Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – MSS Zone Settings Management

APIM Phoenix Domain Controller Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.0

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Version Date: September 9, 2021

FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
September 9, 2021	1.0	Initial Release	

Table of Contents

1 Overview

MSS Zone Manager in an infotainment system architecture requires coordination amongst the "objects" which plays a key role in MSS function. Within this architecture the MSS Zone Manager tasks have been divided into several objects

1. MSSApplicationServer
2. Prompt Generator
3. Beep Generator

Object Name	Description
MSSApplicationServer	The 'MSSApplicationServer' object acts as manager which is responsible to co-ordinate with other Zone manager objects and interface with 'Audio Resource Server' if the audio resources are needed. The 'MSSApplicationServer' object is also responsible for managing zone settings like seat Mute controls, 'Passenger Zonal Audio Request' Control & Volume Offset control. Based on the vehicle operation condition and audio mode schema, the 'MSSApplicationServer' object is responsible for managing the vehicle audio mode status.
Beep Generator	The 'Beep Generator' object is responsible for the beep function and will produce beep signal. 'Beep Generator' shall interfaces with MSSApplicationServer to start and stop beep generation.
Prompt Generator	The 'Prompt Generator' object is responsible for the prompt function and will produce prompt signal. 'Prompt Generator' shall interfaces with MSSApplicationServer to start and stop prompt generation.

1.1 Feature Assumptions

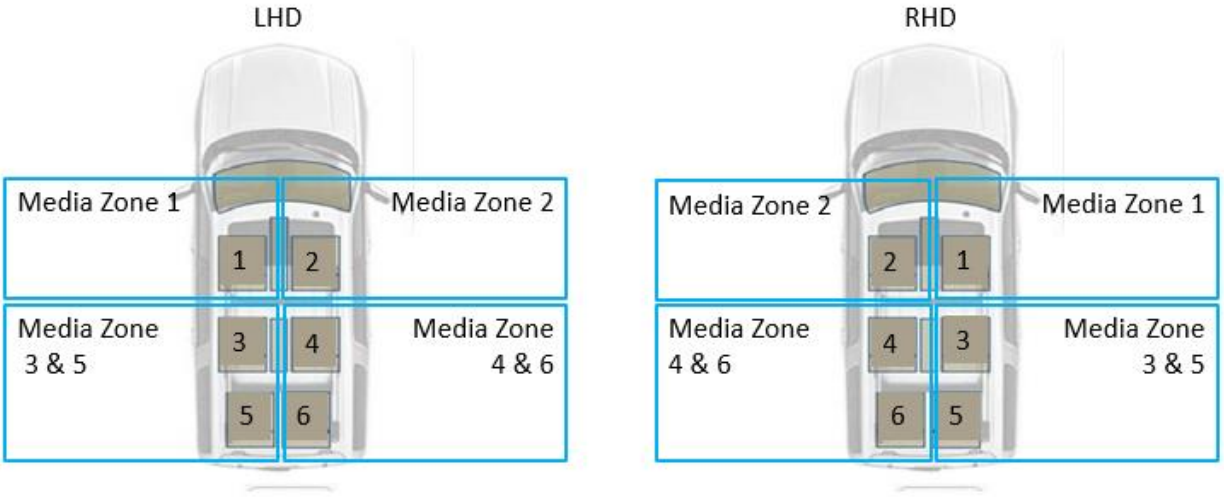
1. Cabin mode is defined when there are no individual sound zones for the Driver and other vehicle passengers. Generally, audio is played throughout the entire vehicle in cabin mode.
2. Zone mode is defined when there are individual sound zones for the Driver and other vehicle passengers. The audio is played through the individual sound zone speakers.
3. The table below shall be used to define the individual audio zones. When individual audio zones are like below the vehicle is considered in zone mode.

In a 2 Media zone system:

1. Seat 1 & 2 – shall share same media source.
2. Seat 3/5 & 4/6 – shall share same media source.

In a 4 Media zone system:

1. Seat 1 – Can be in independent (or) shared media source.
2. Seat 2 – Can be in independent (or) shared media source.
3. Seat 3/5 – Can be in independent (or) shared media source.
4. Seat 4/6 – Can be in independent (or) shared media source.



1.2 3rd Row Seat Assumptions

In an MSS vehicle with the infotainment system operating in individual zone audio mode then

1. The seat 3 and seat 5 shall share same audio source.
2. The seat 4 and seat 6 shall share same audio source.

All the applicable requirement (like Audio source allocation/deallocation, Mute/Unmute, Volume Up/Down, DND, etc.,) that is addressed for Seat 3 and Seat 4 is also applicable to seat 5 and Seat 6 respectively. Unless until the exceptional(s) is called out explicitly in the individual feature specification.

1.3 Terminology and Abbreviations

The following table lists terminologies that are used in this document along with a brief description.

Term	Description
MSS	My Seat Space
ICC	In Car Communication
CA	Captains Announcement
ISZ	Individual Sound Zone
DND	Do not Disturb
PAC	Phoenix Audio Controller
PDC	Phoenix Domain Controller
URC	Ultimate Remote Controller
LHD	Left Hand Drive
RHD	Right Hand Drive

2 Architectural Design

2.1 Deployment Table

The table below shows how the logical classes may be mapped to physical modules to support this specification.

At the time the specification was written the below table was the latest. If there are additional modules deployed to the class descriptions or the vehicle architecture changed since the spec was written and released, then the applicable implementation guide class description would cover those modules. If there is a conflict between the implementation guide and the table below the implementation guide takes precedent.

