## Research & Vehicle Technology
### "Infotainment Systems Product Development"

# Feature – Wireless Accessory Charging

# Wireless Accessory Charging Module (WACM) Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.4
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**Version Date: August 12, 2021**

**FORD CONFIDENTIAL**

# Revision History

| Date | Version | Notes | |
|---|---|---|---|
| October 8, 2015 | 1.0 | **Initial Release** | |
| | | | |
| March 10, 2016 | 1.1 | | |
| | | IIR-REQ-163263/B-Wireless Charging interface signals | <Jmyslin2 / David Gonzalez> Updated to add signal from the BCM to inhibit Wireless Charging |
| | | WCG-SR-REQ-207775/A-PEPS Charging Interruption | <jmyslin2 / David Gonzalez> new requirement with details of the network based PEPS charging interruption system strategy |
| | | | |
| December 1, 2016 | 1.2 | | |
| | | WCG-SR-REQ-162836/D-Detecting AM Band as the Active Source and detecting the Active Frequency | <jmyslin2> Clarified / update requirement on the exit conditions |
| | | | |
| April 3, 2019 | 1.3 | | |
| | | WCG-UC-REQ-162496/F-Phone finishes charging on charging pad | <bgrifka/jmyslin2> updated use case |
| | | WCG-SR-REQ-163179/D-Wireless Charging - Charging Complete | <bgrifka / jmyslin2> updated requirement with more detail |
| | | WCG-UC-REQ-162485/E-Charging phone not successful due to Metal Object detected | <bgifka / jmyslin2> added comments to use case |
| | | WCG-UC-REQ-348155/A-Phone stops & restarts charging due to sliding across charging surface | <bgrifka/jmyslin2> New use case for phone sliding while charging |
| | | WCG-SR-REQ-163182/C-Wireless Charging - Charging Not In Progress | <bgrifka/jmyslin2> updated requirement with exceptions |
| | | WCG-FUR-REQ-164300/C-Reduce phone charging power due to AM frequency or a changing frequency | <bgrifka/jmyslin2> updated requirement |
| | | WCG-SR-REQ-207775/B-PEPS Charging Interruption | <bgrifka/jmyslin2> updated requirement |
| | | STR-240177/C-Appendix: Reference Documents | <bgrifka/jmyslin2> added HMI specs to appendix |
| | | | |
| August 12, 2021 | 1.4 | | |
| | | IIR-REQ-163263/C-Wireless Charging interface signals | jmyslin2:  added new MD for Phoenix architecture |
| | | MD-REQ-420537/A-AM Interference - Variant 2 (Phoenix) | jmyslin2:  new interface MD for audio management on the Phoenix architecture |
| | | WCGv2-SR-REQ-420518/A-Detecting AM Band as the Active Source and detecting the Active Frequency - Variant 2 (Phoenix) | jmyslin2:  new requirement for phoenix architecture for detecting AM band interferance |

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

## 1.2    WCG-CLD-REQ-162505/B-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-163263/C-Wireless Charging interface signals

#### 1.3.1.1    *MD-REQ-162530/C-Wireless Charger Status*

| Method | Notes | Parameters |
|---|---|---|
| WirelessCharging.St | Status signal broadcast by the wireless charging module | 0x0 Null<br>0x1 Charging Not In Progress<br>0x2 Charging  In Progress<br>0x3 Charging  Complete<br>0x4 Metal Object Detected<br>0x5 Overheat<br>0x6 Misalignment<br>0x7 Reserved |
|  |  |  |

#### 1.3.1.2    *MD-REQ-162509/C-AM Interface*

| Method | Notes | Parameters |
|---|---|---|
| **«CAN»**<br>**ResourceUpdate.St()** | This method is used to inform clients/requesters what the current status is of a request.<br><br>This method is application event-periodic driven.<br><br>When there are no resources allocated, the audio source and priority parameters shall be set to 'Not Requested'.<br><br>ResourceUpdate(Front system, Not Requested, Not requested, De-allocated) | int *RequesterSystem :*<br>0x0: FrontRequester<br>0x1: RearRequester<br><br>int *RequestedAudioSource :*<br>Indicates the respective audio source:<br><br>0x0: AM/FM Radio<br>0x1: Front Disc<br>0x2: SDARS/DAB<br>0x3: In Dash CD Changer<br>0x4: Voice Recogniser<br>0x5: Telematic Unit<br>0x6: Bluetooth Phone<br>0x7: Rear Disc<br>0x8: APIM<br>0x9: Front AUX Input<br>0xA: Navigation<br>0xB: Rear Aux |

