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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Revision History

Date	Version	Notes	
October 15, 2021	1.0	Initial Release	

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1 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).

1.1 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).

2 Architectural Design

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

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

2.2 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.

2.3 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.

2.4 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).

2.5 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).

2.6 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

2.7 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_Speed_QF	VehVActlEng_D_Qf
Vehicle_Ignition_St	Ignition_Status
VehicleTorq_St	PwPckTq_D_Stat
Reverse_Gear_St	GearRvrse_D_Actl
Gear_Level_Position_St	GearLvrPos_D_Actl
Speaker_Health_St.External_Front	SpkrCnnctFront_D_Stat
Speaker_Health_St.External_Rear	SpkrCnnctRear_D_Stat

AVAS_Directionality_Rq	SpkrSel_D_Rq

Table: Logical name/CAN signal mapping

2.8 AVAS-IIR-REQ-422340/A-AVAS Event Client_Rx

2.8.1 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

2.8.2 MD-REQ-276459/A-Vehicle_Speed_QF

Message Type: Status

Signal with the Vehicle Speed Quality Factor

Logical Signal Name	Literals	Value	Description
Vehicle_Speed_QF	Faulty	0x0	
	No_Data_Exists	0x1	
	Not_Within_Specifications	0x2	
	OK	0x3	

2.8.3 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	

2.8.4 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

2.8.5 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	

2.8.6 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

2.8.7 MD-REQ-422345/A-Speaker_Health_St.External_Front

Message Type: Status

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

Logical Signal Name	Literals	Value	Description
Speaker_Health_St.External_Front	-	-	External Front speaker status.
	Null/Inactive	0x0	
	Normal Operation	0x1	
	Faulted/No audio	0x2	
	Not Used	0x3	

2.8.8 MD-REQ-440297/A-Speaker_Health_St.External_Rear

Message Type: Status

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

Logical Signal Name	Literals	Value	Description
Speaker_Health_St.External_Rear	Null/Inactive	0x0	External Rear speaker status.
	Normal Operation	0x1	
	Faulted/No audio	0x2	
	Not Used	0x3	

2.9 AVAS-IIR-REQ-422343/A-AVAS Event Client_Tx

2.9.1 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	

2.9.2 MD-REQ-425234/A-Pedestrian_Fault_St

Message Type: Status

This signal is used by the AVAS Event Client to report the status of pedestrian alert fault status to the AVAS Status Client

Name	Literals	Value	Description
Pedestrian_Fault_St	-	-	
	Normal	0x0	
	Faulted	0x1	

3 General Requirements

4 Functional Definition

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

4.1.1 Requirements

4.1.1.1 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 2 seconds when the power state transitions from Sleep/Standby to RUN. 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).

Only when both the AVAS Internal Generator & AVAS audio DE bits are enabled the AVAS Audio Generator Server, AVAS Audio Source Server shall support the requirements covered in this spec (refer IDS spec for details of DE bits).

4.1.1.2 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 150 ms so that no audio blips or pop's heard.

4.1.1.3 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 'Speaker_Health_St.External_Front=Normal Operation' and/or 'Speaker_Health_St.External_Rear=Normal Operation' (based on the number of speaker configuration).

4.1.1.4 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.

4.1.1.5 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

Note1:
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).

Note2: If the Vehicle Speed Quality Factor network signal 'Vehicle_Speed_QF' is not set to OK then the 'AVAS Event Client' shall treat the vehicle speed 'VehicleSpeed_St' as though the vehicle is not moving for the AVAS pedestrian alert feature.

4.1.1.6 AVAS-SR-REQ-430917/A-AVAS Sound id assignment

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

4.1.1.7 AVAS-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

4.1.1.8 AVAS-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

4.1.1.9 AVAS-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 and be readily available to route the audio so that no audio pops or blips is heard.	msec	0-200		50

4.1.1.10 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 requests 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
    a. The 'AVAS Event Client' shall request the 'AVAS Audio Generator Server' to stop ongoing generation and to mute the audio channels.
    b. 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)
    c. Once the new speaker directionality is requested the AVAS Event Client shall wait for Tspeaker_direction_switch_time before it requests 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
    a. The AVAS Event Client shall request the 'AVAS Audio Generator Server' to stop ongoing generation and to mute the audio channels.
    b. 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
    a. The AVAS Event Client shall request the AVAS Generator Server to mute the audio channels and to stop ongoing generation.
    b. 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').