Logical Class	Physical Module (ECU)	Comments
MSS Zone Manager	APIM PDC	SW application hosted by PDC to support MSS feature
MSSApplicationServer	APIM PDC	MSS Zone Manager object
Beep Generator	APIM PDC	MSS Zone Manager object
Prompt Generator	APIM PDC	MSS Zone Manager object
Audio Resource Server	APIM PDC	Overall Audio manager
Volume Settings Server	APIM PDC	Volume master
Audio Source Client(s)	APIM PDC	Internal audio sources
URC Application Server	APIM PDC	SW application hosted by PDC to support URC feature
BT Phone Server	APIM PDC	Bluetooth connection Server for the Driver phone mapped to Seat1
Audio IO Controller	DSP AMP	Controls the audio outputted to the vehicle speakers
Passenger BT Phone Client	PAC	Client for the passenger phone(s) mapped and connected to Seat 2, Seat 3 & Seat 4
MSSOnboardClient	-	Client to handle the Infotainment HMI input/output
URC Client	-	Client to handle the URC HMI input/output

2.2 MSS-CLD-REQ-410679/A-MSSApplicationServer

The ‘MSSApplicationServer’ object is responsible to co-ordinate and interface between the Audio Source Client(s), Input Client(s) and ‘AudioResourceServer’. The ‘MSSApplicationServer’ is also responsible for controlling and updating the MSS Zone Manager objects when incoming service requests are received. The ‘MSSApplicationServer’ also transmits related status information to the Input client(s) (i.e. ‘MSSOnboardClient’, ‘URC Client’). The ‘MSSApplicationServer’ shall interface with ‘Passenger BT Phone Client’ to handle the passenger BT phone calling and BT Media streaming. It also requests the ‘Audio Resource Server’ if the audio resources are needed.

2.3 MSS-CLD-REQ-416064/A-Passenger BT Phone Client

The ‘Passenger BT Phone Client’ is responsible for establishing BT Classic connection and Pairing with the passenger phones.

2.4 VOLv2-CLD-REQ-411664/A-Volume Settings Server

The Volume Settings Server is responsible for the volume function and is the volume master. This includes controlling the volume level and outputting the volume status to the rest of the vehicle.

2.5 AUMGNTv2-CLD-REQ-410572/A-Audio IO Controller

The Audio IO Controller is the object that controls the audio outputted to the vehicle speakers.

2.6 AUMGNTv2-CLD-REQ-410573/A-Source Client

The Source Client object is responsible for requesting audio sources and acting on the responses from the Audio Resource Server.

The Source Client object may or may not have an HMI output component

2.7 MSS-CLD-REQ-410680/A-URC Client

The ‘URC Client’ is the user interface from the passenger phone that controls MSS function. The ‘URC Client’ interfaces with ‘URC Application Server’ and the ‘URC Application Server’ passes the request to ‘MSSApplicationServer’ to control the MSS function.

2.8 MSS-CLD-REQ-420338/A-MSS Onboard Client

The ‘MSSOnboardClient’ is the user interface from the infotainment HMI that controls the MSS function. It interacts with ‘MSSApplicationServer’ if the audio resources are needed.

3 Functional Definition

3.1 MSS-FUN-REQ-410646/A-MSS Zone Settings - Operation

3.1.1 Requirements

3.1.1.1 MSS-SR-REQ-410640/A-System start-up for Vehicle Audio mode

The MSSApplicationServer shall set the 'VehicleAudioMode' signal to 'Cabin' every time the infotainment system is powered up (i.e. HMIAudioMode transitions from OFF to ON).

Note: Refer Audio management specification, for more details on usage of this signal and setting default vehicle audio mode.

3.1.1.2 MSS-SR-REQ-412290/A-'Passenger Zonal Audio Request' switch functional definition

Based on the user selection received from 'MSSOnboardClient', the MSSApplicationServer shall support to change the 'Passenger Zonal Audio Request ' setting to Enable/disable. MSSApplicationServer shall also support to update the current 'Passenger Zonal Audio Request ' to 'MSSOnboardClient' and 'URC Client'.

When the 'Passenger Zonal Audio Request ' is 'Enabled',

1. The MSSApplicationServer **shall** allow to switch the VehicleAudioMode between 'Zone' and 'Cabin' mode. Based upon the media share request and user preference received either from 'MSS Onboard Client' or 'URC Client', the MSSApplicationServer shall support to switch the vehicle audio between 'Cabin' and 'Zone'. Details of media sharing is detailed in this specification and in 'MSS Zone Audio management SPSS'.
2. The MSSApplicationServer **shall pass** the control command received from 'URC Client' to control the MSS features like (DND/Mute/Volume off Set) details of it is covered in this specification and in URC SPSS.

When the 'Passenger Zonal Audio Request ' is 'Disabled',

1. The MSSApplicationServer shall switch to Cabin mode (if it was in Zone mode earlier) and shall remain in cabin as long as the settings is 'Disabled'.
2. The MSSApplicationServer shall allow the passenger from 'URC Client' to share the Zx_BTMedia to entire Cabin. However, sharing passenger media to individual zone(s) shall be restricted.
3. When the Zone1 user (i.e. Driver) tries to share a different media source with other zone while the vehicle audio mode is already in Cabin, then the MSSApplicationServer shall change the state of 'Passenger Zonal Audio Request = Enabled' and the vehicle audio mode shall transition from Cabin to Zone mode.
4. As an error handling, the MSSApplicationServer **shall restrict to pass** the control commands from 'URC Client' to change the settings like (DND/Mute/Volume off Set) when in Cabin mode (detailed in this specification).

3.1.1.3 MSS-SR-REQ-412291/A- 'Passenger Zonal Audio Request ' settings at startup

The MSSApplicationServer shall support to persist last known 'Passenger Zonal Audio Request ' setting over ignition cycle. The default state of settings shall be 'Passenger Zonal Audio Request = Enabled'.

3.1.1.4 MSS-SR-REQ-414502/A-Impact on MSS Feature - For MyKey User

When MyKey is detected, the MSSApplicationServer shall set the MSS feature status as follows and shall remain unchanged as long as the MYKey is active.

The MSSApplicationServer shall

1. Set the 'VehicleAudioMode=Cabin'.
2. Set the 'Passenger Zonal Audio Request=Disabled'

Note: Refer MyKey SPSS for details on MSS restriction for Mykey User '**MK-FUR-REQ-412818'.**

3.1.1.5 MSS-SR-REQ-433165/A-Support to update 'Passenger Zonal Audio Request ' status

MSSApplicationServer shall support to update the current 'Passenger Zonal Audio Request ' status (i.e. Enabled/Disabled) to 'MSSOnboardClient' and 'URC Client'.

