible to do this for CCC mobile devices, so they are exempted.

**R\_F\_NFC Entry & Starting\_93 Service tool operations only work locally**

The service tool used by technicians shall not permit performing privileged operations (add card, remove card, enable/disable feature) remotely (without being physically connected to the vehicle).

*This requirement references the following elements:*

* -1901886539.jpg [Enable/Disable NFC Retail feature (service)](#_f5436b3e71209a18a531a6268d17ad43) (Use Case Specification)
* -1901886539.jpg [Add an NFC key card (Service Technician)](#_d14a34d5aeb6c674a39d20ae30c74dbd) (Use Case Specification)
* -1901886539.jpg [Remove all NFC user keys (service)](#_42dc5e6851aae169d6c7833cd821fa82) (Use Case Specification)

**R\_F\_NFC Entry & Starting\_94 Service tool restrictions secure against local tampering**

The restrictions placed on service tool operations (request expiry, requirement for local connection to vehicle) shall be implemented in a way that is secure against tampering with the service tool (for example, tampering with the service tool's real-time clock).

*This requirement references the following elements:*

* -1901886539.jpg [Enable/Disable NFC Retail feature (service)](#_f5436b3e71209a18a531a6268d17ad43) (Use Case Specification)
* -1901886539.jpg [Remove all NFC user keys (service)](#_42dc5e6851aae169d6c7833cd821fa82) (Use Case Specification)
* -1901886539.jpg [Add an NFC key card (Service Technician)](#_d14a34d5aeb6c674a39d20ae30c74dbd) (Use Case Specification)

**R\_F\_NFC Entry & Starting\_97 Service operations require technician credentials**

The service tool shall require valid technician credentials to be provided before any NFC service operation in the following list can be completed using the service tool:

* Adding NFC key card pairings (any type)
* Removing NFC key card pairings (any type)
* Clearing All NFC Key Cards
* Restoring Factory and User Cards as part of replacing an NFC module (module swap)

"Valid technician credentials" are credentials assigned to a single individual, associated with their identity, and issued through a process providing equivalent vetting to NASTF credentials.

**R\_F\_NFC Entry & Starting\_149 Method for viewing existing pairings**

Service technicians shall be able to use a Ford-provided service tool to view all current and pending NFC device pairings on a given vehicle. The following information shall be displayed for each of the pairings:

* Device type (Ford NFC card or NFC-equipped smart device)
* Key identifier: for Ford NFC cards, the FESN; for NFC-equipped smart device pairings, the key fingerprint/hash
* The friendly name assigned to the pairing
* Key type (factory pairing, retail user pairing, fleet pairing)
* Status of the pairing (active, pending addition, pending deletion)

# Functional Safety

NFC Entry and Starting feature is comprised as a requestor of an authorization and/or initialization status to initiate a System Behavior. It is not comprised of System Behaviors that performe the functionality of starting or locking systems.

This is similar to a iPhone app acting as a NFC authorization requestor for hotel room unlock function. The app authorizes and send the request, but the System Behavior is performed within the unlock function of the Functional Safety “item” equivalent, which is the unlock system on the hotel door. The Functional Safety “item” equivalents are the Vehicle Start Control feature and applicable Lock Control features. If the NFC feature fails, you can still press the remote start button on the key fob or the engine start stop button or the lock/unlock button on the key fob or the lock/unlock buttons on the door.

Feature Classification is QM.

Refer to HARA and impact analysis documentation for additional details.

