

**Research & Vehicle Technology**

**“Infotainment Systems Product Development”**

**Feature – AVAS Pedestrian**

**Alert Sounder**

**Infotainment Subsystem Part Specific Specification (SPSS)**

Version 1.0

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**FORD CONFIDENTIALF**

**Revision History**

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# Overview

This SPSS defines system functional and system requirement for AVAS (Approaching Vehicle Audible System) intended for electric vehicles.

Due to quiet operation on Electric Vehicles (EV), Hybrid Electric Vehicles (HEV) and Plug-in Hybrid Electric Vehicle (PHEV) at low vehicle speeds, there exists a higher risk of vehicle/pedestrian’s collisions. The purpose of the AVAS is to have the function of a ‘vehicle sounder’ to create pleasing noise to alert pedestrians of the presence of vehicles when they are nearby. AVAS should provide alerting information at least equivalent to the cues provided by internal combustion engine (ICE).

## Feature Assumptions

The AVAS Sound feature integrates the AVAS Status Client (Cluster), AVAS Event Client (APIM) and AVAS Generator Server (APIM) functionality into one Phoenix Domain Controller module and they are no longer separate modules on the CAN bus. The AVAS Status Client, AVAS Event Client and AVAS Generator Server functionality are separate core processors at the time this spec was written so an internal interface must still be developed. From this spec the logical signals could be used to develop signals internal to APIM PDC (ex. logical Pedestrian\_Fault\_St message between Cluster and APIM).

Note:

If the sequences diagrams reference CAN that should be ignored as the sequence diagrams should be considered at the logical level (i.e. not network dependent).

# Architectural Design

## AVAS-CLD-REQ-429477/A-AVAS Event Server

The AVAS Event Server is responsible to notify the change in vehicle status.

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| **Acceptance Criteria** |
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## AVAS-CLD-REQ-428397/A-AVAS Event Client

The AVAS Event Client is the master that tells the AVAS system (i.e. Generator & Source Server) when and where to play the sound. It also receives the vehicle status from AVAS Server and controls the AVAS sound based on the status received. The AVAS Event Client is also required to interface ‘AVAS Status Client’ to indicate the status of AVAS System.

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| **Acceptance Criteria** |
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## AVAS-CLD-REQ-422338/A-AVAS Audio Generator Server

The AVAS Sound Generator Server is responsible for controlling the AVAS sound function is also responsible to generate sound signal for respective state.

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| **Acceptance Criteria** |
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## AVAS-CLD-REQ-422339/A-AVAS Audio Source Server

The AVAS Audio Source Server is responsible for producing sound heard in the external vehicle speaker(s).

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| **Acceptance Criteria** |
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## AVAS-CLD-REQ-435101/A-AVAS Status Client

The AVAS Status Client is responsible for notifying the vehicle user with the status of the AVAS system (i.e. Capable of producing AVAS audio or not).

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| **Acceptance Criteria** |
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## Physical Mapping of Classes

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)** |
| AVAS Event Server | BCM/PCM |
| AVAS Event Client | APIM PDC CCPU |
| AVAS Audio Generator Server | APIM PDC CCPU |
| AVAS Status Client | APIM PDC VMCU |
| AVAS Audio Source Server | PAC |

## Logical Signal Mapping

The CAN signals mentioned throughout this document shall refer to the CAN signal’s logical name. The logical names shall be mapped to their actual CAN signal names. Please use the table below to perform the mapping. The InfoCAN database file is the master file for the actual CAN signal names. Note: There may be cases where the actual CAN signal name is used in this documentation.

|  |  |
| --- | --- |
| **Logical Name** | **CAN Signal Name** |
| VehicleSpeed\_St | Veh\_V\_ActlEng |
| Vehicle\_Ignition\_St | Ignition\_Status |
| VehicleTorq\_St | PwPckTq\_D\_Stat |
| Reverse\_Gear\_St | GearRvrse\_D\_Actl |
| Gear\_Level\_Position\_St | GearLvrPos\_D\_Actl |
| ~~Pedestrian\_Fault\_St~~ | ~~PdstrnAlrt\_B\_Falt~~ |
| AVAS\_Speaker\_Health\_St |  |
| AVAS\_Directionality |  |

Table: Logical name/CAN signal mapping

## IIR-REQ-422340/A-AVAS Event Client\_Rx

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| **Acceptance Criteria** |
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### MD-REQ-367940/A-VehicleSpeed\_St