3.1.1.6 MSS-SR-REQ-429737/A-Summary of audio mode transition through Passenger Zonal Audio Request

Cabin to Zone mode Transition

Scenarios	Pre-Condition: 'VehicleAudioMode = Cabin'	Event:	Post Condition:	Comments
Case 1	'Passenger Zonal Audio Request = Enabled'	MSSApplicationServer receives media share request from 'MSS OnBoardClient' (i.e. Driver).	'Passenger Zonal Audio Request = Enabled' and 'VehicleAudioMode' transitions to Zone mode.	Driver sharing different PDC media source with the zone triggers zone transitions.
Case 2	'Passenger Zonal Audio Request = Enabled'	MSSApplicationServer receives media share request from 'URC Client' (i.e. passenger phones).	'Passenger Zonal Audio Request = Enabled' and 'VehicleAudioMode' transitions to Zone mode.	Passenger sharing phone media source triggers zone transitions.
Case 3	'Passenger Zonal Audio Request = Disabled'	MSSApplicationServer receives media share request from 'MSS OnBoardClient' (i.e. Driver).	'Passenger Zonal Audio Request = Enabled' and 'VehicleAudioMode' transitions to Zone mode.	Driver sharing different PDC media source with the zone triggers zone transitions.
Case 4	'Passenger Zonal Audio Request = Disabled'	MSSApplicationServer receives media share request from 'URC Client' (i.e. passenger phones).	Transitions not allowed (request rejected by 'MSSApplicationServer')	Passenger sharing phone media source with the zone is not allowed.

Zone to Cabin mode Transition

Scenarios	Pre-Condition: 'VehicleAudioMode = Zone'	Event:	Post Condition:	Comments
Case 1	'Passenger Zonal Audio Request = Enabled' Vehicle audio mode is in zone mode.	MSSApplicationServer receives media share request from 'MSS OnboardClient' (i.e. Driver) to play the media in entire Cabin.	'Passenger Zonal Audio Request = Enabled' and 'VehicleAudioMode' transitions to Cabin mode.	Driver shares new PDC media source to entire cabin is allowed.
Case 2	1. 'Passenger Zonal Audio Request = Enabled'. 2. Vehicle audio mode is in zone mode. 3. Zone 1&2 – listening to PDC media source. Zone 3&4 – listening to Passenger phone media.	MSSApplicationServer receives media share request from 'URC Client' (i.e. passenger phones) to play phone media in entire Cabin. (ex. Z3_BTMedia to Cabin)	'Passenger Zonal Audio Request = Enabled' and 'VehicleAudioMode' transitions to Cabin mode.	Passenger sharing phone media source to entire cabin is allowed.
Case 3	1. 'Passenger Zonal Audio Request = Enabled'. 2. Vehicle audio mode is in zone mode.	Vehicle Ignition is cycled.	'Passenger Zonal Audio Request = Enabled'	When the vehicle ignition is cycled, the vehicle audio mode defaults to Cabin mode.

	3. Zone 1&2 – listening to PDC media source. Zone 3&4 – listening to Passenger phone media.			
Case 4	1. 'Passenger Zonal Audio Request = Enabled'. 2. Vehicle audio mode is in zone mode. 3. Zone 1&2 – listening to PDC media source. Zone 3&4 – listening to Passenger phone media.	'Passenger Zonal Audio Request =Disabled'.	'VehicleAudioMode' transitions to Cabin mode.	Zone mode transition is not allowed for passenger media share.

3.1.2 Use Cases

3.1.2.1 MSS-UC-REQ-411597/A-Passenger Zonal Audio Request setting retained across ignition cycle.

Actors	Vehicle Occupant
Pre-conditions	1. 'Passenger Zonal Audio Request = Disabled'. 2. Vehicle Ignition is OFF
Scenario Description	1. Vehicle Ignition is turned ON and the Infotainment System is ON.
Post-conditions	1. 'Passenger Zonal Audio Request' shall remain disabled, passenger would not be able to request for Media share with zone (i.e. transitioning from Cabin to zone is not allowed). 2. All the passengers in the vehicle shall listen to same audio source selected by the Driver (or) shared by the Passenger to entire Cabin.
List of Exception Use Cases	
Notes	1. Accessing MSS features may be limited or restricted through Phone. Refer URC SPSS for details.
Interfaces	MSSApplicationServer, AudioResourceServer, MSSOnboardClient, Phone URC App.

3.1.2.2 MSS-UC-REQ-411599/A-Driver Streams BT Media from the connected phone and when the 'Passenger Zonal Audio Request = Disabled'

Actors	Vehicle Occupant
Pre-conditions	1. Infotainment System is Powered ON. 2. 'Passenger Zonal Audio Request = Enabled' by the vehicle user from the HMI. 3. Phone paired and connected with the Infotainment system. Phone is mapped either to Driver Seat.
Scenario Description	1. Driver streams BT media from the connected Phone. 2. 'Passenger Zonal Audio Request = Disabled' by the vehicle user from the HMI.
Post-conditions	1. Vehicle audio mode shall remain in Full Cabin mode.

	2. All the passengers in the vehicle will be able to listen to the BT Media streamed by the Driver.
List of Exception Use Cases	
Notes	
Interfaces	MSSApplicationServer, AudioResourceServer, Audio IO Controller, G-HMI, Phone URC App.

3.1.2.3 MSS-UC-REQ-411600/A-Passenger gets Phone Call and when the 'Passenger Zonal Audio Request = Disabled'

Actors	Vehicle Occupant
Pre-conditions	1. Infotainment System is Powered ON. 2. 'Passenger Zonal Audio Request = Disabled' by the vehicle user from the HMI. 3. Passenger has paired and connected their phone with the Infotainment system. 4. Paired Phone is mapped to any of the passenger seat (i.e. Seat 2/3/4).
Scenario Description	1. Passenger receives an incoming phone call and the incoming Phone call is accepted.
Post-conditions	1. Vehicle audio mode shall remain in Full Cabin mode. 2. All the passengers in the vehicle shall be able to listen the same audio source selected by the Driver and the audio shall sound through Full cabin speakers. 3. The passenger shall be able to accept and speak to the phone call privately (i.e. Not Hands Free)
List of Exception Use Cases	
Notes	1. The above use case is also applicable for Outgoing calls and Conference phone calls made through the phones mapped to zones. 2. Vehicle passenger(s) may be able to pair and connect their phones with the Infotainment system.
Interfaces	MSSApplicationServer, AudioResourceServer, Audio IO Controller, G-HMI, Phone URC App.