4.1.1.11 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.

4.1.1.12 AVAS-SR-REQ-433997/A-Speaker health status handling

The AVAS Source Server shall report the speaker health on 'Speaker_Health_St.External_Front' or '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 same 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 '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)…

4.1.1.13 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

4.1.1.14 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.

4.1.1.15 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

In a One speaker Configuration:

1. When the AVAS components is **not available** to generate and play AVAS audio on the available speaker, 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'.

In a two speaker Configuration:

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 both of the speaker(s), then the 'AVAS Event Client' shall send 'Pedestrian_Fault_St=Normal'.

4.1.1.16 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 Server' on the 'Speaker_Health_St.External_Front' or 'Speaker_Health_St.External_Rear' signal. 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 '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 'Speaker_Health_St..External_Front=Faulted' (or) '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.

Note: Depending upon the speaker fault detected, the AVAS Event Client shall set the 'Pedestrian_Fault_St' as mentioned in the 'AVAS-SR-REQ-435011'.

4.1.1.17 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 'Speaker_Health_St.External_Front' or 'Speaker_Health_St.External_Rear' 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.

4.1.2 Use Cases

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

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 the 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

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

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 the AVAS Audio Source Server.
Interfaces	AVAS Event Client, AVAS Audio Generator Server, AVAS Audio Source Server, AVAS Status Client

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

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 fault is detected by AVAS Audio Source Server. - Speaker Fault is reported on the signal 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

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

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 fault is detected by AVAS Audio Source Server. - Speaker Fault is reported on the signal Speaker_Health_St.External_Front=Faulted
Post-conditions	- The actively generated AVAS audio is switched from the Front to Rear speaker. - The AVAS audio 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 'Speaker_Health_St.External_Front=Faulted' & 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)
Notes	- The above use case is also applicable when the External rear speaker is Faulted, the AVAS audio switched from External rear to External Front and remain in External Front for the entire ignition cycle.
Interfaces	AVAS Event Client, AVAS Audio Generator Server, AVAS Audio Source Server, AVAS Status Client

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

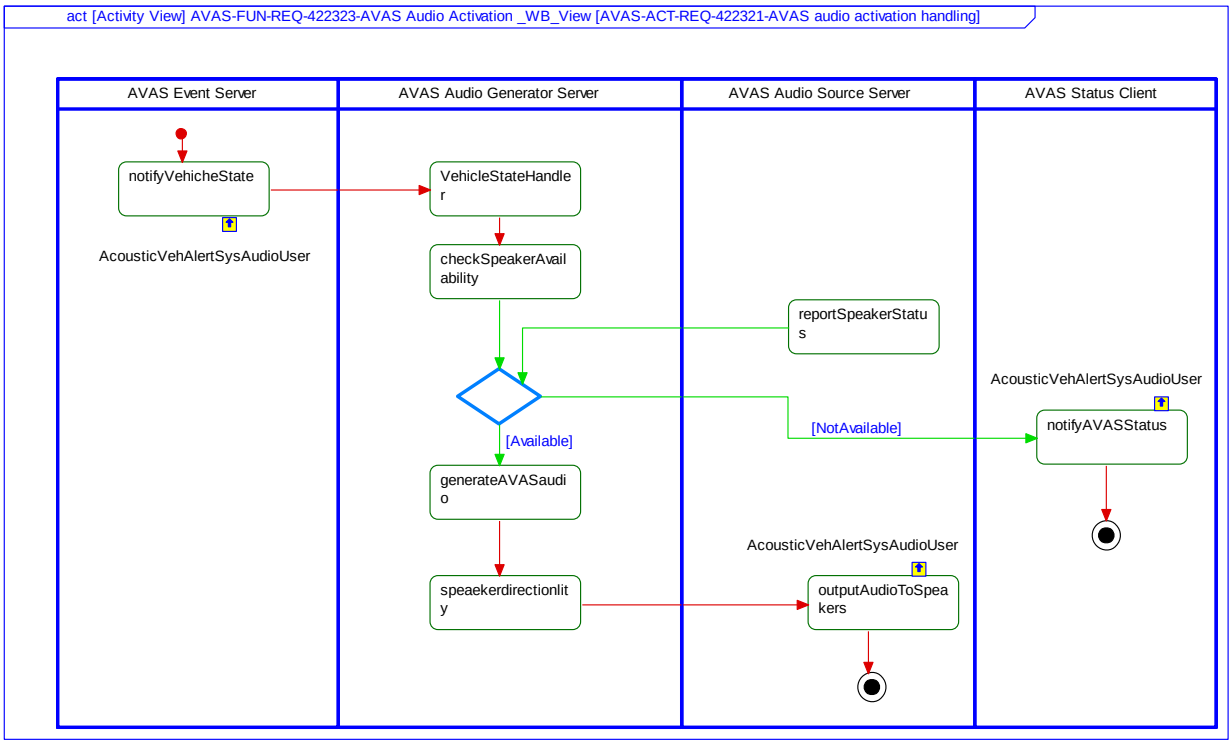
Actors	AVAS User
Pre-conditions	- Vehicle Ignition is RUN. - AVAS system is configured for Two speaker system. - AVAS audio is active in the external Front vehicle.
Scenario Description	- Vehicle Gear is shifted from Front to Rear.
Post-conditions	- The actively generated AVAS audio is shall be continued 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 Speaker_Health_St.External_Front=Faulted & 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