Message Type: Status

This signal is used to represent the vehicle speed.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** | |
| Type | - | - | Indicates vehicle speed. |
|  | <Range> | 0x0 – 0xFFFF | 0 to 655.35 kilometers / hour. Unit: kph Resolution:0.01 Offset:0 |

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| **Acceptance Criteria** |
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### MD-REQ-386520/C-Vehicle\_Ignition\_St

Message Type: Status

This signal is used to indicate the processed value for current Ignition state.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Vehicle\_Ignition\_St | - | - | Current Vehicle Ignition Status |
|  | Unknown | 0x0 |  |
|  | Off | 0x1 |  |
|  | Accessory | 0x2 |  |
|  | Run | 0x4 |  |
|  | Start | 0x8 |  |
|  | Invalid | 0xF |  |

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| **Acceptance Criteria** |
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### MD-REQ-367903/B-VehicleTorq\_St

Message Type: Status

Represents whether the vehicle is in Motive mode or not. If the vehicle moves or stops, this signal indicates whether the vehicle is in Motive mode or not.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** | |
| VehicleTorq\_St | - | - | Indicates if vehicle is in Motive mode or not. |
|  | Torque\_Disabled | 0x0 | PwPckOffTqNotAvailable |
|  | Torque\_Enabled | 0x1 | PwPckOnTqNotAvailable |
|  | Torque\_InProgress | 0x2 | PwPckStrtInPrgrssTqNotAvailable |
|  | Torque\_Available | 0x3 | PwPckOnTqAvailable |

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| **Acceptance Criteria** |
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### MD-REQ-425228/A-Reverse\_Gear\_St

Message Type: Status

This signal is used to indicate if the reversing gear is in use or not.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Reverse\_Gear\_St | - | - |  |
| Inactive\_not\_confirmed | 0x0 |
| Inactive\_confirmed | 0x1 |
| Active\_not\_confirmed | 0x2 |
| Active\_confirmed | 0x3 |
| Not used | 0x4 |
| Not used | 0x5 |
| Not used | 0x6 |
| Fault | 0x7 |

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| **Acceptance Criteria** |
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### MD-REQ-425230/A-Gear\_Level\_Position\_St

Message Type: Status

This signal is used to indicate the Gear Lever Position.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Gear\_Level\_Position\_St | - | - |  |
| Park | 0x0 | Park |
| Reverse | 0x1 | Reverse |
| Neutral | 0x2 | Neutral |
| Drive | 0x3 | Drive |
| Sport | 0x4 | Sport/Drive Sport |
| Low | 0x5 | Low |
| Gear1 | 0x6 | 1 |
| Gear2 | 0x7 | 2 |
| Gear3 | 0x8 | 3 |
| Gear4 | 0x9 | 4 |
| Gear5 | 0xA | 5 |
| Gear6 | 0xB | 6 |
| NotUsed | 0xC | undefined |
| NotUsed | 0xD | undefined |
| NotUsed | 0xE | unknown position |
| Fault | 0xF | fault |

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| **Acceptance Criteria** |
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### MD-REQ-422345/A-AVAS\_Speaker\_Health\_St

Message Type: Status

Method sent from the AVAS Audio Source Server to indicate AVAS external speaker status.

|  |  |  |  |
| --- | --- | --- | --- |
| **Logical Signal Name** | **Literals** | **Value** | **Description** |
| External\_Front | - | - | External Front speaker status. |
| Null/Inactive | 0x0 |
| Normal Operation | 0x1 |
| Faulted/No audio | 0x2 |
| Not Used | 0x3 |
|  |  |  |  |
| External\_Rear | Null/Inactive | 0x0 | External Rear speaker status. |
| Normal Operation | 0x1 |
| Faulted/No audio | 0x2 |
| Not Used | 0x3 |

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| **Acceptance Criteria** |
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## IIR-REQ-422343/A-AVAS Event Client\_Tx

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| **Acceptance Criteria** |
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### MD-REQ-422344/A-AVAS\_Directionality\_Rq

Message Type: Request

Request from the AVAS Audio Generator Server to play AVAS Audio in the specified speaker directionality.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| AVAS\_Directionality\_Rq | - | - | AVAS speaker directionality |
| OFF / Inactive | 0x0 |
| External\_All | 0x1 |
| External\_Front | 0x2 |
| External\_Rear | 0x3 |