3.1.2.4 MSS-UC-REQ-411601/A-Passenger streams BT Media and when the 'Passenger Zonal Audio Request = Disabled'

Actors	Vehicle Occupant
Pre-conditions	1. Infotainment System is Powered ON. 2. 'Passenger Zonal Audio Request = Disabled' by the vehicle user from the HMI. 3. Passenger has paired and connected their phone with the Infotainment system. 4. Paired Phone is mapped to any of the passenger seat (i.e. Seat 2/3/4).
Scenario Description	1. Passenger shares BT Media from the connected phone to entire Cabin.
Post-conditions	1. Vehicle audio mode shall remain in Full Cabin mode.

	2. The BT Media streamed by the passenger(s) shall play through the full Cabin speakers.
List of Exception Use Cases	
Notes	1. Passenger sharing BT Media to individual zone(s) shall be restricted when 'Passenger Zonal Audio Request = Disabled'.
Interfaces	MSSApplicationServer, AudioResourceServer, Audio IO Controller, G-HMI, Phone URC App.

3.1.2.5 MSS-UC-REQ-411605/A-While the audio mode is in Zone mode and when the 'Passenger Zonal Audio Request = Disabled'

Actors	Vehicle Occupant
Pre-conditions	1. Infotainment System is Powered ON. 2. 'Passenger Zonal Audio Request = Enabled' by the vehicle user from the HMI. 3. 1 Phone is paired and mapped to the zone1 (i.e. Driver phone). Minimum of one phone is connected and mapped to the passenger seat (i.e. Seat 2/3/4). 4. Vehicle audio mode is in Zone mode. 5. The passengers in the vehicle is listening to different audio source and the audio is played through zone speakers. (ex.Zone1=FM, Zone2=FM, Zone3/4=PAC_BT Media3)
Scenario Description	1. 'Passenger Zonal Audio Request = Disabled' by the vehicle user from the HMI.
Post-conditions	1. Vehicle audio mode shall switch to Full cabin mode. 2. All the passengers in the vehicle shall listen to same audio source that the Driver is actively listening to. (i.e. Full cabin will be playing – FM source). 3. The audio shall play through full cabin speakers. 4. The Audio which was played earlier in the individual zone mode(s) may be paused or released from Infotainment system to the Phones.
List of Exception Use Cases	
Notes	1. Vehicle passenger(s) would be still able to pair and connect their phones with the Infotainment system. Accessing MSS features may be limited or restricted through Phone.
Interfaces	MSSApplicationServer, AudioResourceServer, Audio IO Controller, G-HMI, Phone URC App.

3.1.2.6 MSS-UC-REQ-411606/A-While the audio mode is in Full Cabin mode and when the 'Passenger Zonal Audio Request = Disabled'

Actors	Vehicle Occupant
Pre-conditions	1. Infotainment System is Powered ON. 2. 'Passenger Zonal Audio Request = Enabled' by the vehicle user from the HMI.

	3. Vehicle audio mode is in Full cabin mode. 4. All the passengers in the vehicle is listening to same audio source that the Driver is actively listening to. (i.e. Full cabin will be playing – FM source). 5. The audio shall be played through full cabin speakers.
Scenario Description	1. 'Passenger Zonal Audio Request = Disabled' by the vehicle user from the HMI.
Post-conditions	1. Vehicle audio mode shall remain in Full cabin mode. 2. All the passengers in the vehicle shall continue listening to the same audio source sounded through full cabin speakers.
List of Exception Use Cases	
Notes	
Interfaces	MSSApplicationServer, AudioResourceServer, Audio IO Controller, G-HMI, Phone URC App.

3.1.2.7 MSS-UC-REQ-412209/A-Vehicle audio mode resumes in Full cabin mode when MyKey is detected

Actors	Vehicle Occupant
Pre-conditions	1. 'Passenger Zonal Audio Request = Enabled' earlier by the vehicle user. 2. Vehicle ignition is OFF.
Scenario Description	1. Vehicle Ignition is turned ON and the Infotainment System is Powered ON. 2. MyKey is detected by the Infotainment system.
Post-conditions	3. 'Passenger Zonal Audio Request = Disabled' (i.e. MSS feature) shall be disabled for the vehicle user with MyKey. (i.e. Audio mode shall remain in Full-Cabin) 4. Vehicle audio mode shall resume in Full cabin mode.
List of Exception Use Cases	
Notes	5. Vehicle passenger(s) may be able to pair and connect their phones with the Infotainment system. Accessing MSS features may be limited or restricted through Phone. Refer URC SPSS for more details on the impact of MyKey for passenger phones.
Interfaces	6. MyKeyServer, MSSApplicationServer

3.1.3 White Box View

3.1.3.1 Sequence Diagrams

3.1.3.1.1 MSS-SD-REQ-412372/A-'Passenger Zonal Audio Request ' is Disabled when vehicle audio mode is in Zone mode

Pre-condition

1. Vehicle Audio is in Zone Mode.
2. Vehicle Front Media Zone (i.e. Zon1 & Zone2) is listening to FM Tuner.
3. Vehicle Rear Media Zone (i.e. Zone 3 to 4) is listening to USB Audio shared by the Driver with the rear audio zone passenger(s).