4.1.3 White Box View

4.1.3.1 Activity Diagrams

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



4.1.3.2 Sequence Diagrams

4.1.3.2.1 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.

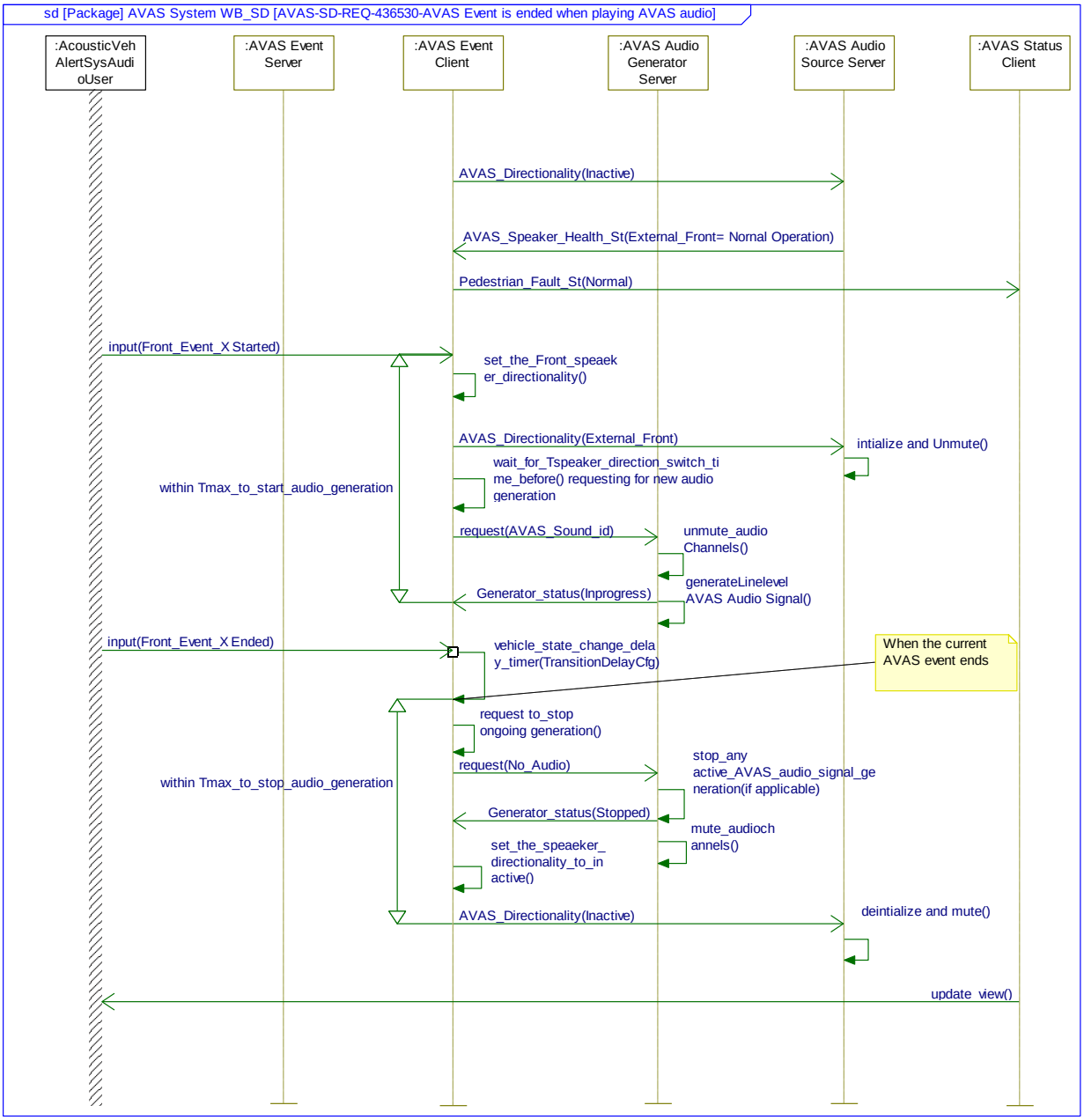
Scenario

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