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| **Acceptance Criteria** |
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### MD-REQ-425234/A-Pedestrian\_Fault\_St

Message Type: Status

This signal is used to report the status of pedestrian alert fault status

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| Pedestrian\_Fault\_St | - | - |  |
| Normal | 0x0 |
| Faulted | 0x1 |

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| **Acceptance Criteria** |
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# General Requirements

# Functional Definition

## AVAS-FUN-REQ-422323/A-AVAS Audio Activation

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| **Acceptance Criteria** |
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### Requirements

#### AVAS-SR-REQ-422324/A-Power-up time for AVAS audio components

The AVAS Audio Generator Server and AVAS Audio Source Server shall be capable to produce AVAS audio through infotainment external speakers within TBD seconds when the power state transitions from Sleep/Standby to RUN and when the AVAS audio is enabled through Infotainment System (refer IDS spec for details).

The infotainment components responsible for AVAS audio shall be capable of producing audio regardless of HMIAudioMode/HMI\_HMIMode\_St signal status (Load Shed shall not prevent AVAS from producing audio).

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-435883/A-AVAS audio components state during Power down

When the vehicle power state transitions from RUN to Sleep/Standby states, the AVAS Audio Generator Server and AVAS Audio Source Server shall stop playing the AVAS audio (if active earlier) and shall support to gracefully mute the speaker audio channels within TBD seconds so that no audio blips or pop’s heard.

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-435477/A-Speaker health status availability before generation

On system start up, the AVAS Event client shall support to generate AVAS audio only when it receives the speaker status from AVAS Audio Source Server on ‘AVAS\_Speaker\_Health\_St.External\_Front=Normal Operation’ and/or ‘AVAS\_Speaker\_Health\_St.External\_Rear=Normal Operation’ (based on the number of speaker configuration).

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-422326/A-Timing for single AVAS Event Client and AVAS Audio Generator Server module

When AVAS Event Client and AVAS Audio Generator Server are in the same module then the AVAS Audio Generator Server shall start producing AVAS audio signal within ‘Tmax\_to\_start\_audio\_generation’ of detecting change in vehicle state.

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-422325/A-Summary of AVAS audio generation triggers

The AVAS Event Client shall support to produce AVAS audio only when

1. **‘**Vehicle\_Ignition\_St = RUN‘.
2. ‘VehicleTorq\_St = PwPckOn\_TqAvailable’.
3. ‘Vehicle speed <= Max\_Speed\_Sound\_Cfg‘ and when any of the below condition is satisfied.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Use case** | **Reverse\_Gear\_St** | **Gear\_Level\_Position\_St** | **AVAS Audio Generator Server availability** | **AVAS Event Client ‘AVAS\_Directionality\_Rq’ signal** | |
| **Single Speaker Config** | **2 Speaker Config** |
| Case1 | Not in ‘Active\_confirmed’ | Is in ‘Drive/Low/Sport’ | Allowed to generate  AVAS Sounder for Drive position. | External Front | External Front |
| Case2 | Is in ‘Active\_confirmed’ | Is in ‘Reverse’ | Allowed to generate  AVAS Sounder for reverse position. | External Front | External Rear |
| Case3 | Not in ‘Active\_confirmed’ | Is in ‘Neutral/Gear 1 to 6’ | Allowed to generate  AVAS Sounder for Front position. | External Front | External Front |
| Case4 | Not in ‘Active\_confirmed’ | Is in ‘Park’ | Not Allowed  (Shall stop ongoing sounding if any immediately). | Inactive | Inactive |
| Case5 | Not in ‘Active\_confirmed’ | All other state | Not Allowed  (Shall stop ongoing sounding if any immediately). | Inactive | Inactive |

Note:

AVAS Event Client shall support to read the allowed vehicle speed limit configuration on ‘Max\_Speed\_Sound\_Cfg’. Based on the configuration the AVAS Event Client shall support to alter its allowed vehicle speed limit algorithm.( Refer IDS for AVAS speed limit configuration).