| Method | Notes | Parameters |
|---|---|---|
| | | 0xC: Not Requested<br>0xD: BTAudio<br>0xE: USB<br>0xF: iPod<br><br>int *RequesterPriority :*<br>This parameter indicates the priority associated with the respective audio source.<br><br>0x0: Emergency Service<br>0x1: Telephony Service<br>0x2: Auto Answer<br>0x3: TA<br>0x4: PTT Mute & Voice<br>0x5: Nav. User Voice Cmd<br>0x6: Nav. System Voice Cmd<br>0x7: Radio<br>0x8: Disc<br>0x9: Alarm<br>0xA: PTY/NEWS<br>0xB: Aux_ExtSource<br>0xC: Mobile NAV/Tel lMute<br>0xD: Manual Audio Mute<br>0xE: Not Requested<br><br><br>int *ResourceRequestStatus :*<br>The status of the respective audio source:<br><br>0x0: No Resource Update<br>0x1: Deallocated<br>0x2: Allocated<br>0x3: Stacked<br>0x4: Granted<br>0x5: Granted (no control of audio source) |
| **«CAN»**<br>**CurrentTUBand.St()** | Message Type: Status<br><br>This signal delivers the Band of the actual selected radio station. | int *Mode*<br>Size: 4 bit<br>Values:<br>0x0 Invalid<br>0x1 FM1<br>0x2 FM2<br>0x3 FM AST<br>0x4 AM<br>0x5 AM AST<br>0x6 FM3 |

| Method | Notes | Parameters |
|---|---|---|
| | | 0x7 DAB1 0x8 DAB2 0x9 SAT1 0xA SAT2 0xB SAT3 0xC DAB3 0xD - 0xF reserved |
| «CAN» CurrentFreq.St() | Message Type: Status This status message delivers the frequency of the currently tuned station. Formulas to apply: AM - Frequency = 153 + Offset kHz. Offset range = 0..1557 FM - Frequency = 76 + Offset*0.05 MHz. Offset range = 0..640 | int *Number :* Offset from lowest possible. Depending on the currently tuned band, the offset will be in KHz or MHz. Size: 11 bits |
| «CAN» RadioSeekMode2.St() | Message Type: Status This status message tells the clients in which seek mode the radio is. The PTY Search mode may be entered automatically by the radio when the user selects PTY codes. Note: Added parameters Continuous Automatic Up and Continuous Automatic Down for SDARS functionality. If RadioSeekMode2.St is sent then the radio needs to send RadioSeekMode.St. | int *Mode:* 0x01: Seek Off 0x02: Automatic Up 0x03: Automatic Down 0x04: Manual Single Step Up 0x05: Manual Single Step Down 0x06: Continuous Manual Up 0x07: Continuous Manual Down 0x08: Scan Up 0x09: Scan Down 0x0A: PTY Seek Up 0x0B: PTY Seek Down 0x0C: Autostore 0x0D: TP Seek 0x0E: PISeek 0x0F: Continuous Automatic Up 0x10: Continuous Automatic Down |