4.1.3.2.2 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 1 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

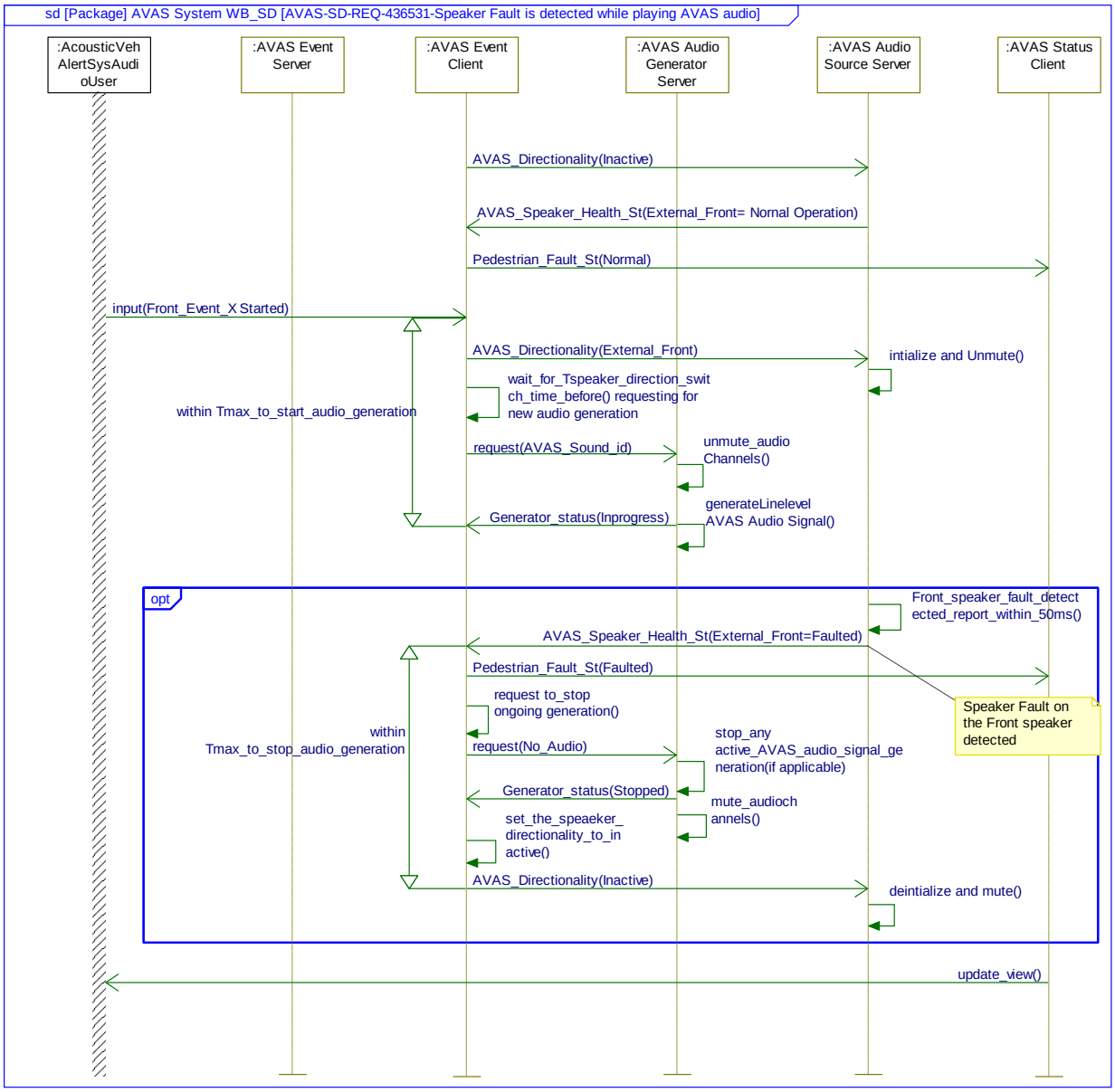
1. While sounding on the Front speaker, speaker fault is detected on the Front speaker by the AVAS Sound Source Server and the same is notified on the signal 'AVAS_Speaker_Health_St(External_Front= Faulted)'