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-430917/A-AVAS Sound id assignment

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| --- | --- |
| AVAS Sound id | AVAS audio type |
| 0x0 | No audio/Stop previous generation if any |
| 0x1 | AVAS Sounder for Front position |
| 0x2 | AVAS Sounder for Reverse position |
| 0x3 | AVAS Sounder for Drive/Sport position |

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| **Acceptance Criteria** |
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#### TMR-REQ-435822/A-Tmax\_to\_start\_audio\_generation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Description** | **Units** | **Range** | **Resolution** | **Default** |
| Tmax\_to\_start\_audio\_generation | Maximum time for the AVAS Event Client and the AVAS Audio Generator Server to generate AVAS audio signal on the line. | msec | 0-300 |  | 70 |

#### TMR-REQ-435827/A-Tmax\_to\_stop\_audio\_generation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Description** | **Units** | **Range** | **Resolution** | **Default** |
| Tmax\_to\_stop\_audio\_generation | Maximum time for the AVAS Event Client and the AVAS Audio Generator Server to stop the ongoing AVAS audio generation signal on the line. | msec | 0-300 | 10 | 70 |

#### TMR-REQ-437377/A-Tspeaker\_direction\_switch\_time

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Description** | **Units** | **Range** | **Resolution** | **Default** |
| Tspeaker\_direction\_switch\_time | Maximum allowed time for the AVAS Audio Source Server to switch the speaker directionality from ‘External Front’ to ‘External Rear’ or vice versa and be readily available to route the audio so that no audio pops or blips is heard. | msec | 0-200 |  | 50 |

#### AVAS-SR-REQ-422327/A-Impact on AVAS audio when change in vehicle state is detected

When the AVAS Components is not playing any AVAS audio and the change in vehicle state demands a ‘AVAS Sound id’ and new Speaker Directionality, the AVAS components shall play the new audio within Tmax\_to\_start\_audio\_generation as follows

1. The ‘AVAS Event Client’ shall request the ‘AVAS Audio Source Server’ with the new speaker directionality on ’AVAS\_Directionality\_Rq’ signal as (i.e. Inactive -> New directionality).
2. Once the new speaker directionality is requested the ‘AVAS Event Client’ shall wait for Tspeaker\_direction\_switch\_time before it request the ‘AVAS Audio Generator Server’ to unmute the audio channels and shall generate the new AVAS audio signal.

When the AVAS Components is playing AVAS audio and the change in vehicle state demands a new ‘AVAS Sound id’ and new Speaker Directionality, then

1. The ‘AVAS Event Client’ shall continue to play the current active AVAS audio for the duration of ‘TransitionDelayCfg’ time.
2. Only when the when the delay timer (i.e. ‘TransitionDelayCfg’) expires and the new vehicle gear position remains unchanged, the AVAS components shall switch to new AVAS audio within ‘Tmax\_to\_start\_audio\_generation’ as mentioned below
   1. The ‘AVAS Event Client’ shall request the ‘AVAS Audio Generator Server’ to stop ongoing generation and to mute the audio channels.
   2. Once the previous audio generation is stopped, the AVAS Event shall request the ‘AVAS Audio Source Server’ to change the speaker directionality. (previous directionality -> New directionality)
   3. Once the new speaker directionality is requested the AVAS Event Client shall wait for Tspeaker\_direction\_switch\_time before it request the ‘AVAS Audio Generator Server’ to unmute the audio channels and shall generate the new AVAS audio signal.

When the change in vehicle state demands a new ‘AVAS Sound id’ but on the same Speaker Directionality,

1. The AVAS Client shall continue to play the current active AVAS audio for the duration of ‘TransitionDelayCfg’ time.
2. Only when the when the delay timer (i.e. ‘TransitionDelayCfg’) expires and the new vehicle gear position remains unchanged, the AVAS components shall switch to new AVAS audio within ‘Tmax\_to\_start\_audio\_generation’ as mentioned below
   1. The AVAS Event Client shall request the ‘AVAS Audio Generator Server’ to stop ongoing generation and to mute the audio channels.
   2. Once the channels are muted, the ‘AVAS Event Client’ shall request the ‘AVAS Audio Generator Server’ to unmute the audio channels and shall generate the new AVAS audio signal

When the change in vehicle state demands to stop the ongoing AVAS audio

1. The AVAS Client shall continue to play the current active AVAS audio for the duration of ‘TransitionDelayCfg’ time.
2. Only when the when the delay timer (i.e. ‘TransitionDelayCfg’) expires and the new vehicle gear position remains unchanged, then the AVAS components shall stop the ongoing AVAS audio within ‘Tmax\_to\_stop\_audio\_generation’ as mentioned below
   1. The AVAS Event Client shall request the AVAS Generator Server to mute the audio channels and to stop ongoing generation.
   2. Once the channels are muted, the AVAS Event Client shall also request the ‘AVAS Audio Generator Server’ with speaker directionality signal loaded as ’AVAS\_Directionality\_Rq=Inactive’ (i.e. Previous directionality -> ‘Inactive’).