# Data analytics

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Data Element (Variable)** | **Data Element Description** | **Purpose** | **Value/ Opportunity** | **Data Type** | **Current Data Source** | **Priority** |
| **Data Elements for Customer Outputs** |  |  |  |  |  |  |
| NFC Device added successfully | Used to indicate the type and ID of the NFC Device that was successfully added to the vehicle. | - Determine if the feature's add/delete device capability is being utilized - Determine number of active devices present on vehicle | - Revenue - Customer Satisfaction - Reductive Design - Warranty | Signal | NFAM | High |
| NFC Device deleted successfully | Used to indicate the type and ID of the NFC Device that was successfully removed from the vehicle. | - Determine if the feature's add/delete device capability is being utilized - Determine number of active devices present on vehicle | - Revenue - Customer Satisfaction - Reductive Design - Warranty | Signal | NFAM | High |
| NFC Feature enabled on vehicle | Indicates whether the feature is enabled on the vehicle | - Determine the enabled or disabled status of the feature with vehicles that have the supported hardware | - Revenue - Customer Satisfaction - Reductive Design - Warranty | DID | NFAM | High |
| NFC Feature disabled on vehicle | Indicates whether the feature is disabled on the vehicle | - Determine the enabled or disabled status of the feature with vehicles that have the supported hardware | - Revenue - Customer Satisfaction - Reductive Design - Warranty | DID | NFAM | High |
| NFC Device scan location prior to vehicle start: Exterior or Interior | Indicates the NFC Device scan location (Interior reader or Exterior Reader) that occurred prior to used starting the vehicle | - Determine if users are entering and starting the vehicle within the exterior starting authorization time | - Revenue - Customer Satisfaction - Reductive Design - Warranty | Signal | NFAM | High |
| Vehicle locked or unlocked with NFC device | Indicates the locking event that occurred after scanning an NFC Device at the exterior reader. | - Determine if users are entering/locking the vehicle using their NFC Device(s) | - Revenue - Customer Satisfaction - Reductive Design - Warranty | Signal | BCM | High |
| NFC Device ID authorized at time of vehicle start | Indicates the NFC Device ID that was scanned/authorized at the time the vehicle is started | - Determine the ID of the NFC device that was used to start the vehicle | - Revenue - Customer Satisfaction - Reductive Design - Warranty | Signal | NFAM | High |
| Total number of NFC MyKey Devices on the vehicle | Indicates how many of the NFC Devices programmed to the vehicle have MyKey restrictions on them | - Be able to compare the number of standard to MyKey devices programmed on a vehicle | - Revenue - Customer Satisfaction - Reductive Design - Warranty | DID | BCM | High |
| Interior scan used to exit secure idle | Indicates if 1. the vehicle entered the secure idle state and 2. if an NFC scan was then used to exit the secure idle state | - Determine how often the Secure Idle feature is activated, and if having the secure idle be active on the vehicle impacts the NFC Feature's adoption rate | - Revenue - Customer Satisfaction - Reductive Design - Warranty | Signal | NFAM | High |
| **Data Elements for Customer Inputs** |  |  |  |  |  |  |
| NFC device scan location | Whether an NFC Device was scanned at an interior or exterior reader | - Determine where NFC Devices are being detected | - Customer Satisfaction - Warranty | Signal | NFAM | High |
| NFC Device add/delete requested in-vehicle HMI | Determine if users are using the in-vehicle HMI to add or delete their devices | Determine the preferred method for adding or deleting devices from the vehicle | - Customer Satisfaction - Warranty | Signal | Sync | High |
| NFC Device add/delete requested via service tool | Determine if users are taking their vehicle to the dealer to add or delete their devices | Determine the preferred method for adding or deleting devices from the vehicle | - Customer Satisfaction - Warranty | Signal | NFAM | High |
| User performs master reset | Determine if the user initiated a master reset | Determine how often users initiate a master reset (since it causes all the retail NFC Keys to be deleted) | - Customer Satisfaction - Warranty | Signal | Sync | High |
| **Data Elements for Customer Level Failure Modes** |  |  |  |  |  |  |
| Exterior reader not polling/error | Indicate if an Exterior Reader is faulted | - Feature Diagnostics | - Customer Satisfaction - Warranty | DTC | NFAM | High |
| Interior reader not polling/error | Indicate if an Interior Reader is faulted | - Feature Diagnostics | - Customer Satisfaction - Warranty | DTC | NFAM | High |
| In-vehicle NFC key add fail | Indicate if an NFC key add requested couldn't be completed due to a system error | - Feature Diagnostics | - Customer Satisfaction - Warranty | Signal | NFAM | High |
| In-vehicle NFC key delete fail | Indicate if an NFC key delete requested couldn't be completed due to a system error | - Feature Diagnostics | - Customer Satisfaction - Warranty | Signal | NFAM | High |
| NFC module not communicating/error | Indicate if the NFC module is faulted | - Feature Diagnostics | - Customer Satisfaction - Warranty | DTC | NFAM | High |

