



**Research & Vehicle Technology**  
**“Infotainment Systems Product Development”**

**Feature – Volume Variant 3**

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

Version 1.2

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## Revision History

Date	Version	Notes	
July 22, 2021	1.0	Initial Release	
September 22, 2021	1.1		
	VOL-FUN-REQ-443617/A-SetVolume signal usage		jmyslin2: new function for SetVolume for the TCU
	VOL-SR-REQ-442537/A-SetVolume signal for TCU eCall		jmyslin2: new setVolume signal for TCU eCall
October 26, 2021	1.2		
	VOLv3-FUR-REQ-412277/B-Audio Attenuation_Mute / Unmute Ramps - variant 3		Oct 21 2021 MDAGE: Updated muting graph. Added graphs for volume step increases/decreases. Added tables 3 and 4 describing volume step change timing.
	VOL-SR-REQ-452697/A-Logical to Physical CAN signal mapping - Volume (Phoenix)		jmyslin2: added logical to CAN signal physical mapping



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## 1 Assumptions throughout this spec

1. When say AHU in this spec that could be either the Audio Head Unit or Phoenix Audio Controller (both are mutually exclusive). When call out Phoenix Audio Controller (PAC) it does not mean it applies to the AHU though.
2. 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.

Left Hand Drive vehicle

Front of the Vehicle	
Zone 1 – Front Driver	Zone 2 – Front Passenger
Zone 3 – Middle Left Occupant	Zone 4 – Middle Right Occupant
Zone 5 – Rear Left Occupant	Zone 6 – Rear Right Occupant
Rear of the Vehicle	

Right Hand Drive vehicle

Front of the Vehicle	
Zone 2 – Front Passenger	Zone 1 – Front Driver
Zone 4 – Middle Left Occupant	Zone 3 – Middle Right Occupant
Zone 6 – Rear Left Occupant	Zone 5 – Rear Right Occupant
Rear of the Vehicle	

3. Cabin mode is defined when there are no individual sound zones for the front passenger or rear occupants. Generally, audio is played throughout the entire vehicle in cabin mode.



## 2 Architectural Design

### 2.1 Deployment

The table below shows how the logical classes may be mapped to physical modules for the Volume feature. The table below covers the lead program.

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)
Volume Settings Server	APIM Phoenix Domain Controller
Volume Controller	AHU/PAC, Phoenix Audio Controller, DSP AMP, APIM Phoenix Domain Controller
Volume Setting Button Input Client	CAN EFP (button panel), LIN ICP (button panel), Steering Wheel Control module, RACM, APIM PDC volume touch screen
HMI Output	HUD, RACM display, RSEM display, APIM Phoenix Domain Controller

### 2.2 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.

### 2.3 VOLv2-CLD-REQ-411666/A-Volume Settings Button Input Client

The Volume Settings Button Input Client is responsible for making volume requests to the Volume Settings Server.

### 2.4 VOLv2-CLD-REQ-411665/A-Volume Controller

The Volume Controller is the object that controls the volume gain adjustment.

### 2.5 VOLv2-CLD-REQ-412243/A-Volume Setting Server - Functional Requirements

#### 2.5.1 VOLv3-F-REQ-412094/A-Press & Hold Volume Control - APIM Phoenix Domain Controller

The APIM Phoenix Domain Controller (ie Volume Settings Server) shall increment / decrement the volume by a single step when the volume button is initially pressed.

The APIM Phoenix Domain Controller (ie Volume Setting Server) shall monitor the volume control (button) message, and if the messages have continuously indicated a volume control button as being "pressed" for a time equal to or greater than Tvolume\_button\_held, then the APIM Phoenix Domain Controller shall treat this button as being held.

Upon detection of the volume button being held, the APIM Phoenix Domain Controller shall adjust the volume one volume step, in the direction indicated by the volume control message, for every 100 milliseconds (+/- 10%) the button is held (past Tvolume\_button\_held) until the button status reverts to "not pressed"

**2.5.2 VOL-TMR-REQ-014823/C-Volume Button Held Timer (TcSE ROIN-169727-3)**

Name	Description	Units	Range	Resolution	Default
Volume Button Held Timer	Tvolume_button_held is a timer used to determine if the volume button (from steering wheel controls, etc) has been held.  Note: Use the default value	msec	200 - 2000	100	500

**2.5.3 VOLv3-FUR-REQ-412277/B-Audio Attenuation Mute / Unmute Ramps - variant 3****Audio Attenuation / Mute ramps**

Fade in and fade out of audio sources.