Scenario

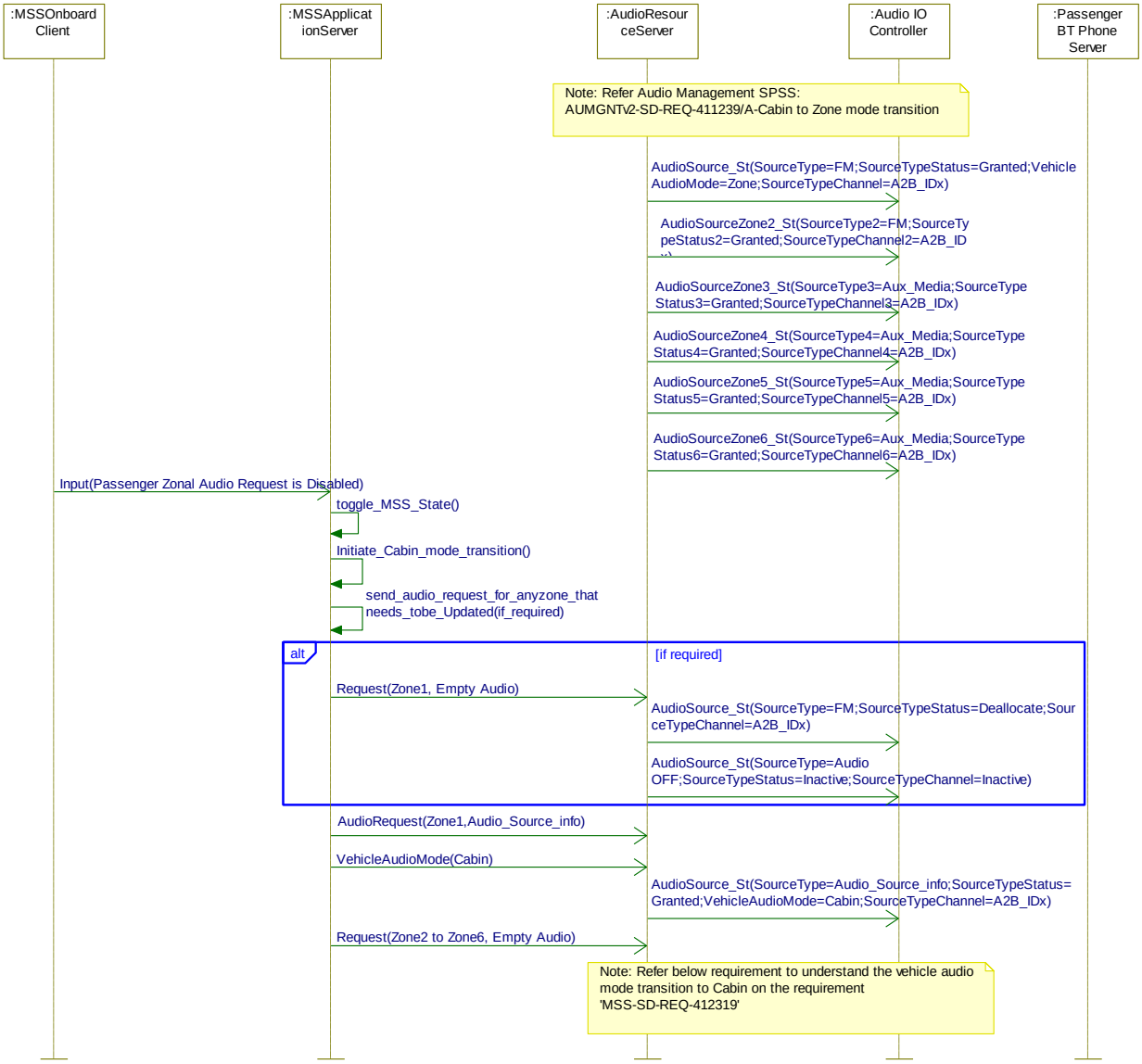
1. Vehicle user disables 'Passenger Zonal Audio Request '.

Post-condition

1. Vehicle audio mode shall switch to Cabin mode.
2. The audio source for all the vehicle passengers shall switch to Driver audio source (i.e. FM tuner).

Note: When there is any conflict between the Audio Resource Server and Audio IO Controller interface then the Audio Management spec would take priority.

Sequence Diagram



3.2 MSS-FUN-REQ-415951/A-MSS zone Mute/Unmute

3.2.1 Requirements

3.2.1.1 MSS-SR-REQ-430518/A-Passenger Seat Mute state at Startup

On every ignition cycle the MSSApplicationServer shall set the ‘Mute state’ for each of passenger seat to ‘Disabled’.

Seat(s)	Mute State
Seat 1	Disabled
Seat 2	Disabled
Seat 3	Disabled
Seat 4	Disabled
Seat 5	Disabled
Seat 6	Disabled

3.2.1.2 MSS-SR-REQ-430519/A-Allowed Clients to change Zone mute status

When the vehicle audio mode is in Cabin mode, the MSSApplicationServer shall not pass the 'Mute state' change intent received from 'MSSOnBoardClient' and/or 'URC Client' to mute individual seats.

When the vehicle audio mode is in zone mode, the MSSApplicationServer shall support to pass the 'Mute state' change intent received from 'MSSOnBoardClient' and/or with 'URC Client' to mute individual seats.

1. The MSSApplicationServer shall allow the Zone1 user via 'MSSOnBoardClient' to change the 'Mute state' either for the
   a. Driver Seat.
   b. Any of the Passenger Seat(s) (Seat 2-6).
   c. Mute all (Seat 1 -6).

2. When the MSSApplicationServer receives the intent to change the 'Mute State' from passenger phone, then MSSApplicationServer shall allow to pass the request to change the mute state only for the seat that is mapped to that Passenger. On the same ignition cycle when the passenger phone that is connected already gets disconnected then the 'Mute state' for the seat shall be set to default.

MSSApplicationServer shall keep track of the 'Mute state' for each of the passenger seat(s) and shall update both 'MSSOnboardClient' and 'URC Client' with current 'Mute state' for each of the seat(s).

Note: Refer 'URC SPSS' for the details on passenger phone Connection and Disconnection.(FUN-REQ-415918 & FUN-REQ-415923)

3.2.1.3 MSS-SR-REQ-415953/A-Seat Mute/Un-mute activation

When the MSSApplicationServer intends to mute the appropriate seat, then the MSSApplicationServer shall pass the request to Volume Settings Server to set the volume level to "No Volume" (i.e. Volume Step 0). As fail safe, when any of the seat is in phone Call, then the 'MSSApplicationServer' shall not support to pass the mute request from the 'MSS Onboard Client' to volume settings Server.

When the MSSApplicationServer intends to un-mute the appropriate seat, then the MSSApplicationServer shall interface with Volume Settings Server to unmute.

Note1: Refer Volume SPSS for the details on Mute and Unmute Ramps 'VOLv3-FUR-REQ-412277-Audio Attenuation_Mute / Unmute Ramps - variant 3'
Note2: Refer Volume SPSS for the details on default volume level for a zonal audio unmute 'VOL-FUR-REQ-412239-Zone Mode Volume rules'.