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-429677/A-Speaker directionality signal usage based on speaker configuration

Based on the configuration the AVAS Event Client shall support to request the ‘AVAS Audio Source Server’ with the directionality information on ’AVAS\_Directionality\_Rq‘ signal. The value on the signal shall remain unchanged unless until the AVAS audio need to be interrupted (or) stopped by AVAS Event Client. AVAS Audio Source Server shall route the audio to the respective external speakers depending upon the speaker directionality received on ‘AVAS\_Directionality\_Rq’.

When the speaker directionality is switched from ‘External Front’ to ‘External Rear’ or vice versa, then the ‘AVAS Audio Source Server’ shall support to switch the audio routing to respective speaker within Tspeaker\_direction\_switch\_time.

For a Single speaker configuration:

1. When the ‘AVAS\_Directionality\_Rq = External Front’, the AVAS Source Server shall support to route the audio through external Front speaker (if available).
2. When the ‘‘AVAS\_Directionality\_Rq = External Rear/External All’, the AVAS Source server shall treat it as ‘Inactive’.

For a Two speaker configuration:

1. When the ‘AVAS\_Directionality\_Rq = External Front’, the AVAS Source Server shall support to route the audio through external Front speaker.
2. When the ‘AVAS\_Directionality\_Rq = External Rear’, the AVAS Source Server shall support to route the audio through external Rear speaker.
3. When the ‘AVAS\_Directionality\_Rq = External All’, the AVAS Source Server shall treat it as ‘Inactive’.

Refer Infotainment Diagnostics Specification for AVAS speaker configuration.

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-433997/A-Speaker health status handling

The AVAS Source Server shall report the speaker health on ‘AVAS\_Speaker\_Health\_St.External\_Front’ or ‘AVAS\_Speaker\_Health\_St.External\_Rear’ signal respectively

1. When the AVAS Source Server is capable to produce audio through the respective vehicle speaker(s) then the AVAS Source Server shall set the corresponding signal to ‘Normal Operation’ and shall remain unchanged unless until noted in this spec.
2. When the AVAS Source Server is not capable to produce audio through the respective vehicle speaker(s) then the AVAS Source Server shall set the corresponding speaker status to ‘No Audio’ within 50 ms and shall remain unchanged for the dame ignition cycle.

When the AVAS Client doesn't receive the speaker health status from AVAS Source Server signal when the vehicle power state is in RUN, then the AVAS client shall treat the signal status 'Inactive' same as 'No Audio'

For a Single speaker configuration:

1. The AVAS Source Server shall report the status of the Rear speakers as ‘AVAS\_Speaker\_Health\_St.External\_Rear=Inactive’ always.

Note:

Example speaker fault conditions (while not limited to these)

1) Short/open circuit to any of the AVAS speakers

2) low voltage preventing the AVAS Source Server from producing audio (not applicable to crank but if stuck at a low voltage)

3) A2B link error / A2B loss of communication (see A2B SPSS for details)…

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-437037/A-Muting/Unmuting - AVAS Audio Source Server

When the speaker directionality signal is received as ‘AVAS\_Directionality\_Rq = Inactive’ the AVAS Audio Source Server shall mute within 20 msec of receiving the signal from the AVAS Event Client.

When the speaker directionality signal is received as ‘AVAS\_Directionality\_Rq = External Front/External Rear’ the AVAS Audio Source Server shall unmute within 20 msec of receiving the signal from the AVAS Event Client

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-433995/A-Support to play concurrent media and AVAS audio

The AVAS Source Server shall be capable of playing AVAS audio on the external speaker independent of media audio played on the vehicle interior speakers. The exterior AVAS audio levels shall not be affected by the interior volume levels and audio settings.