*1.3.1.3   MD-REQ-420537/A-AM Interference - Variant 2 (Phoenix)*

| Method | | Parameters |
|---|---|---|
| **AudioSource.St()** | Message:  Status<br><br>The AudioSource.St message defines the current active audio source(s) for the infotainment system in cabin mode or zone 1 in zone mode.<br><br>Cabin mode is when the vehicle audio for one media source is coming on all speakers (standard set-up).<br><br>Zone mode is when the vehicle can be divided into 6 audio zones for the up to 6 seats. | SourceType:<br>0x0 Inactive / Audio OFF<br>0x1 Aux_Media<br>0x2 AM<br>0x3 FM<br>0x4 SDARS SAT<br>0x5 SDARS IP<br>0x6 DAB<br>0x7 Phone<br>0x8 Call Ring<br>0x9 Radio Announcement<br>0xA VR<br>0xB Priority Assist<br>0xC – 0x1F Reserved<br><br>SourceTypeStatus:<br>0x0 Inactive<br>0x1 Deallocated<br>0x2 Stacked<br>0x3 Granted |
| **AudioSourceZone2.St()**<br>**AudioSourceZone3.St()**<br>**AudioSourceZone4.St()**<br>**AudioSourceZone5.St()**<br>**AudioSourceZone6.St()** | Message: Status<br><br>The AudioSourceZone(2 – 6).St messages defines the current active audio source(s) for the infotainment system in the applicable zone (2 – 6).<br><br>Example: AudioSourceZone2.St is the audio management message for zone 2.  SourceType2 and SourceTypeStatus2 are the signals for zone 2 | SourceType2:<br>SourceType3:<br>SourceType4:<br>SourceType5:<br>SourceType6:<br>0x0 Inactive / Audio OFF<br>0x1 Aux_Media<br>0x2 AM<br>0x3 FM<br>0x4 SDARS SAT<br>0x5 SDARS IP<br>0x6 DAB<br>0x7 Phone<br>0x8 Call Ring<br>0x9 Radio Announcement<br>0xA VR<br>0xB Priority Assist<br>0xC – 0x1F Reserved<br><br>SourceTypeStatus2:<br>SourceTypeStatus3:<br>SourceTypeStatus4:<br>SourceTypeStatus5:<br>SourceTypeStatus6:<br>0x0 Inactive<br>0x1 Deallocated<br>0x2 Stacked |

| **Method** | | **Parameters** |
| --- | --- | --- |
| | | 0x3 Granted |
| **«CAN» CurrentFreq.St()** | Message Type: Status<br><br>This status message delivers the frequency of the currently tuned station. Formulas to apply:<br>AM - Frequency = 153 + Offset kHz. Offset range = 0..1557<br>FM - Frequency = 76 + Offset\*0.05 MHz. Offset range = 0..640 | int *Number :*<br>Offset from lowest possible. Depending on<br>the currently tuned band, the offset will be in KHz or<br>MHz.<br>Size: 11 bits |
| **«CAN» RadioSeekMode2.St()** | Message Type: Status<br><br>This status message tells the clients in which seek mode the radio is. The PTY Search mode may be entered automatically by the radio when the user selects PTY codes.<br><br>Note: Added parameters Continuous Automatic Up and Continuous Automatic Down for SDARS functionality.<br>  If RadioSeekMode2.St is sent then the radio needs to send RadioSeekMode.St. | int *Mode:*<br>0x01: Seek Off<br>0x02: Automatic Up<br>0x03: Automatic Down<br>0x04: Manual Single Step Up<br>0x05: Manual Single Step Down<br>0x06: Continuous Manual Up<br>0x07: Continuous Manual Down<br>0x08: Scan Up<br>0x09: Scan Down<br>0x0A: PTY Seek Up<br>0x0B: PTY Seek Down<br>0x0C: Autostore<br>0x0D: TP Seek<br>0x0E: PISeek<br>0x0F: Continuous Automatic Up<br>0x10: Continuous Automatic Down |

### 1.3.1.4  MD-REQ-162529/C-PEPS interface

| Method | Notes | Parameters |
|---|---|---|
| WrlssAcsyChrgInhbt_B_Rq | Request signal sent by the BCM to Inhibit Wireless Charging during BCM interior Key search event | 0x0 No<br>0x1 Yes |
| | | |

# 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<br>Phone is not on the Wireless Charging pad<br>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<br>2.   Charger sends a Ping to identify object<br>3.   If the object is a compatible phone then communication protocol is established<br>4.   Charging session starts, phone may indicate that there is a charge in progress<br>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<br><br>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.<br><br>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.<br><br>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   <u>*WCG-SR-REQ-163172/C-Wireless Charging - Charging In Progress*</u>

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/F-Phone finishes charging on charging pad*

| Actors | Wireless Accessory Charging Module, Display HMI, Vehicle Occupant |
|---|---|
| Pre-conditions | Infotainment system is powered ON<br>Phone is charging on the Wireless Charging pad<br>Charge pad is capable of charging a phone<br>Charging Icon is present in HMI (if HMI supports) |
| Scenario Description | Phone indicates charge complete (to wireless charger) ~~finishes charging~~ |
| Post-conditions | Phone is present on charging pad and charged<br>Wireless charging pad is no longer charging the phone.<br>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.<br><br>Most phones do not reach charging complete state, they simply reduce rate of charge to a trickle charge to keep battery level at 100%. For test and verification purposes, this state is not easily verifiable with a phone, but a special test receiver can be used to send this message. |

### 2.2.2 Requirements

#### 2.2.2.1 *WCG-SR-REQ-163179/D-Wireless Charging - Charging Complete*

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

When a phone finishes charging and sends a charging complete message over wireless charging protocol to the Wireless Charging Server then the Wireless Charging Server shall set WirelessCharging.St = ChargingComplete.