As basic principle any distortions like pop noise must not be audible under every circumstance.

The mute ramp times are dependent of the source to which the user switches and not from the actual source.

The mute attack time for every volume source shall use the fast ramp – mute attack time curve.

The table 1 shows the allocation of the timing and the attenuation of the volume.

The table 2 shows the allocation of the source and the mute ramps.

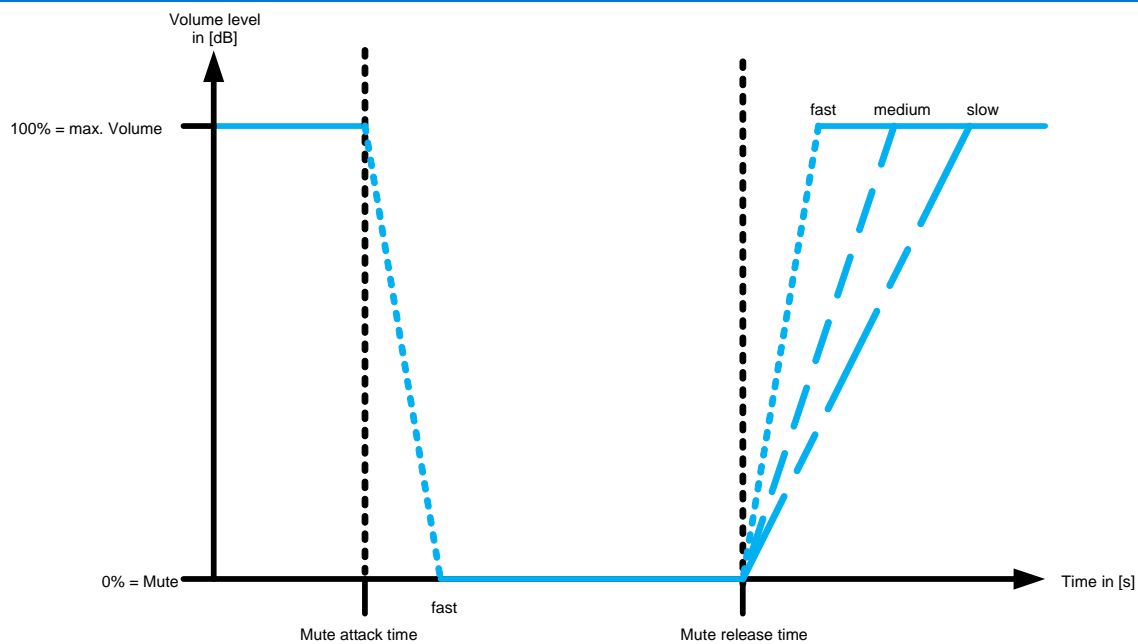
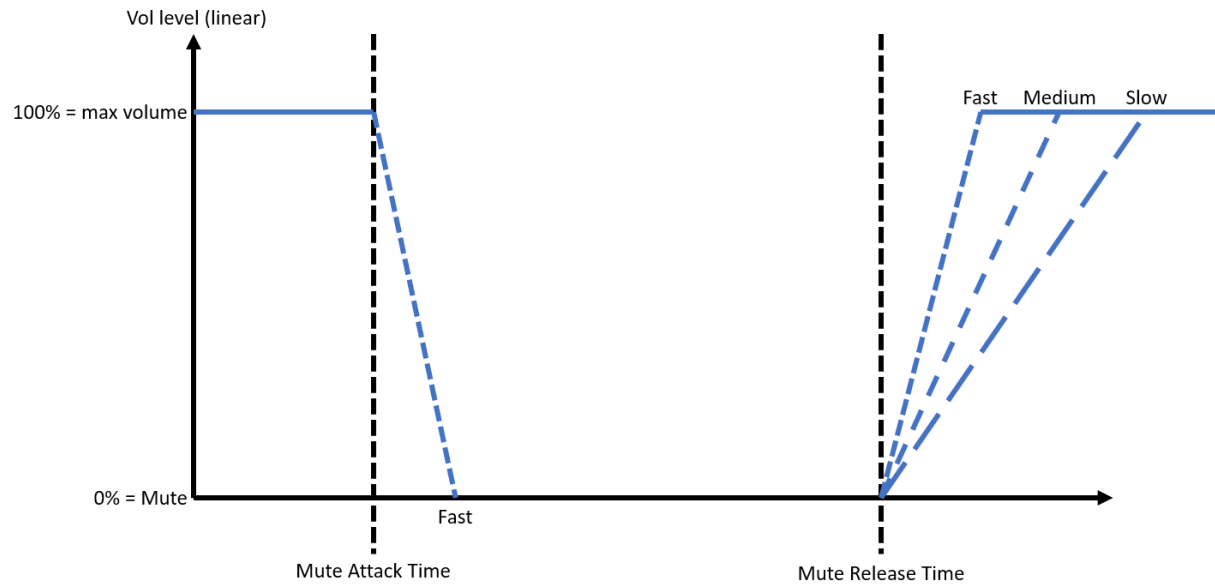
~~The table 3 shows the smoothing timing for volume step increases and decreases.~~

