Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – Wireless Accessory Charging

APIM Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.0

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Version Date: October 8, 2015

FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
October 8, 2015	1.0	Initial Release	

Table of Contents

1 Architectural Design

1.1 CLD-REQ-163173/A-Wireless Charging Server

The Wireless Charging Server is responsible for carrying out the wireless charging function (ex charging the phone).

1.2 CLD-REQ-162505/A-Wireless Charging HMI Output

The Wireless Charging HMI Output is responsible for providing the wireless charging HMI.

1.3 Interface Requirements

1.3.1 IIR-REQ-163258/A-Wireless Charging interface signals

1.3.1.1 MD-REQ-162530/B-Wireless Charger Status

Method	Notes	Parameters
WirelessCharging.St	Status signal broadcast by the wireless charging module	0x0 Null 0x1 Charging Not In Progress 0x2 Charging In Progress 0x3 Charging Complete 0x4 Metal Object Detected 0x5 Overheat 0x6 Misalignment 0x7Reserved

2 Functional Definition

2.1 WCG-FUN-REQ-162483/A-Charging the Phone

2.1.1 Use Cases

2.1.1.1 WCG-UC-REQ-162484/F-Charging a phone on the wireless charging pad

Actors	Wireless Accessory Charging Module, Display HMI, Vehicle Occupant
Pre-conditions	Infotainment system is powered ON Phone is not on the Wireless Charging pad Charge pad is capable of charging a phone
Scenario Description	User put their phone on the wireless charging pad to charge their phone
Post-conditions	1. Charger detects an object on the charger pad 2. Charger sends a Ping to identify object 3. If the object is a compatible phone then communication protocol is established 4. Charging session starts, phone may indicate that there is a charge in progress 5. HMI indicates that there is a charge in progress (if HMI supports)
Interfaces	G-HMI
Notes	See HMI specification and screen flows if HMI is supported for this use case If no infotainment system on a vehicle then WACM module would only use Ignition Status and Delayed Accessory for power moding (ie no HMI_HMIMode_St on bus). See Power Management WACM SPSS for details. This use case pre-condition doesn't mention ignition status or delayed accessory since when infotainment system powered ON (ie HMI_HMIMode_St = ON) since when infotainment system is powered on is the only time infotainment HMI is available. The rest of the use cases with HMI in this SPSS follow the same assumption. The functional requirements in this SPSS apply for the wireless accessory charging module whether there is an infotainment system (with HMI) present or not.

2.1.2 Requirements

2.1.2.1 WCG-SR-REQ-163172/C-Wireless Charging - Charging In Progress

The Wireless Charging Server shall set WirelessCharging.St = ChargingInProgress when the Wireless Server is charging a phone.

The Wireless Charging HMI Output shall display the applicable HMI (if HMI supports) when WirelessCharging.St = ChargingInProgress.

2.2 WCG-FUN-REQ-163176/A-Charging Complete

2.2.1 Use Cases

2.2.1.1 WCG-UC-REQ-162496/E-Phone finishes charging on charging pad

Actors	Wireless Accessory Charging Module, Display HMI, Vehicle Occupant
Pre-conditions	Infotainment system is powered ON Phone is charging on the Wireless Charging pad Charge pad is capable of charging a phone Charging Icon is present in HMI (if HMI supports)
Scenario Description	Phone finishes charging
Post-conditions	Phone is present on charging pad and charged Wireless charging pad is no longer charging the phone. Charging HMI is updated to indicate charging is complete (if HMI supports)
Interfaces	
Notes	See HMI specification and screen flows if HMI is supported for this use case.

2.2.2 Requirements

2.2.2.1 WCG-SR-REQ-163179/C-Wireless Charging - Charging Complete

The Wireless Charging Server shall set WirelessCharging.St = ChargingComplete when the Wireless Server finishes charging a phone.

The Wireless Charging HMI Output shall display the applicable HMI (if HMI supports) when charging is complete when WirelessCharging.St = ChargingComplete.

2.3 WCG-FUN-REQ-162492/A-Phone Charging Interruption / Fault condition

2.3.1 Use Cases

2.3.1.1 WCG-UC-REQ-162494/C-Metal Object on charging pad with no phone present

Actors	Wireless Accessory Charging Module, Display HMI, Vehicle Occupant
Pre-conditions	Infotainment system is powered ON There is no Phone on the Wireless Charging pad Charge pad is capable of charging a phone Charging Icon is not present on the HMI
Scenario Description	User puts a metal object on the charging pad but does not put a phone on the charging pad
Post-conditions	Metal object warning is not shown on the HMI
Interfaces	
Notes	