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-435011/A-Pedestrian\_Fault\_St signal usage

The AVAS Event Client shall report if the AVAS components is capable to sound the audio on the vehicle speakers on the ‘Pedestrian\_Fault\_St’ signal

1. When the AVAS components is **not available** to generate and play AVAS audio on any of the available speaker(s), then the ‘AVAS Event Client’ shall send ‘Pedestrian\_Fault\_St=Faulted’.
2. When the AVAS components **is available** to generate and play AVAS audio on any of the available speaker(s), then the ‘AVAS Event Client’ shall send ‘Pedestrian\_Fault\_St=Normal’.

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-422333/A-Error Handling when speaker fault is reported

AVAS Event Client shall support to check the speaker status reported by ‘AVAS Audio Source Generator Server’ on the ‘AVAS\_Speaker\_Health\_St’ message. On the same ignition cycle when any of the speaker is reported as faulty, then the AVAS Event Client shall support to switch the active audio to the next available speaker immediately and shall assume the next available speaker is the only speaker for any future request in the same ignition cycle.

In a One speaker Configuration:

When the AVAS Event Client receives the signals as ‘AVAS\_Speaker\_Health\_St.External\_Front=Faulted’, then the AVAS components shall stop the ongoing AVAS audio within Tmax\_to\_stop\_audio\_generation and remain unchanged for the entire ignition cycle as follows

1. The AVAS Event Client shall request the ‘AVAS Audio Generator Server’ to stop the ongoing AVAS sound.
2. Once the audio generation is stopped, the AVAS Event Client shall also request the ‘AVAS Audio Source Server’ with the speaker directionality on ’AVAS\_Directionality\_Rq’ signal as ‘Inactive’ (i.e. Previous Directionality -> Inactive)

In a two speaker Configuration:

When the AVAS Event Client is actively generating AVAS audio to external Front or external Rear and when the speaker status of corresponding speaker is received as ‘AVAS\_Speaker\_Health\_St.External\_Front=Faulted’ (or) ‘AVAS\_Speaker\_Health\_St.External\_Rear=Faulted’, then on the same ignition cycle

1. The AVAS Event Client shall request the ‘AVAS Audio Generator Server’ to stop the ongoing AVAS audio generation and shall mute the audio channels within 30 msec.
2. When the channels are muted the AVAS Event Client shall request the ‘AVAS Audio Source Server’ with the new speaker directionality on ’AVAS\_Directionality\_Rq’ signal as (i.e. Previous Directionality -> New directionality).
3. Once the new speaker directionality is sent, the AVAS Event Client shall wait Tspeaker\_direction\_switch\_time before it requests the ‘AVAS Audio Generator Server’ to unmute the audio channel and to start AVAS audio generation within 30ms.
4. When both the speakers are Faulted, then the AVAS Event Client shall stop all the AVAS sound generation within ‘Tmax\_to\_stop\_audio\_generation’ (if there is any) and shall set the speaker directionality to ‘AVAS\_Directionality\_Rq= Inactive’. The speaker directionality state shall remain unchanged for entire ignition cycle.

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| **Acceptance Criteria** |
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#### AVAS-SR-REQ-430605/A-Loss of communication with Audio Source Server

If the AVAS Event Client loses communication with AVAS Audio Source Server for more than 5 seconds (ex. Missing ‘AVAS\_Speaker\_Health\_St’ signal), then the AVAS Event Client shall stop all the AVAS sound generation immediately if there is any and shall set the ‘AVAS\_Directionality\_Rq=Inactive’ and remain unchanged for the same ignition cycle.

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| **Acceptance Criteria** |
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### Use Cases

#### AVAS-UC-REQ-422328/A-AVAS audio activation

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| --- | --- |
| **Actors** | AVAS User |
| **Pre-conditions** | * Vehicle Ignition is OFF * No AVAS audio is active in the vehicle. * Vehicle gear is in Park state. * Vehicle Torque Status is not available. |
| **Scenario Description** | * Vehicle ignition is transitioned to RUN. * Vehicle Torque status is PwPckOn\_TqAvailable. * Vehicle gear is switched to ‘Drive/Low/Sport’ position. * Vehicle speed is less than the allowed limit (i.e. Max\_Speed\_Sound\_Cfg). * AVAS Status Client is notified with the status of AVAS system as Pedestrian\_Fault\_St(Normal) |
| **Post-conditions** | * AVAS Audio is sounded on the vehicle exterior Front speaker. |
| **List of Exception Use Cases** | * No speaker fault is detected by AVAS Audio Source Server. |
| **Notes** | * The above use case is also applicable when the Gear position is shifted to ‘ Neutral/Gear 1 to 6’ then the AVAS audio is sounded on exterior Front speaker. * The above use case is also applicable when the Gear position is shifted to ‘ Reverse’ then the AVAS audio is sounded on exterior Rear speaker. |
| **Interfaces** | AVAS Event Client, AVAS Audio Generator Server, AVAS Audio Source Server, AVAS Status Client |