# Revision History

| Revision | Description | Responsible |
| --- | --- | --- |
| 2020-05-22 | Initial Functional Specification release for P708 UPV0 | abonnel1,  adelong2,  fehsan2, ekarpins |
| 2020-08-24 | Updated release for P708 UPV1 | abonnel1,  adelong2,  fehsan2,  ekarpins |
| 2021-03-11 | Section 4.2.3 "Use Case Descriptions"  Modified:   * 1 Enable/Disable NFC Retail feature * 9 Add an NFC key card (retail) * 10 Add an NFC key card (Service Technician) * 11 Remove and NFC key card (retail) * Remove an NFC key card (Service Technician) * Replace NFC module (service)   Added:   * Enable NFC Feature Manufacturing * View Current Pairings * Pair NFC key card(s) (manufacturing) * Use NFC Key Card to Drive Vehicle During Manufacturing * NFC-DK-UC-001 Digital Key - Pair Owner Device * NFC-DK-UC-002 Digital Key - Change Owner Device * NFC-DK-UC-004 Digital Key - Owner Terminate Friend Key in Vehicle * NFC-DK-UC-007 Digital Key - Friend Key Expires * NFC-DK-UC-010 Digital Key - Security Breach on Friend Device * NFC-DK-UC-012 Digital Key -out of scope- Owner Terminates Friend Key in Ford app * NFC-DK-UC-013 Digital Key - Owner Terminates Owner Key in Native App * NFC-DK-UC-014 Digital Key - Owner Device is Wiped Locally * NFC-DK-UC-015 Digital Key - Owner Device is Wiped Remotely * NFC-DK-UC-016 Digital Key - Security Breach on Owner Device * NFC-DK-UC-018 Digital Key - Vehicle Removed From Primary Account * NFC-DK-UC-019 Digital Key - Vehicle Removed From Secondary Account * NFC-DK-UC-020 Digital Key - Garage Service Process     Section 5.1 Functional Requirements  Modified:   * R\_F\_NFC Entry & Starting\_17 Fleet NFC management subscription * R\_F\_NFC Entry & Starting\_18 Fleet NFC management subscription - unsubscribing deletes all fleet-added keys * R\_F\_NFC Entry & Starting\_31 Purchasing additional NFC cards for a fleet - with NFC management interface * R\_F\_NFC Entry & Starting\_32 Fleet NFC management subscription - Conditions for activating subscribing * R\_F\_NFC Entry & Starting\_33 Fleet NFC management subscription - Conditions for deactivating subscription * R\_F\_NFC Entry & Starting\_40 Fleet NFC management subscription - deactivating subscription post conditions * 41 Starting a vehicle using exterior NFC authorization * R\_F\_NFC Entry & Starting\_50 Short tap at exterior reader is equivalent to lock or unlock request * R\_F\_NFC Entry & Starting\_52 Support NFC cards * R\_F\_NFC Entry & Starting\_53 Adding and removing NFC key cards * R\_F\_NFC Entry & Starting\_54 Adding/Deleting NFC key cards - information presented to Admin for approval * R\_F\_NFC Entry & Starting\_59 Adding/removing NFC key cards - owner approval timeout * R\_F\_NFC Entry & Starting\_60 Adding/removing NFC key cards - requires owner approval * R\_F\_NFC Entry & Starting\_62 Mobile app - method for approving or denying NFC requests * R\_F\_NFC Entry & Starting\_63 Removing NFC key cards * R\_F\_NFC Entry & Starting\_104 Unlocking a vehicle