2.3.1.2 WCG-UC-REQ-162485/D-Charging phone not successful due to Metal Object detected

Actors	Wireless Accessory Charging Module, Display HMI, Vehicle Occupant
Pre-conditions	Infotainment system is powered ON Phone is on the Wireless Charging pad Charge pad is capable of charging a phone Charging Icon is not present on the HMI
Scenario Description	User put their phone on the wireless charging pad with Metal object(s) present on the charging pad Charger detects an object on the charging pad Charger sends a ping to identify object Charger starts power transfer with the phone Charger detects metallic objects on it
Post-conditions	Charger ends charging session Metal object warning is shown on the HMI (if HMI supports) Charging Icon is not present on the HMI
Interfaces	G-HMI
Notes	

2.3.1.3 WCG-UC-REQ-162497/E-Phone is misaligned on the charging pad

Actors	Wireless Accessory Charging Module, Display HMI, Vehicle Occupant
Pre-conditions	Infotainment system is powered ON Phone is charging on the Wireless Charging pad Charge pad is capable of charging a phone Charging Icon is present on the HMI (if HMI supports)
Scenario Description	Phone misaligned (ex. from vibration)

Post-conditions	Phone is no longer charging Charging Icon is not present on the HMI Misalignment warning is shown on the HMI (if HMI supports)
Interfaces	
Notes	Minor misalignment may reduce charging efficiency, major misalignment may end the charging session

2.3.1.4 WCG-UC-REQ-162499/C-Phone stops charging on the charging pad because of loss of efficiency

Actors	Wireless Accessory Charging Module, Display HMI, Vehicle Occupant
Pre-conditions	Infotainment system is powered ON Phone is on the Wireless Charging pad Charge pad is capable of charging a phone Charging Icon is present on the HMI (if HMI supports)
Scenario Description	Loss of efficiency detected by coil due to z-stack height (nonmetal thick object in-between phone and Charger)
Post-conditions	Charger / phone detects efficiency drop and increases power transfer until maximum input power threshold is exceeded. Charger finishes charging session. Charging Icon is not present on the HMI.
Interfaces	
Notes	End of charging session due to efficiency happens just in case of thermal event

2.3.1.5 WCG-UC-REQ-162495/C-User removes the phone from the charging pad while charging

Actors	Wireless Accessory Charging Module, Display HMI, Vehicle Occupant
Pre-conditions	Infotainment system is powered ON Phone is charging on the Wireless Charging pad Charge pad is capable of charging a phone Charging Icon is present on the HMI (if HMI supports)
Scenario Description	User removes the phone from the wireless charging pad
Post-conditions	Phone not present on charging pad Charging Icon is not present on the HMI
Interfaces	
Notes	

2.3.1.6 WCG-UC-REQ-162498/C-Phone stops charging on the charging pad because of overheat conditions

Actors	Wireless Accessory Charging Module, Display HMI, Vehicle Occupant
Pre-conditions	Infotainment system is powered ON Phone is charging on the Wireless Charging pad Charge pad is capable of charging a phone Charging Icon is present on the HMI (if HMI supports)
Scenario Description	Phone / Sleeve or Charging Pad exceeded max operating temp.

Post-conditions	Charger or Phone detect max temp threshold Charger ends charging session Charging Icon is not present on the HMI (if HMI supports) Overheat warning is shown on the HMI (if HMI supports)
Interfaces	G-HMI
Notes	See HMI specification and screen flows if HMI is supported for this use case

2.3.2 Requirements

2.3.2.1 WCG-SR-REQ-163174/B-Wireless Charging - Metal Object Detected

The Wireless Charging Server shall set WirelessCharging.St = Metal Object Detected when the Wireless Server has detected a metal object.

The Wireless Charging HMI Output shall display the applicable HMI (if HMI supports) when WirelessCharging.St = Metal Object Detected.

2.3.2.2 WCG-SR-REQ-163180/B-Wireless Charging - Overheat

The Wireless Charging Server shall set WirelessCharging.St = Overheat when the Wireless Server has exceeded max operating temperature or phone / sleeve request end power transfer due to over temperature condition.

The Wireless Charging HMI Output shall display the applicable HMI (if HMI supports) when WirelessCharging.St = Overheat.

2.3.2.3 WCG-SR-REQ-163182/B-Wireless Charging - Charging Not In Progress

The Wireless Charging Server shall set WirelessCharging.St = Charging Not In Progress when the Wireless Server is not charging a phone.

The Wireless Charging HMI Output may display applicable HMI (if HMI supports) when WirelessCharging.St = Charging Not In Progress.

2.3.2.4 WCG-SR-REQ-195367/A-Wireless Charging - Misalignment

The Wireless Charging Server shall set WirelessCharging.St = Misalignment when the phone is misaligned.

The Wireless Charging HMI Output shall display the applicable HMI (if HMI supports) when WirelessCharging.St = Misalignment.

3 Appendix: Reference Documents

Reference #	Document Title
1	
2	
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