#### AVAS-UC-REQ-430918/A-AVAS audio deactivation

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| --- | --- |
| **Actors** | AVAS User |
| **Pre-conditions** | * Vehicle Ignition is RUN * AVAS audio is active in the vehicle. * Vehicle gear is not in Park state. * Vehicle speed is less than the allowed limit (i.e. Max\_Speed\_Sound\_Cfg). * AVAS Status Client is notified with the status of AVAS system as Pedestrian\_Fault\_St(Normal) |
| **Scenario Description** | * Vehicle gear is switched to ‘Park’ position. |
| **Post-conditions** | * The actively generated AVAS audio is shall be continued for ‘TransitionDelayCfg’ time. * When the delay timer is elapsed, the actively AVAS audio shall be stopped by the AVAS Event Client within Tmax\_to\_stop\_audio\_generation |
| **List of Exception Use Cases** | * No speaker fault is detected by AVAS Audio Source Server. |
| **Interfaces** | AVAS Event Client, AVAS Audio Generator Server, AVAS Audio Source Server, AVAS Status Client |

#### AVAS-UC-REQ-422335/A-Speaker Fault detected on a Single speaker system

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| --- | --- |
| **Actors** | AVAS User |
| **Pre-conditions** | * Vehicle Ignition is RUN. * AVAS system is configured for Single speaker system. * AVAS audio is active in the external Front vehicle. |
| **Scenario Description** | * Speaker lines are Shorted to Ground (or) the speaker lines are open. (speaker fault is detected by AVAS Audio Source Server). * Speaker Fault is reported on the signal AVAS\_Speaker\_Health\_St(External\_Front=Faulted) |
| **Post-conditions** | * The actively generated AVAS audio on the Front speaker is stopped playing immediately. * The AVAS audio shall remain unavailable for the same ignition cycle. * AVAS Status Client is notified with the status of AVAS system as Pedestrian\_Fault\_St(Faulted) |
| **List of Exception Use Cases** |  |
| **Interfaces** | AVAS Event Client, AVAS Audio Generator Server, AVAS Audio Source Server, AVAS Status Client |

#### AVAS-UC-REQ-437378/A-Speaker Fault detected on a Two speaker system

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| --- | --- |
| **Actors** | AVAS User |
| **Pre-conditions** | * Vehicle Ignition is RUN. * AVAS system is configured for Two speaker system. * AVAS audio is active in the external Front vehicle. |
| **Scenario Description** | * Front Speaker lines are Shorted to Ground (or) the speaker lines are open. (speaker fault is detected by AVAS Audio Source Server). * Speaker Fault is reported on the signal AVAS\_Speaker\_Health\_St(External\_Front=Faulted) |
| **Post-conditions** | * The actively generated AVAS audio is switched from the Front to Rear speaker. * The AVAS audio for the Front speaker shall not be available on the external Front speakers for the same ignition cycle. |
| **List of Exception Use Cases** | * When both the speakers are Faulted as reported by AVAS Audio Source Server on AVAS\_Speaker\_Health\_St(External\_Front=Faulted) & AVAS\_Speaker\_Health\_St(External\_Rear=Faulted), the AVAS Event Client shall notify the AVAS Status Client with the status of AVAS system as Pedestrian\_Fault\_St(Faulted) |
| **Interfaces** | AVAS Event Client, AVAS Audio Generator Server, AVAS Audio Source Server, AVAS Status Client |