~~The table 3 shows the smoothing timing for volume step changes less than 10 dB.~~

~~The table 4 shows the smoothing timing for a volume step increase and decrease for changes greater than 10 dB.~~

The values are default values and they must be flexible in 10 ms steps from 0ms to 1000ms for each ramp.

[Mute/Unmute graph](#)



Ramp type	Time volume max. to mute	Time mute to volume max.	Tolerance
Fast ramp – mute attack time	320 ms	N/A	+/- 5ms
Fast ramp – Mute release time	N/A	100 ms	+/- 10ms
Medium ramp	N/A	250 ms	+/- 10ms
Slow ramp	N/A	450 ms	+/- 10ms

Table 1

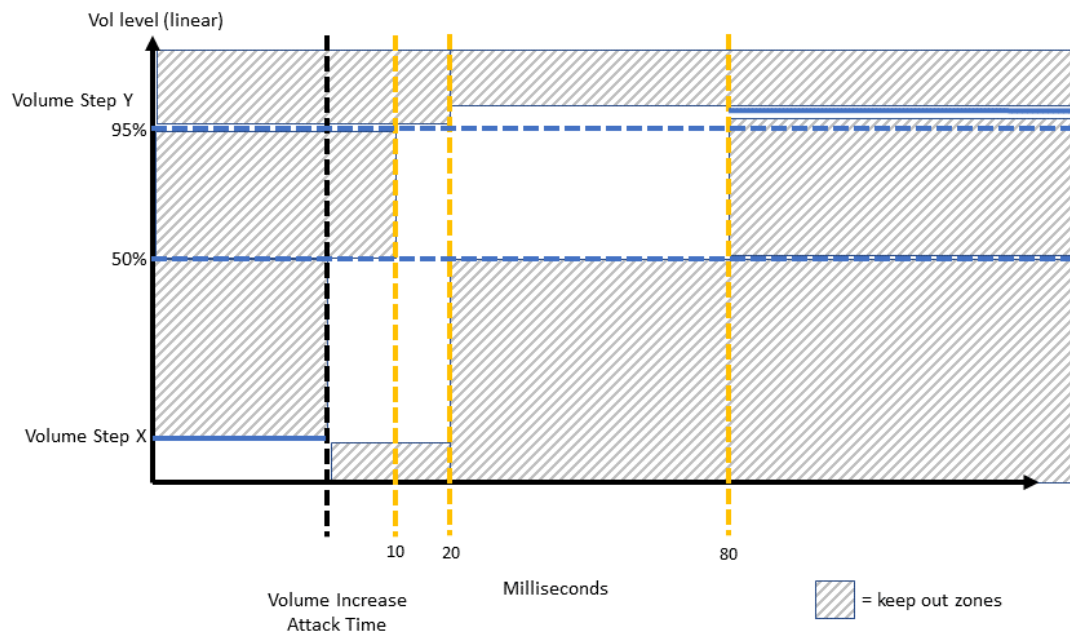
Audio source	Initiation	Mute Release Time – Ramp Type
Voice	Start of the new audio content	Fast ramp
Phone	Start of the new audio content	Medium ramp