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<br>There is no Phone on the Wireless Charging pad<br>Charge pad is capable of charging a phone<br>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/E-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<br>Phone is on the Wireless Charging pad<br>Charge pad is capable of charging a phone<br>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<br>Charger detects an object on the charging pad<br>Charger sends a ping to identify object<br>Charger starts power transfer with the phone<br>Charger detects metallic objects on it |
| Post-conditions | Charger ends charging session<br>Metal object warning is shown on the HMI (if HMI supports)<br>Charging Icon is not present on the HMI |
| Interfaces | G-HMI |
| Notes | Metal will only be detected if the object sufficiently degrades the wireless charging session, i.e. a very small piece of metal may not be enough to be detected.  The type of metal also plays a role – metals that are not affected by wireless charging are less likely to be detected and also are less likely to heat up. |

#### 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<br>Phone is charging on the Wireless Charging pad<br>Charge pad is capable of charging a phone<br>Charging Icon is present on the HMI (if HMI supports) |

| **Scenario Description** | Phone misaligned (ex. from vibration) |
|---|---|
| **Post-conditions** | Phone is no longer charging<br>Charging Icon is not present on the HMI<br>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<br>Phone is on the Wireless Charging pad<br>Charge pad is capable of charging a phone<br>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.<br>Charger finishes charging session.<br>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<br>Phone is charging on the Wireless Charging pad<br>Charge pad is capable of charging a phone<br>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<br>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<br>Phone is charging on the Wireless Charging pad<br>Charge pad is capable of charging a phone<br>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<br>Charger ends charging session<br>Charging Icon is not present on the HMI (if HMI supports)<br>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 |

### 2.3.1.7  WCG-UC-REQ-348155/A-Phone stops & restarts charging due to sliding across charging surface

| | |
|---|---|
| **Actors** | Wireless Accessory Charging Module, Display HMI, Vehicle Occupant |
| **Pre-conditions** | Infotainment system is powered ON<br>Phone is charging on the Wireless Charging pad<br>Charge pad is capable of charging a phone<br>Charging Icon is present on the HMI (if HMI supports) |
| **Scenario Description** | Phone slides across charging surface but remains within designated charge area |
| **Post-conditions** | Charging session ends temporarily and then resumes<br>No HMI indication that charging has stopped at all<br>Charging Icon is present on the HMI (if HMI supports) |
| **Interfaces** | G-HMI |
| **Notes** | See HMI specification and screen flows if HMI is supported for this use case<br><br>The same behavior applies if a phone is lifted and replaced quickly |

## 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/C-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. –There are two exceptions to this requirement:

1. If charging stops due to a PEPS event and the phone automatically resumes charging after the end of the PEPS event, the Wireless Charging Server shall remain WirelessCharging.St = Charging In Progress during the entire event.
2. If charging stops due to a phone sliding across the surface and the phone automatically resumes charging after sliding across the surface, the Wireless Charging Server shall remain WirelessCharging.St = Charging In Progress during the entire event.

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.

## 2.4 WCG-FUN-REQ-162482/A-AM Band Interference

### 2.4.1 Use Cases

#### 2.4.1.1 *WCG-UC-REQ-162486/D-AM Band Interference from AM frequency station*

| Actors | Wireless Accessory Charging Module |
| --- | --- |
| Pre-conditions | Infotainment system is powered ON<br><br>Phone is charging on the wireless charging pad<br><br>The user is NOT on AM frequency that would cause a frequency shift of the fundamental wireless charging frequency |
| Scenario Description | The user changes to AM frequency which could cause interference |
| Post-conditions | Charging pad shifts frequency to avoid interference to minimize AM noise while keeping the current power session active.<br><br>No HMI indication of the reduction of charging |
| Interfaces | |
| Notes | |

#### 2.4.1.2 *WCG-UC-REQ-164304/B-AM Band Interference Scan or Seek function active*

| Actors | Wireless Accessory Charging Module |
| --- | --- |
| Pre-conditions | Infotainment system is powered ON<br><br>Phone is charging on the wireless charging pad<br><br>The user is on the AM band |
| Scenario Description | Scan, seek or tune is initiated |
| Post-conditions | Charging pad reduces phone charging power to a value sufficient to eliminate AM noise and keep session active during the AM frequency change.<br><br>No HMI indication of the reduction of charging |
| Interfaces | |
| Notes | |

### 2.4.2 Requirements

#### 2.4.2.1 *WCG-SR-REQ-162836/D-Detecting AM Band as the Active Source and detecting the Active Frequency*

In order to detect AM band as the active source the Wireless Charging module shall monitor the ResourceUpdate_St and the CurrentTUBand_St.