3.2.1.4 MSS-SR-REQ-415954/A-Mute state Overrides

When the audio mode is switched from Zone to Cabin, the Mute state for all the seats shall be in default state (i.e. Disabled).

3.2.1.5 MSS-SR-REQ-425399/A-Mute/Unmute activation summary

When the vehicle audio mode is in Zone mode (regardless of 2 media or 4 Media zone), the MSSApplicationServer shall interface with Volume Settings Server to pass the Mute intent based on the below criteria

Pre-Condition: Vehicle audio mode is in Zone mode

Scenario	Event	Post condition
Case 1	Seat 1 Mute/Unmute is enabled	Affects Seat 1 only.
Case 2	Seat 2 Mute/Unmute is enabled	Affects Seat 2 only.
Case 3	Seat 3 Mute/Unmute is enabled	Affects both Seat 3 and 5.
Case 4	Seat 4 Mute/Unmute is enabled	Affects both Seat 4 and 6.
Case 5	Seat 5 Mute/Unmute is enabled	Affects Seat 5 only.
Case 6	Seat 6 Mute/Unmute is enabled	Affects Seat 6 only.

3.2.2 Use Cases

3.2.2.1 MSS-UC-REQ-415993/A-Seat Mute is released when Vehicle switched from Zone mode to Full Cabin to Zone Mode

Actors	Vehicle Occupant
Pre-conditions	1. Infotainment System is Powered ON. 2. MSS vehicle audio mode is in Zone mode. 3. All the seat in the vehicle is in unmute state.
Scenario Description	1. Vehicle passenger activates Mute for the seat 3.
Post-conditions	1. Zone 3 (seat 3/5) shall remain in Mute state and the currently played media audio shall be muted. 2. All the other passengers in their seat shall be able to listen to media audio played in that zone.
List of Exception Use Cases	
Notes	3. This same use case is applicable to any of the Seat (i.e. seat 1 to 6).which is Muted and when the audio mode is transitioned.
Interfaces	MSSApplicationServer, Volume Settings Server, Audio IO Controller, G-HMI, Phone URC App.

3.2.2.2 MSS-UC-REQ-416112/A-Zone volume level is restored to global volume level when the Mute is released

Actors	Vehicle Occupant
Pre-conditions	1. Infotainment System is Powered ON. 2. MSS vehicle audio mode is in Zone mode. Seat 4 is in Mute state. 3. All the other seat in the vehicle is in unmute state and listening to USB audio source.
Scenario Description	1. Zone4 Mute is released by the Driver.
Post-conditions	1. Zone 4 (seat 4/6) mute state shall be released. 2. When the Mute is released the Media volume would go to whatever the global volume is and shall go back to previous stored offset volume (unless driver reset it)
List of Exception Use Cases	
Notes	1. This same use case is applicable to zone 3 (i.e. Seat 3 &5) when the mute is released Zone 3 will go back to global volume level.
Interfaces	MSSApplicationServer, Volume Settings Server, G-HMI

3.2.3 White Box View

3.2.3.1 Sequence Diagrams

3.2.3.1.1 MSS-SD-REQ-416002/A-Mute request in Zone Mode

Pre-condition

1. Infotainment system is turned ON.
2. Vehicle audio mode is in zone mode and the passengers in the respective zone mode is listening to different audio source.
3. No seat is mute state.

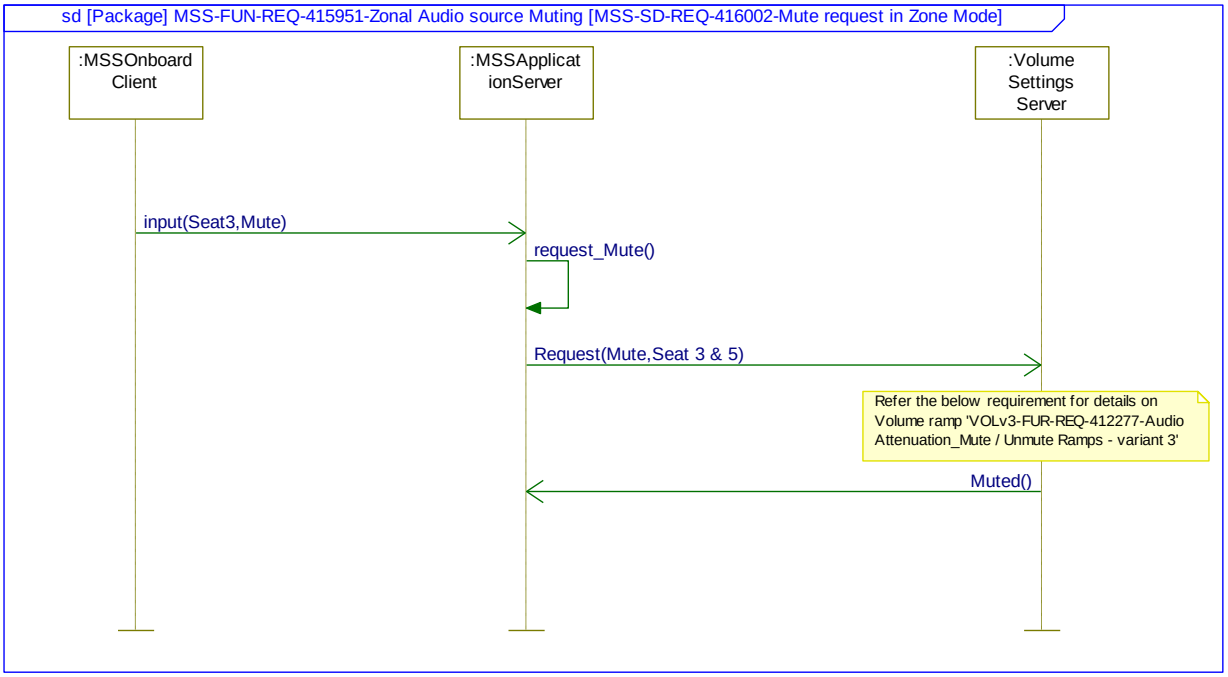
Scenario

1. Seat3 is set to Mute by the Driver.

Post-condition

1. Seat 3 and Seat 5 shall be set to Mute, the passenger(s) in that seat shall not be able to listen to the audio played in that zone.