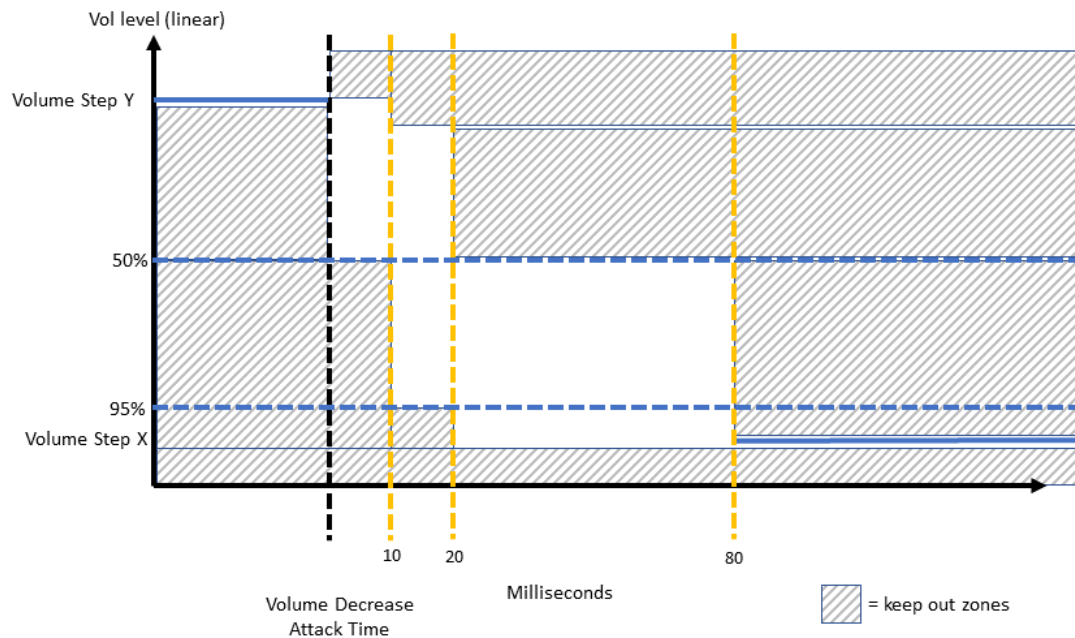


Audio source	Initiation	Mute Release Time – Ramp Type
Chimes <sup>1 2</sup>	Start of the new audio content	Fast ramp
Mixable prompts <sup>1</sup>	Start of the new audio content	Fast ramp
Radio Announcements (TA, News Alarm)	Start of the new audio content	Medium ramp
Analogue radio sources (AM/FM)	Start of the new audio content	Slow ramp
Digital radio sources (DAB, Sirius,...)	Start of the new audio content	Slow ramp
Media sources (CD, USB,...)	Start of the new audio content	Slow ramp

Table 2

[Note 1: Audio Attenuation unmute event](#)[Note 2: Chime event](#)[Volume event increase \(less than 10 dB\) graph](#)

### Volume event decrease (less than 10 dB) graph



<u>Volume event (less than 10 dB)</u>	<u>Time to 50% of new value</u>	<u>Time to new value (≥95% of value)</u>
Volume step – decrease	10 – 20 ms	20 – 80 ms
Volume step – increase	10 – 20 ms	20 – 80 ms

Volume event	Ramp Time or Type	Tolerance
Volume step—decrease	20 ms	+/- 5ms
Volume step—increase (less than 10 dB)	20 ms	+/- 5ms
Volume step—increase (greater than 10 dB)	Medium ramp	N/A

Table 3Table 3

<u>Volume event (greater than 10 dB)</u>	<u>Time to 50% of new value</u>	<u>Time to new value (≥95% of value)</u>
<u>Volume step – decrease</u>	<u>10 – 20 ms</u>	<u>20 – 80 ms</u>
<u>Volume step – increase</u>	<u>10 – 20 ms</u>	<u>20 – 80 ms</u>
Timing per 10 dB of increase		

Table 4

Audio Attenuation unmute event:

For an Audio Attenuation unmute event the infotainment system shall follow the behavior described in Table 3 for volume step increases.