AM Band is the active source when ResourceUpdate_St indicates that AMFM radio is either the granted or stacked source and the CurrentTUBand_St is reporting either 0x4 AM or 0x5 AM AST is the active Band.

Entry Conditions (when AM/FM Granted or Stacked):
ResourceUpdate_St consists of the following parameters:
RequestedAudioSource = 0x0 AM/FM Radio
RequestorPriority = 0x7 Radio
ResourceRequestStatus = 0x4 Granted

OR

> ResourceUpdate_St consists of the following parameters:
> RequestedAudioSource = 0x0 AM/FM Radio
> RequestorPriority = 0x7 Radio
> ResourceRequestStatus = 0x3 Stacked
>> • <u>Note</u>: When AM/FM is Stacked the ResourceUpdate_St will alternate between Granted and Stacked sources.  Going to the Granted source (not AM/FM) in the ResourceUpdate.St does not mean the AM/FM stacked event is no longer valid.

<u>Exit Conditions (when AM/FM no longer Granted or Stacked)</u>:
> ResourceUpdate_St consists of the following parameters:
> RequestedAudioSource = 0x0 AM/FM Radio
> RequestorPriority = 0x7 Radio
> ResourceRequestStatus = 0x01 Deallocated

OR

> The entry conditions above (AM/FM Granted or Stacked) are both no longer true for more than 5 seconds (error handling if didn't get the Deallocated).

When AM/FM is stacked or granted and AM is the active band, the Wireless Charging module shall look at the CurrentFreq_St signal to determine the active frequency.

*2.4.2.2    <u>WCGv2-SR-REQ-420518/A-Detecting AM Band as the Active Source and detecting the Active Frequency - Variant 2 (Phoenix)</u>*

In order to detect AM band as the active source the Wireless Charging module shall monitor the AudioSource_St, AudioSourceZone(2 – 6).St messages (6 messages).

AM Band is the active source when AudioSource_St or AudioSourceZone(2-6).St indicates that AM is either the granted or stacked source.

<u>Entry Conditions (when AM/FM Granted or Stacked)</u>:
> AudioSource.St or AudioSourceZone(2 – 6).St consists of the following parameters:
> SourceType or SourceType(2 – 6) = AM
> SourceTypeStatus or SourceTypeStatus(2 – 6) = Granted

OR

> AudioSource.St or AudioSourceZone(2 – 6).St consists of the following parameters:
> SourceType or SourceType(2 – 6) = AM
> SourceTypeStatus or SourceTypeStatus(2 – 6) = Stacked
>> • <u>Note</u>: When AM is Stacked the AudioSource.St will alternate between Granted and Stacked sources (applies for AudioSourceZone(2 – 6).St messages also).  Going to the Granted source (not AM) in the AudioSource.St does not mean the AM stacked event is no longer valid (applies for AudioSourceZone(2 – 6).St messages also).

<u>Exit Conditions (when AM no longer Granted or Stacked)</u>:
> AudioSource.St or AudioSourceZone(2 – 6).St consists of the following parameters:
> SourceType or SourceType(2 – 6) = AM
> SourceTypeStatus or SourceTypeStatus(2 – 6) = Deallocated

OR

> The entry conditions above (AM Granted or Stacked) are both no longer true for more than 5 seconds (error handling if didn't get the Deallocated).

When AM is stacked or granted, the Wireless Charging module shall look at the CurrentFreq_St signal to determine the active frequency.

*2.4.2.3    WCG-SR-REQ-164323/A-AM Scan / Seek in progress*

The Wireless Charging module shall monitor the RadioSeekMode2_St signal while AM is the active source to determine when the AM frequency is in the process of changing.