with an NFC key     Added:   * R\_F\_NFC Entry & Starting\_69 Maximum number of pairings - remotely configurable * R\_F\_NFC Entry & Starting\_102 Exterior NFC Authorization Configuration * R\_F\_NFC Entry & Starting\_103 No Slam Lock * R\_F\_NFC Entry & Starting\_108 Fleet NFC management subscription - vehicle capability while fleet subscription is active * R\_F\_NFC Entry & Starting\_109 Viewing NFC Key Card add and delete history in Mobile App * R\_F\_NFC Entry & Starting\_110 setup condition – online registration required before use * R\_F\_NFC Entry & Starting\_111 setup condition – owner authentication * R\_F\_NFC Entry & Starting\_112 setup condition – owner presence * R\_F\_NFC Entry & Starting\_113 setup condition – time to hold device * R\_F\_NFC Entry & Starting\_114 setup methods * R\_F\_NFC Entry & Starting\_115 setup permission * R\_F\_NFC Entry & Starting\_116 owner/primary device change – key sync * R\_F\_NFC Entry & Starting\_117 owner/primary device change – remove old owner key * R\_F\_NFC Entry & Starting\_119 owner/primary device change condition – must complete owner pairing * R\_F\_NFC Entry & Starting\_120 owner/primary device change methods * R\_F\_NFC Entry & Starting\_121 Vehicle NFC Readers * R\_F\_NFC Entry & Starting\_122 Number of digital keys allowed on vehicle * R\_F\_NFC Entry & Starting\_123 Sharing methods * R\_F\_NFC Entry & Starting\_124 sharing permission * R\_F\_NFC Entry & Starting\_125 Viewing digital keys * R\_F\_NFC Entry & Starting\_126 Friend key deletion permission and methods for owner * R\_F\_NFC Entry & Starting\_127 Friend key termination from owner device * R\_F\_NFC Entry & Starting\_128 Master Reset behavior * R\_F\_NFC Entry & Starting\_129 self-deletion permission and methods * R\_F\_NFC Entry & Starting\_130 Vehicle removal from primary account behavior * R\_F\_NFC Entry & Starting \_825 Using exterior NFC authorization when Secure Idle is active * R\_F\_NFC Entry & Starting \_826 NFC feature management conditions     Section 5.2.2 Security    Added:   * R\_F\_NFC Entry & Starting\_99 NFC devices scan only inside 15cm range     Section 5.2.3 Reliability    Added:   * R\_F\_NFC Entry & Starting\_98 Alternative means of vehicle entry/starting     Section 5.3 HMI Requirements    Deleted:   * 13 Fleet NFC management interface - HMI - views provided     Modified:   * R\_F\_NFC Entry & Starting\_13 Fleet NFC management interface - HMI - views provided     Added:   * R\_F\_NFC Entry & Starting \_76 Admin User Phone App: Viewing pending Approval Requests * R\_F\_NFC Entry & Starting \_77 Admin User Phone App: NFC Card add/delete FESN entry retry strategy * R\_F\_NFC Entry & Starting \_78 Admin User Phone App: HMI for Responding to Approval Requests * R\_F\_NFC Entry & Starting \_79 Admin User Phone App: Viewing history of approval request responses * R\_F\_NFC Entry & Starting \_80 Admin User Phone App: HMI Screen for approving an NFC Card add/delete request * R\_F\_NFC Entry & Starting \_81 Admin User Phone App: NFC Specific notification prior to removing vehicle from Garage     Section 5.4.2 Manufacturing Requirements    Modified:   * R\_F\_NFC Entry & Starting\_81 Enabling/disabling the NFC Retail feature via EOL tool     Section 5.4.3 Service Requirements    Modified:   * R\_F\_NFC Entry & Starting\_84 Add/remove NFC keys with service tool has timeout * R\_F\_NFC Entry & Starting\_86 Enabling/disabling the NFC Retail feature via Service tool * R\_F\_NFC Entry & Starting\_87 Method for adding/removing NFC keys locally     Added:   * R\_F\_NFC Entry & Starting\_97 Service operations require technician credentials * R\_F\_NFC Entry & Starting\_98 Method for viewing existing pairings     Section 6 Functional Safety   * Clarified that the feature is rated QM     Section 7 Data Analytics   * Added entire section/table | abonnel1,  adelong2,  fehsan2,  ekarpins,  rsepulv6,  jwolf53 |
| 2021-06-07 | Section 4.2.3, “Use Case Descriptions”:  Added:   * NFC-UC-GE2-1 “Start a DCO vehicle using exterior NFC authentication” * NFC-UC-GE2-2 “Start a DCO vehicle using interior NFC authorization” * NFC-UC-GE2-3 “Enter Motive State with an NFC Key following DCO vehicle Remote Start” * NFC-UC-GE2-4 “Exit Secure Idle with an NFC Key on DCO vehicles”   Deleted:   * #22 “Start a vehicle using exterior NFC authentication” * #28 “Exit Secure Idle with an NFC Key” * #29 “Enter Motive State with an NFC Key following Remote Start”   Modified:   * Use cases which did not have full IDs (for example, “9” instead of “NFC-UC-9” have been renumbered. In some cases, the number of the use case has changed. The titles are unchanged. * NFC-UC-48 “Add an NFC key card (retail)” * NFC-UC-02 “Add an NFC key card (service technician)” * NFC-UC-23 “Lock a vehicle with an NFC Key” (wording only) * NFC-UC-30 “Remove an NFC key card (retail) * NFC-UC-41 “Unlock a vehicle with an NFC key” (wording only)   Removed: 4.2 “Driving and Operation Scenarios” (duplicated by previous section)  Section 5.1 “Functional Requirements”:  Added:   * R\_F\_NFC\_Entry & Starting\_143 “NFC System Perceived Latency”   Deleted:   * R\_F\_NFC\_Entry & Starting\_109 “Viewing NFC Key Card add and delete history in Mobile App” * R\_F\_NFC\_Entry & Starting\_114 “Setup methods” * R\_F\_NFC\_Entry & Starting   Modified:   * R\_F\_NFC\_Entry & Starting\_108 – renumbered to R\_F\_NFC Entry & Starting\_2 * R\_F\_NFC Entry & Starting\_56 – change in title * R\_F\_NFC\_Entry & Starting\_114 – renumbered to R\_F\_NFC\_Entry & Starting\_89 * R\_F\_NFC\_Entry & Starting\_69 – renumbered to R\_F\_NFC\_Entry & Starting\_150 * R\_F\_NFC\_Entry & Starting\_102 “Exterior NFC Authorization Configuration” * R\_F\_NFC\_Entry & Starting\_129 – renumbered to R\_F\_NFC\_Entry & Starting\_105 * R\_F\_NFC\_Entry & Starting\_76 – renumbered to R\_F\_NFC\_Entry & Starting\_148 * Several other requirements renumbered without changes to text. | abonnel1,  adelong2,  fehsan2,  ekarpins,  rsepulv6,  jwolf53 |