Sequence Diagram



3.2.3.1.2 MSS-SD-REQ-416109/A-Un-mute request in Zone Mode

Pre-condition

1. Infotainment system is turned ON.
2. Vehicle audio mode is in zone mode and the passengers in the respective zone mode is listening to different audio source.
3. Seat 3 is in mute state.

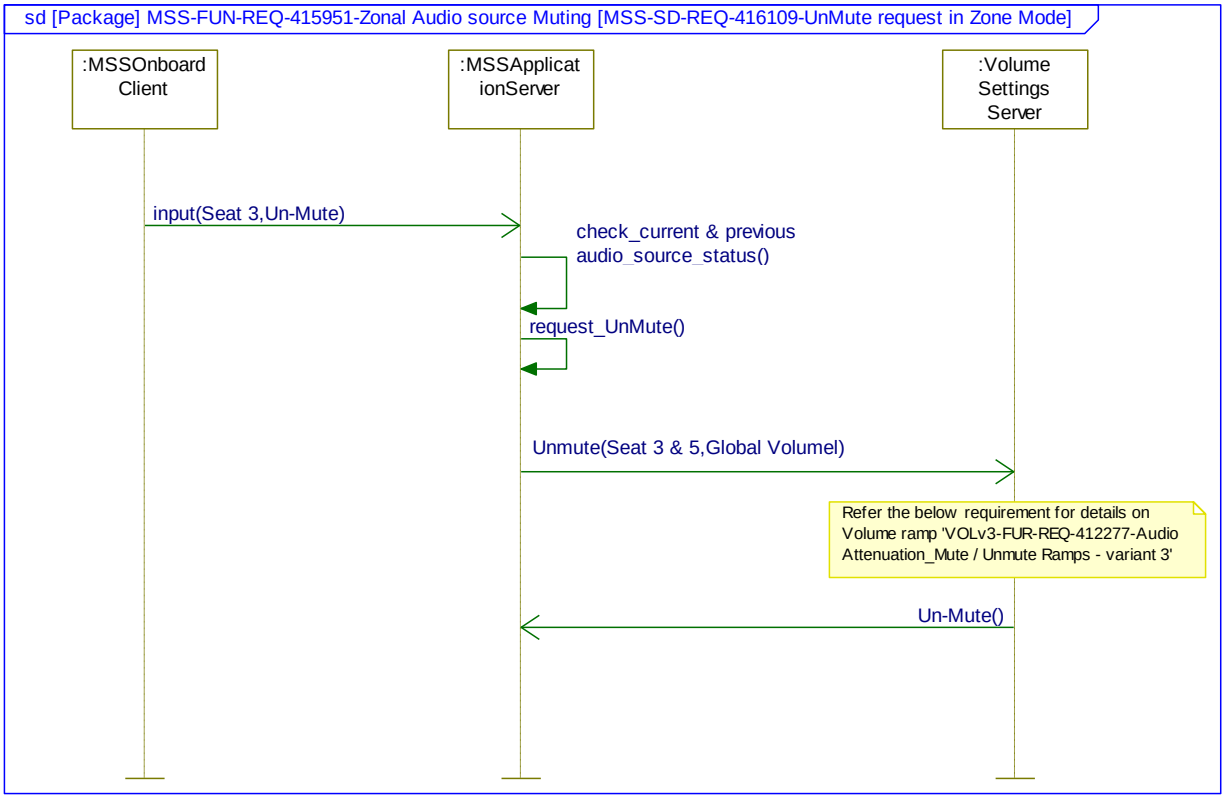
Scenario

1. When listening the corresponding zone Mode is playing the same audio source, Seat3 is requested to Un mute by Driver.

Post-condition

1. When the Seat 3 Mute is released by the Driver, then the passenger in both seat 3 and 5 shall be able to listen to the audio that is currently played in that Media zone.
2. When the mute is released the Media volume would go to whatever the global volume is and go back to the previous stored offset volume (unless driver reset it)

Sequence Diagram



3.3 MSS-FUN-REQ-430554/A-Volume Offset changes

3.3.1 Requirements

3.3.1.1 MSS-SR-REQ-432062/A-Allowed times for Volume Offset changes

The MSSApplicationServer shall allow to pass the volume offset change request from ‘URC Client’ or ‘MSS OnBoard Client’ to ‘Volume Settings Server’ only when the vehicle audio mode is in Zone mode and HMIAudioMode = ON.

a. The MSSApplicationServer shall support to pass the user request received from ‘MSSOnBoardClient’ to change the ‘Volume Offset’ only for the Driver Seat (Seat 1).

b. The MSSApplicationServer shall support to pass the user request received from ‘URC Client’ to change the ‘Volume Offset’ for the passenger seat(s) (i.e. seat 2 to 6).

3.3.1.2 MSS-SR-REQ-430523/A-Allowed Volume Offset changes from 'URC Client'

The allowed volume Offset changes that the MSSApplicationServer shall expect from ‘URC Client’ or ‘MSS Onboard Client’ is -3 to +3. (-3,-2,-1,0,+1,+2,+3 volume Offset). Only when the requested changes are within the range, MSSApplicationServer shall pass the request the ‘Volume Setting Server’.

3.3.1.3 MSS-SR-REQ-430524/A-Support to update zone volume offset level

MSSApplicationServer shall support to update the ‘MSSOnboardClient’ and ‘URC Client’ with the current volume offset volume levels for each of the seats as it is received from the ‘Volume Settings Server’.
(ex. Offset_Vol_Zone1, Offset_Vol_Zone2…. Offset_Vol_Zone6).

Note: Refer “VOL-SD-REQ-42505-Zone Mode only – Volume Offset adjustment from the Volume Settings Button Input Client to Volume Setting Server”.

3.3.1.4 MSS-SR-REQ-430522/A-Volume Offset control summary

Only when the vehicle audio mode is in Zone mode, based on the user preference received from 'URC Client' or 'MSS Onboard Client' the MSSApplicationServer shall support to pass the volume Offset change request to 'Volume Settings Server'.