The Wireless Charging module shall treat the following values as an indication that the frequency is not Scanning/Seeking/Tuning:

RadioSeekMode2_St = 0x0 Invalid
RadioSeekMode2_St = 0x1 Seek Off

The Wireless Charging module shall treat the following values as an indication that the frequency is Scanning/Seeking/Tuning:

RadioSeekMode2_St = 0x2 through 0x10


*2.4.2.4    WCG-FUR-REQ-164300/C-Reduce phone charging power due to AM frequency or a changing frequency*

When the Wireless charger detects the active AM frequency as a harmonic of the fundamental wireless power transfer frequency ~~of 110 kHz (i.e. 550,660,770,880, or 990 kHz)~~ it shall shift the fundamental frequency to mitigate interference within that frequency band. ~~(see Wireless Charger ECU Functional Spec for detailed requirement).~~    When the Wireless Charger detects an AM frequency Scan / Seek, the Wireless Charger shall reduce wireless transmitted power to a value sufficient to eliminate AM interference while keeping the charge session active.

## 2.5 WCG-FUN-REQ-163223/A-PEPS Charging Interruption

### 2.5.1 Use Cases

#### 2.5.1.1 *WCG-UC-REQ-162500/D-Phone stops charging on the charging pad when the antennas are looking for the PEPS key*

| Actors | Wireless Accessory Charging Module, Display HMI, Vehicle Occupant |
| --- | --- |
| **Pre-conditions** | Infotainment system is powered ON, and/or ignition status is in Accessory or Run, and/or Delayed Accessory is 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) |
| | PEPS key antennas are NOT looking for the PEPS key |
| **Scenario Description** | PEPS antennas search for PEPS key |
| **Post-conditions** | Charging pad enables PEPS interface avoidance strategy |
| | Charging Icon is present on the HMI (if HMI supports) |
| **Interfaces** | Vehicle Interface |
| **Notes** | |

### 2.5.2 Requirements

#### 2.5.2.1 <u>WCG-SR-REQ-207775/B-PEPS Charging Interruption</u>

The PEPS Avoidance strategy is a method to mitigate possible interference with wireless charging and the PEPS key identification.  The feature is event driven where the BCM provides both a hardwired and CAN signal to enable / disable the wireless charging based on when a PEPS query is to be performed / PEPS query is complete.  The hardwire and CAN signals are OR'd together so that if either one of them  is indicating a PEPS Avoidance event then the wireless charging is deactivated.

<u>Network activated PEPS Avoidance event:</u>
When "WrlssAcsyChrgInhbt_B_Rq = 0x1 Yes" the WACM module shall initiate the PEPS avoidance charging interruption strategy regardless of the status of the PEPS Avoidance hardwire state (ex hardwire might not indicate a PEPS Avoidance event under hardwire error conditions).  As long as  WrlssAcsyChrgInhbt_B_Rq = 0x1 Yes" the wireless charging will be deactivated.

<span style="color:red">The Wireless Charging Server shall keep WirelessCharging.St set as "Charging In Progress" when charging stops due to a PEPS event.  The wireless charger shall implement a timeout to return the signal value back to Charging Not In Progress in the event of an indefinitely long PEPS event.</span>

<span style="color:red">When the PEPS event has ended (WrlssAcsyChrgInhbt_B_Rq = 0x0 No" and hardwire is not active) the wireless Charging Server shall set WirelessCharging.St = "Charging In Progress" if charging automatically resumes.</span>

<span style="color:red">When the PEPS event has ended (WrlssAcsyChrgInhbt_B_Rq = 0x0 No" and hardwire is not active) the wireless Charging Server shall set WirelessCharging.St = "Charging Not In Progress" if charging does not automatically resume.</span>

~~While the PEPS avoidance strategy is active and wireless charging is not occurring the WACM module shall set "WirelessCharging.St = Charging Not In Progress".~~

<u>Exiting a PEPS Avoidance event:</u>

When "WrlssAcsyChrgInhbt_B_Rq = 0x0 No", and there is no hardwire input to the WACM module indicating there is a PEPS avoidance event then the Wireless Charging module shall end the PEPS avoidance actions.

# 3 Appendix: Reference Documents

| Reference # | Document Title |
|---|---|
| 1 | Netcom SOW and associated specifications |
| 2 | Diagnostics SOW and associated specifications |
| 3 | CAN dB |
| 4 | Start-Stop Power Supply spec or hardware spec with start-stop voltage supported |
| 5 | WACM Infotainment Diagnostic Specification |
| 6 | WACM Power Management SPSS |
| 7 | Infotainment CAN network SPSS |
| 8 | SYNC H28a HMI spec |
| 9 | CTR H28a HMI spec |
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