## Template Revisions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Version | Rev. | Date | Description | Responsible |
| *0* | *6* | *2015-05-26* | * *Chapter “Feature Overview” and made a 2nd level heading.* * *Chapter “Feature Modeling” divided into 3 subchapter (“Scenarios”, “Use Cases”, “State Machines”) for different modeling methods* | *Jbaden1* |
| *0* | *7* | *2015-05-27* | * *Table of Content updated* * *Template Revision History chapter added* | *Jbaden1* |
| *0* | *8* | *2015-07-02* | * *Section “Unsettled Issues” added* | *Alevin7* |
| *0* | *9* | *2015-08-04* | * *Section “Feature Variants” added* * *Section “Feature Boundary Diagram” renamed to “Feature Context Diagram”* * *Document Properties adapted to match needs of VBA macros* | *Jbaden1, Awegman1* |
| *1* | *0* | *2015-09-11* | * *Section “Feature Variants” reworked* * *Feature Goals removed. Only “Safety Goals“ chapter remains.* * *Heading 2 formatting issues corrected.* * *Requirements / Use Cases Listing removed from traceability chapter.* * *Formatting of attribute table in Notation chapter corrected* * *Open Topics / Known Issues chapter moved to the end* | *Jbaden1* |
| *1* | *1* | *2015-11-16* | * *Table-Styles removed (for smooth VSEM import)* * *Some clean-up of sections “Purpose” and “Audience”* | *Awegman1, jbaden1* |
| *1* | *2* | *2016-02-26* | * *Minor corrections based on lessons learned from CC and PCL pilot (e.g. section market/regions) and discussion with Functional Safety Team (purpose of feature)* * *Footer corrected* * *Boundary diagram interface chapter renamed to influences.* | *Jbaden1* |
| *1* | *3* | *2016-02-26* | * *Minor corrections after review with Whitney Keith from Functional Safety team* | *Jbaden1* |
| *1* | *4* | *2016-03-10* | * *Some cleanup of meta-data in Word Properties* | *Jbaden1* |
| *1* | *5* | *2016-03-10* | * *Footer formatting corrected (Issue 19)* * *Results from review with Functional Safety Team incorporated (Issue 20).* | *jbaden1* |
| *1* | *6* | *2016-04-18* | * *Scenario Template added* | *Jbaden1* |
| *1* | *7* | *2016-04-18* | * *Chapter “Operation Modes and States” moved before “Use Case” section.* | *Jbaden1* |
| *1* | *8* | *2016-04-18* | * *Broken Wiki links repaired.* | *Jbaden1* |
| *2* | *0* | *2016-05-19* | * *Adapted to Specification\_Macros.dotm V2.0* * *Requirements Templates chapter (ch. 1.7.1) no longer has an attribute table, but refers directly to the Wiki..* | *Jbaden1* |
| *2* | *1* | *2016-06-10* | * *Table for Context Diagram modified (lists external entities and Influence Description only)* | *Jbaden1* |
| *2* | *2* | *2016-07-08* | * *Template version added to footer* * *Several hints added to the various sections* * *Findings from Functional Safety Team incorporated.* * *RE\_SafetyRequirement style added* | *Jbaden1* |
| *2* | *3* | *2016-09-21* | * *Update from Functional Safety Team incorporated (“Lessons Learned”, “System Behaviors for HARA”)* | *Jbaden1* |
| *2* | *4* | *2016-11-15* | * *Update from Functional Safety Team incorporated (“Lessons Learned”, “System Behaviors for HARA”)* * *Explanatory notes made more formal* | *Jbaden1* |
| *3* |  |  | *Skipped to synchronize with Specification\_Macros.dotm* |  |
| *4* |  |
| *5* | *0* | *2017-01-13* | * *Meta data updated for specification macros, version 3.1* * *SW Unit chapter removed for the time being* * *Green boxes added for user hints* | *Jbaden1* |
| *5* | *1* | *2017-01-18* | * *Minor editorial changes* | *Jbaden1* |
| *6* | *0* | *2017-02-03* | * *CR48: Chapter 6 renamed from “Safety” to “Functional Safety”. New sub-chapter “Safety” introduced in Non-Functional Requirements section* | *Jbaden1* |