Chime event:

The 'mute ramp' requirement shall be applied to the audio leading into the Chime event, and the audio played after the Chime event. The 'mute ramp' shall not be applied to the Chime waveform itself

Phoenix Architecture specific muting/unmuting on source changes using mute ramps:

For an audio source change in the Phoenix distributed system which requires muting/unmuting on both the PDC and AHU/DSP AMP only one module shall perform the Fast, Medium or Slow unmute ramp called out in this requirement.

- The PDC module sending the A2B audio stream shall perform the Fast, Medium and Slow unmute ramps called out in this requirement.
- The AHU/DSP AMP Module receiving the A2B audio stream from the PDC, if muting and unmuting is required for a source change, shall fully unmute within 30 msec from the time the unmuting begins
- If the AHU/DSP AMP module is generating the audio itself and not receiving it from the PDC then the AHU/DSP AMP shall follow the Fast, Medium and Slow unmute ramps called out in this requirement
  - Example: at the time this spec was written (may have changed since then) for the My Seat Space zonal audio system the PAC (ie AHU high end) played rear zone Bluetooth phone audio without sending the audio to the PDC. In this case the PAC would follow the Fast, Medium or Slow unmute curve since not receiving the A2B audio from the PDC.

**General Note:**

In the event of a spec conflict related to the timing of an event, this requirement shall not supersede.

**2.5.4 VOLv2-FUR-REQ-412097/A-Volume Attenuation / Restoration - variant 2****Audio Volume Attenuation**

The Volume Setting Server shall meet the following requirements when supporting an *Attn\_Info\_Audio* audio attenuation event:

- Audio Attenuation for chimes (ex. IPC\_Infotainment : *Attn\_Info\_Audio*) shall apply to the active audio source (media, phone, call ring, VR, Radio Announcements, all zone audio sources), Captains Announcement (see note below), In Car Communication (see note below) and alerts (mixable prompts and beeps). The Chime is not attenuated.
  - Exception: Audio Attenuation for chimes shall not apply to emergency phone call conditions as defined in "Volv2-REQ-412240-Emergency Call Volume Setting".
  - Note: for beeps at a minimum Attenuation 6 shall be supported (full mute). Reference applicable beep attenuation requirements/specifications if Attenuation 1 – Attenuation 5 are supported for beeps.
- Audio Attenuation for mixable prompts shall apply to the active audio source (media, phone, call ring, VR, TA), Captains Announcement, In Car Communication and shall NOT attenuate mixable prompts, chimes and beeps.
  - Exception: Audio Attenuation for prompts shall not apply to emergency phone call conditions as defined in "Volv2-REQ-412240-Emergency Call Volume Setting".
    - Note: for zone mode it shall be determined case by case by the Volume Setting Server if a targeted prompt for a specific zone audio attenuation applies to just that zone or all the vehicle zones
- The audio volume shall only be attenuated if the volume step is above the specified attenuation level in the table below
- The volume shall not be user-adjustable during a Full Mute Audio Volume Attenuation event, unless otherwise noted. Upon exiting a full mute Audio Volume Attenuation event, the volume shall either be restored to the level just prior to the Audio Volume Attenuation event or to the next highest Audio Volume Attenuation level if another attenuation request is active.
- If the volume is NOT user adjusted during an Audio Volume Attenuation event, upon exiting, the volume shall either be restored to the level just prior to the Audio Volume Attenuation event or to the next highest Audio Volume Attenuation level if another attenuation request is active.
- If the user adjusts the volume during a partial Audio Volume Attenuation or Audio Volume Restoration event, the Audio Volume Attenuation or Audio Volume Restoration shall be cancelled and the volume level shall follow the user adjustment, except as noted above for a full mute attenuation.
- The Volume Setting Server shall meet the Audio Volume Restoration requirements when transitioning to a new attenuation level.



Attenuation Level	Volume Step
Attenuation 0	No Attenuation
Attenuation 1	18
Attenuation 2	15
Attenuation 3	13
Attenuation 4	12
Attenuation 5	5
Attenuation 6	Full Mute
Unknown	No Attenuation

**Audio Volume Restoration**

When an Audio Volume Attenuation changes to a less restrictive audio attenuation level, the Volume Setting Server shall restore the volume level as defined in SPSS requirement "VOL-FUR-REQ-352882-Volume Attenuation / Restoration – variant 2".