Post-condition

1. When the Speaker fault is detected then the AVAS System shall stop sounding the AVAS audio on the Front speaker.

2. The AVAS Event Client shall update the AVAS Status Client with the status of AVAS audio generation on 'Pedestrian_Fault_St(Faulted)'.

Sequence Diagram



4.1.3.2.3 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

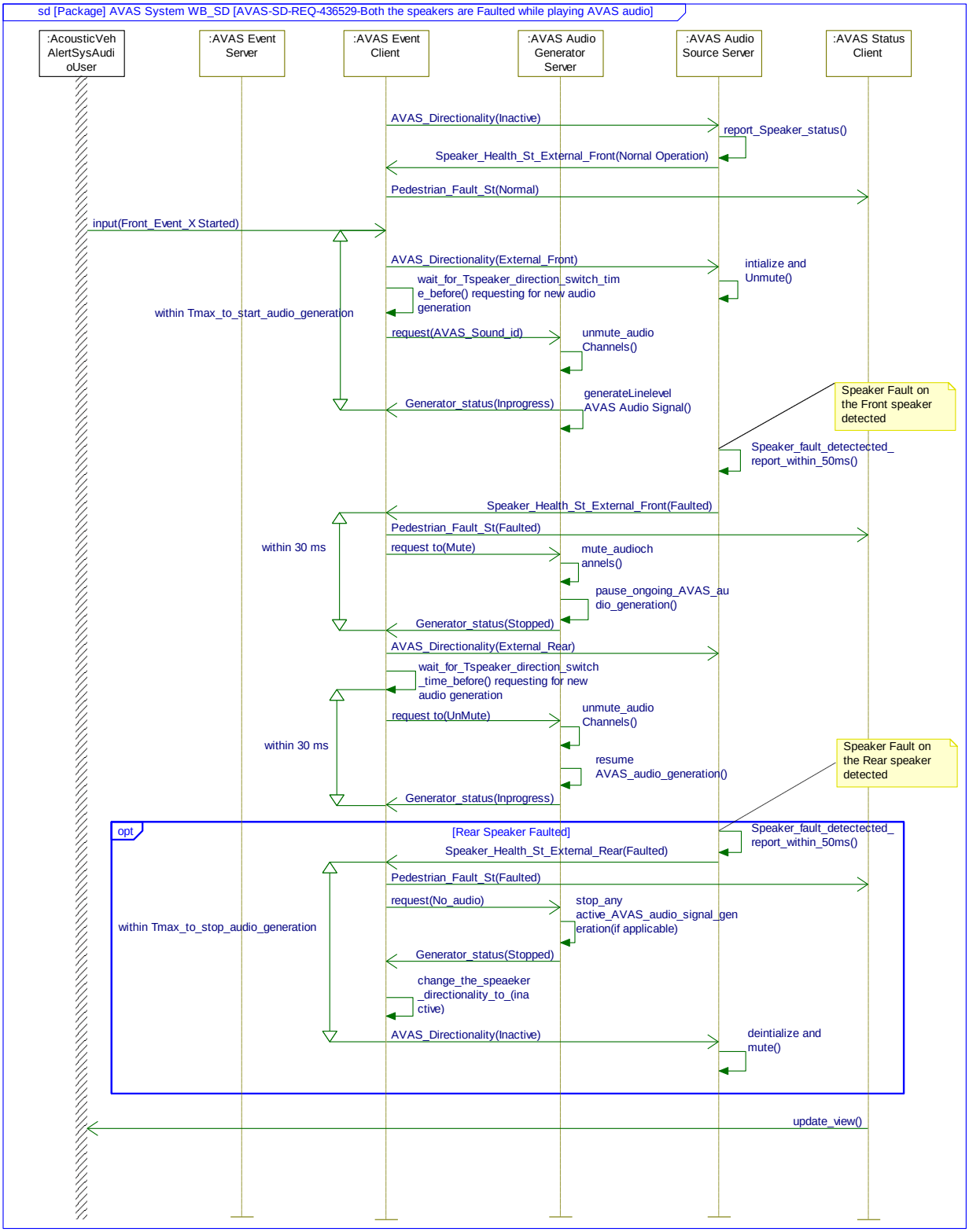
1. While sounding on the Front speaker, speaker fault is detected on Front speaker by AVAS Audio Source Server and the same is notified on the signal 'AVAS_Speaker_Health_St(External_Front= Faulted)'

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



4.1.3.2.4 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.