| *6* | *0* | *2017-04-28* | * *CR7: “RequirementsTraceability” chapter removed* | *Jbaden1* |
| *6* | *0* | *2017-11-15* | * *CR32/53: New Cover Sheet + Disclaimer replaces FAP-150 like ones.* * *CR75: Some rewording -> Terminology to Glossary, Notation -> Document Conventions* * *CR49: Rename “Assumptions & Constraints” to “Assumptions”* * *CR74: Safety Assumptions added to chapter 6.* * *CR58: Add function allocation column to Logical Architecture chapter* | *Jbaden1* |
| *6* | *0* | *2018-01-31* | * *CR63: Updated links to Functional Safety Sharepoint* | *Jbaden1* |
| *6* | *0* | *2018-07-24* | * *CR69: Add FSR to FeatureDoc* * *CR64: Add new section "Design Requirements" to Function Spec and Feature Spec* | *Jbaden1* |
| *6* | *0* | *2018-08-06* | * *CR53: some corrections for metada and formatting* | *Jbaden1* |
| *6* | *0* | *2018-09-28* | * *Broken links to RE Wiki repaired* | *Jbaden1* |
| *6* | *0* | *2018-10-31* | * *Cover sheet and footer more GIS like. Functional Safety team feedback incorporated:*   + *New subsections “Functional Safety Requirements, (Decomposed) FSRs and Parameters / Values*   + *Removal of “Logical Architecture”* | *Jbaden1* |
| *6* | *0* | *2018-12-12* | * *FSR template removed, now as a macro in the Specification\_Macros.dotm* | *Jbaden1* |
| *N* |  | *2019-04-03* | * *Updated code for context diagrams, actors and use cases.* * *Updated code structure with all macros at the beginning.* * *Updated code to populate assumptions using element-assumption relationship or hazardous event.* | *snuesch* |
| *N* |  | *2019-04-18* | * *Added structural boundary diagram for FuSa based on TGB discussion.* * *Added operating modes to functional safety requirements.* | *snuesch* |
| *O* |  | *2019-04-25* | * *Improved export of actions and activities on functional boundary diagram.* | *snuesch* |
| *6* | *0b* | *2019-05-23* | * *Re-introduce “Logical Architecture” (for Functional Safety)* | *Jbaden1* |
| *O* |  | *2019-06-17* | * *Aligned “Architecture” section with RE template.* * *Made “Ford Documents” table more flexible.* * *Added template terms to glossary* | *snuesch* |
| *O* |  | *2019-06-25* | * *Improved use cases to handle Primary and Secondary actors.* * *Added Performance Requirements to Uncategorized.* | *snuesch* |
| *6* | *0b* | *2019-06-26* | * *Chapter “Logical Elements” in “Logical Architecture” section added (FuSa CR 15136240)* * *“References” and “Glossary” chapter moved from section “Feature Overview” to “Introduction”. References and Glossary should be available in the document as early as possible* | *Jbaden1* |
| *O* |  | *2019-07-25* | * *Added populated “Logical Elements” table and allocated functions.* * *Export documentation field of context diagram.* | *snuesch* |

# Appendix

## Definitions

| **Definition** | **Description** |
| --- | --- |
| Indirect pairing | A pairing between an NFC key card and a fleet vehicle that is created as a result of a fleet driver being granted access to that vehicle, as opposed to a direct pairing, which is created directly between an NFC key card and a vehicle. |
| NFC-capable vehicle | A vehicle that is compatible with Ford NFC key cards, CCC-compliant NFC devices, and the Ford fleet NFC management system. |
| Pairing | A pairing is a relationship between a specific NFC device and a specific vehicle.  When an NFC device and a vehicle are paired, the NFC device can generally be used to unlock and start the vehicle, although it may be possible to limit specific permissions (e.g., trunk unlocking) granted to a particular NFC device. |
| Retail admin | TODO define |

Table 5: Definitions used in this document

Document ends here.