#### AVAS-UC-REQ-437379/A-Vehicle Gear is transitions from Front to Rear

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| --- | --- |
| **Actors** | AVAS User |
| **Pre-conditions** | * Vehicle Ignition is RUN. * AVAS system is configured for Two speaker system. * AVAS audio is active in the external Front vehicle. |
| **Scenario Description** | * Vehicle Gear is shifted from Front to Rear. |
| **Post-conditions** | * The actively generated AVAS audio is shall be continued on the Front Speaker for ‘TransitionDelayCfg’ time. * When the delay timer is elapsed, the new AVAS audio shall be sounded and played on the Rear speaker within Tmax\_to\_start\_audio\_generation. |
| **List of Exception Use Cases** | * When both the speakers are Faulted as reported by AVAS Audio Source Server on AVAS\_Speaker\_Health\_St(External\_Front=Faulted) & AVAS\_Speaker\_Health\_St(External\_Rear=Faulted), the AVAS Event Client shall notify the AVAS Status Client with the status of AVAS system as Pedestrian\_Fault\_St(Faulted) |
| **Interfaces** | AVAS Event Client, AVAS Audio Generator Server, AVAS Audio Source Server, AVAS Status Client |

### White Box View

#### Activity Diagrams

##### AVAS-ACT-REQ-422321/A-AVAS audio activation handling



#### Sequence Diagrams

##### AVAS-SD-REQ-436530/A-AVAS Event is ended when playing AVAS audio

Pre-condition

1. Vehicle ignition is in RUN state.
2. Vehicle is configured for 2 speaker AVAS System.
3. No Speaker Faults are detected on both the speakers.
4. Vehicle level AVAS event occurs and demands a AVAS sound on the Front speakers.

Scenario

1. While sounding on the Front speaker, the event status is received as ended from the vehicle network.

Post-condition

1. When the change in vehicle state is detected, then the AVAS System shall continue to play ‘TransitionDelayCfg’ time.
2. When the delay timer expires the AVAS system shall stop sounding the AVAS audio on the Front speaker.

Sequence Diagram



##### AVAS-SD-REQ-436531/A-Single Speaker Fault is detected while playing AVAS audio

Pre-condition

1. Vehicle ignition is in RUN state.
2. Vehicle is configured for 2 speaker AVAS System.
3. No Speaker Faults are detected.
4. Vehicle level AVAS event occurs and demands a AVAS sound on the Front speakers.

Scenario

1. While sounding on the Front speaker, speaker fault is detected on the Front speaker by the AVAS Sound Source Server and the same is notified on the signal ‘AVAS\_Speaker\_Health\_St(External\_Front= Faulted)’

Post-condition

1. When the Speaker fault is detected then the AVAS System shall stop sounding the AVAS audio on the Front speaker and then AVAS system shall update the user that AVAS audio generation is not available on the signal ‘Pedestrian\_Fault\_St(Faulted)’.

Sequence Diagram



##### AVAS-SD-REQ-436529/A-Both the Speakers are Faulted while playing AVAS audio

Pre-condition

1. Vehicle ignition is in RUN state.
2. Vehicle is configured for 2 speaker AVAS System.
3. No Speaker Faults are detected.
4. Vehicle level AVAS event occurs and demands a AVAS sound on the Front speakers.

Scenario

1. While sounding on the Front speaker, speaker fault is detected on Front speaker by AVAS Audio Source Server and the same is notified on the signal ‘AVAS\_Speaker\_Health\_St(External\_Front= Faulted)’

Post-condition

1. When the Speaker fault is detected then the AVAS System shall stop sounding the AVAS audio on Front speaker and shall switch the current AVAS audio generation to the next available Rear Speaker.
2. If both the speakers are Faulted, then AVAS system shall update the user that AVAS System is faulted on the signal ‘Pedestrian\_Fault\_St(Faulted)’.

Sequence Diagram



##### AVAS-SD-REQ-437357/A-Vehicle Gear position transitions from Front to Reverse

Pre-condition

1. Vehicle ignition is in RUN state.
2. Vehicle is configured for 2 speaker AVAS System.
3. No Speaker Faults are detected.
4. Vehicle level AVAS event is active on the Front speakers and the audio is played on the Front speaker.

Scenario

1. Vehicle Gear is transitioned from Front to Reverse Gear.

Post-condition

1. When the gear transition from Front to reverse is detected, the AVAS Audio on the Front is played for the duration of the TransitionDelayCfg time. Only when the timer is expired, the previously played AVAS audio on the Front is stopped and the new AVAS audio for Rear speaker shall switched immediately.

Sequence Diagram



# Appendix: Reference Documents

|  |  |
| --- | --- |
| Reference # | Document Title |
| 1 | AVAS Functional Spec Candidate for Phoenix |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
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