Pre-Condition: Vehicle audio mode in Zone mode

Scenario	Event : Volume Offset change request received for	Post Condition: 'MSSApplicationServer' passes the request to 'Volume Settings Server'
Case 1	Seat 1	Changes the volume Offset for seat 1 only
Case 2	Seat 2	Changes the volume Offset for seat 2 only
Case 3	Seat 3	Changes the volume Offset for both seat 3 & 5.
Case 4	Seat 4	Changes the volume Offset for both seat 4 & 6.
Case 5	Seat 5	Changes the volume Offset for both seat 3 & 5.
Case 6	Seat 6	Changes the volume Offset for both seat 4 & 6.

3.4 MSS-FUN-REQ-425398/A-Do not Disturb activation

3.4.1 Requirements

3.4.1.1 MSS-SR-REQ-430530/A-DND settings at startup

On every ignition cycle the MSSApplicationServer shall set the DND state for each of the passenger zone(s) as 'Disabled'.

Seat	DND State
Seat 2	Disabled
Seat 3	Disabled
Seat 4	Disabled
Seat 5	Disabled
Seat 6	Disabled

3.4.1.2 MSS-SR-REQ-410791/A-Allowed Clients to change the DND status

The MSSApplicationServer shall allow to pass the 'DND State' change request from 'URC Client' only when the vehicle audio mode is in Zone mode and HMIAudioMode = ON.
The MSSApplicationServer shall change the 'DND State' only for the seat that is mapped to the Passenger phone. On the same ignition cycle when the passenger phone that was connected earlier gets disconnected then the 'DND state' for the seat shall be set to default (i.e. Disabled).

MSSApplicationServer shall interface with both 'MSSOnboardClient' and 'URC Client' to update the current DND status of passenger seat(s).

Note: Refer 'URC SPSS' for the details on passenger phone Connection and Disconnection.(FUN-REQ-415918 & FUN-REQ-415923).

3.4.1.3 MSS-SR-REQ-410792/A-Restriction to switch the audio mode to 2 media zone

When the vehicle audio mode is already in 4 media zone and at the same time when any of the passenger seat(s) DND state is enabled, then the MSSApplicationServer shall restrict the system to switch the audio mode to 2 media zone configuration. Any such request from the input clients shall be rejected.

However, MSSApplicationServer shall allow the system to switch the Cabin mode when it receives the request from the input Clients. When the audio mode is switched to Cabin, the DND state for all the passenger seat(s) shall be set to default state (i.e. Disabled).

3.4.1.4 MSS-SR-REQ-431317/A-DND activation Summary

In a MSS vehicle when the vehicle audio mode is in 4 media zone, the 'DND State' changes shall be reflected as

Pre-Condition: Vehicle audio mode is in Zone mode

Scenario	Event	Post condition
Case 1	Seat 2 DND State is Enabled/Disabled	Affects Seat 2 only.
Case 2	Seat 3 DND State is Enabled/Disabled	Affects both Seat 3 and 5.
Case 3	Seat 4 DND State is Enabled/Disabled	Affects both Seat 4 and 6.
Case 4	Seat 5 DND State is Enabled/Disabled	Affects both Seat 3 and 5.
Case 5	Seat 6 DND State is Enabled/Disabled	Affects both Seat 4 and 6.

3.4.1.5 MSS-SR-REQ-421043/A-DND activation impact in Zone mode - Summary

Scenario	**Pre-Condition:** Active Media source in 4 media audio zone system				**Event:** Passenger / Driver Source sharing	**Post-Condition:** Active Media source in 4 media audio zone system				**Comments**
	Zone1	**Zone2**	**Zone3**	**Zone4**		**Zone1**	**Zone2**	**Zone3**	**Zone4**	
case 1	X (PDC Media Source 1)	X (Zone1 media shared with Zone2)	Z3_BT Media	Z4_BT Media	DND enabled for Zone 2	X (PDC Media Source 1)	Audio OFF (Shared Media is deallocated)	X (Z3_BTMedia)	Z4_BT Media	When DND is enabled for a zone then all the shared media for that zone will be deallocated.
case 2	X (Zone 2 media shared with Zone1)	X (Z2_BT Media)	Z3_BT Media	X (Zone 3 media shared with Zone4)	DND enabled for Zone 2	X (Zone2 media shared with Zone1)	X (Z2_BTMedia)	X (Z3_BTMedia)	X (Zone 3 media shared with Zone4)	When DND is enabled for a zone that is being shared to a different zone then the shared to zone will not be affected.
Case 3	X (PDC Media Source 1)	X (Z2_BT Media)	X (PDC Media Source 2)	X (Zone 3 media shared with Zone4)	DND enabled for Zone 3	X (PDC Media Source 1)	X (Zone 1 media shared with Zone2)	Audio OFF (shared media is deallocated)	Audio OFF (Since Zone3 media is shared	Since Zone3 plays the shared media, from Driver zone3 is

									with zone4)	deallocated. Zone 4 which is already sharing Zone 3 media gets Audio OFF.
case 4	X (PDC Media Source 1)	X (Z2_BT Media	X (Z3_BTPhone)	Z4_BT Media	DND enabled for Zone 3	X (PDC Media Source 1)	X (Z2_BTMedia	X (Z3_BTPhone)	Z4_BT Media	Cannot activate DND when the corresponding seat is in phone call.
Case 5	X (PDC Media Source 1)	X (Zone1 media shared with Zone2) & DND Disabled	Z3_BT Media DND Disabled	X (Zone 4 media) DND Enabled	Zone 3 Phone tries to share BT media with Zone 4	X (PDC Media Source 1)	X (Zone 1 media shared with Zone2) & DND Disabled	Z3_BT Media DND Disabled	X (Zone 4 media) DND Enabled	Media sharing with zone 4 is not allowed since DND is enabled. Similarly, when Zone 2 or 3 Zone has DND enabled then sharing PDC media (or)Phone Media is not allowed.

4 Appendix: Reference Documents

Reference #	Document Title
1	Audio Management Phoenix SPSS
2	URC SPSS
3	In Car Communication SPSS
4	Captain Announcement SPSS
5	MSS Zone Audio Management SPSS
6	MSS Passenger Phone Call SPSS
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