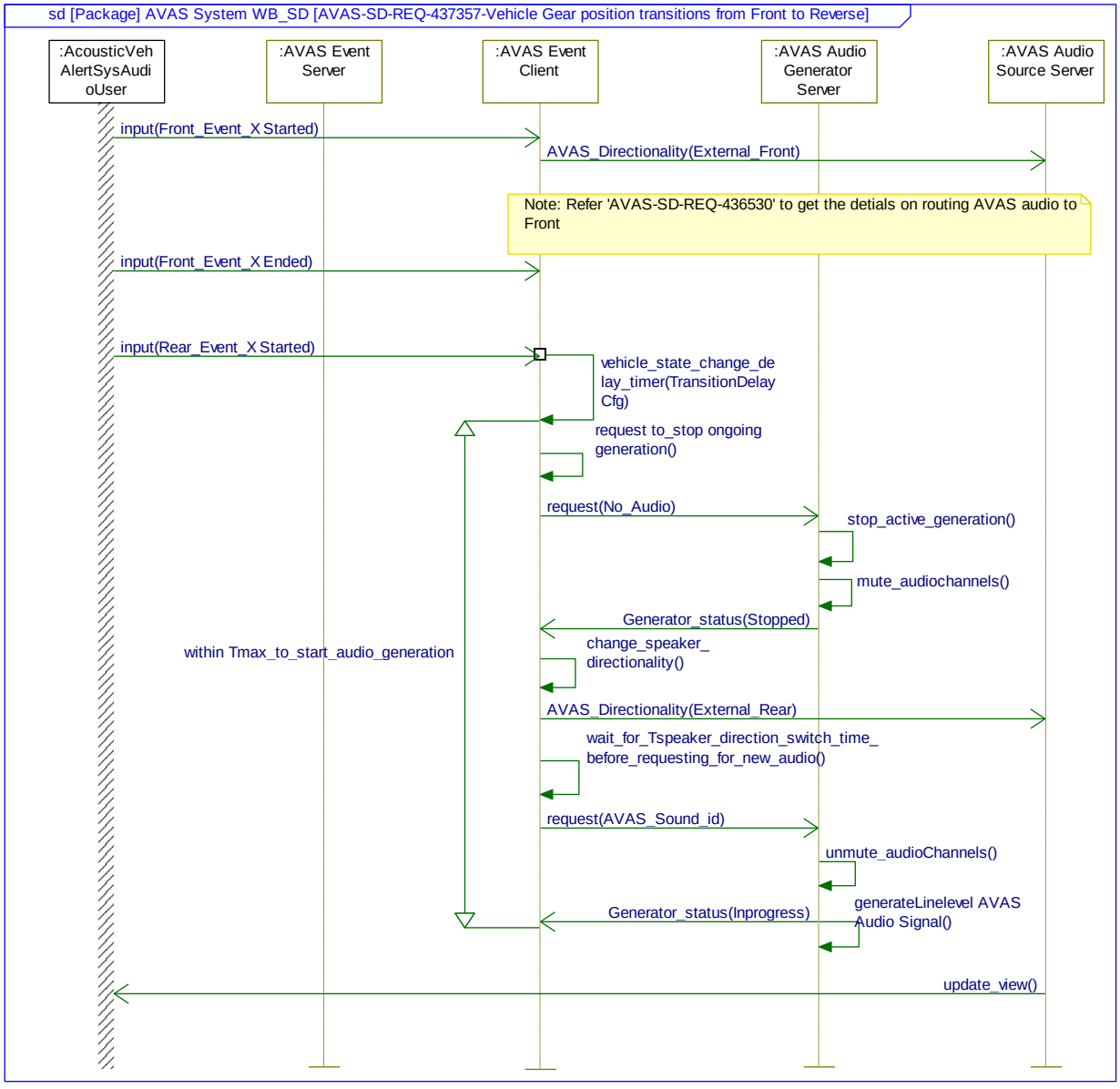
Scenario

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



5 Appendix: Reference Documents

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