**Audio Volume Attenuation Fault Conditions**

If the above signal is not received for 5 seconds or the signal state is set to 0x7 (Unknown), the Volume Setting Server shall default to a "No Attenuation" condition.

**Note about Captains Announcement and In Car Communication**

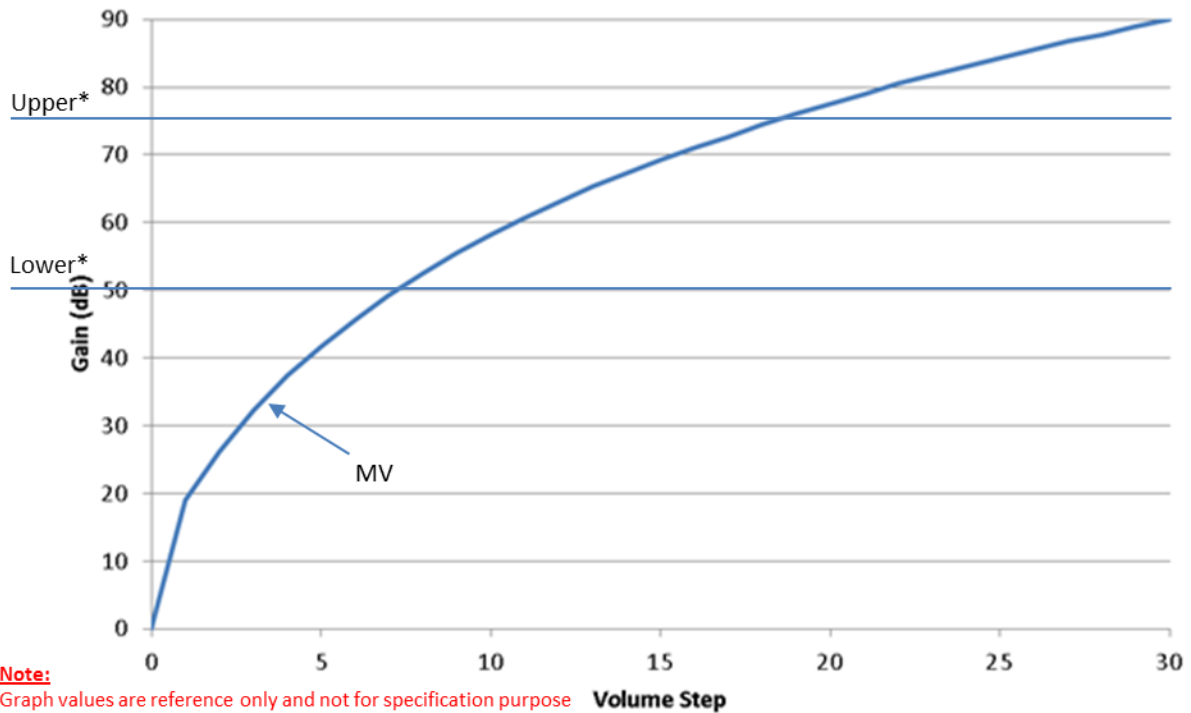
For the requirements above when the PAC/DSP AMP modules do Captains Announcement and In Car Communication then in that case the PAC/DSP AMP is considered the Volume Settings Server only for those two features and shall do the audio attenuation based on the Attn\_Info\_Audio signal(s) it receives.

- Note: above doesn't apply if the APIM Phoenix Domain Controller generates the Captains Announcement and In Car Communication in a future architecture. Above only applies what Captains Announcement and ICC audio comes from the PAC (Phoenix Audio Controller)/DSP AMP

For Captain's Announcement and In Car Communication, the PAC/DSP AMP modules shall apply Attenuation 6 when requested. The attenuation behavior for the other attenuation levels will be defined later and is currently **TBD**.

**2.5.5 VOLv3-FUR-REQ-412192/A-User Volume and Audio Settings Behavior**

**The Volume Settings Server shall follow the following volume requirements:**



\* The limits for all feature volumes are:  
Upper = 18  
Lower = 7

**Definitions:**

M.V. = Media volume

M.V.<sub>Atten</sub> = The last level of the Media Volume before an attenuation event.

F.V. = Feature volume during event (see list of Feature Events below in the Static Rules chart)

F.V.<sub>stored</sub> = stored Feature volume in memory (initially set at the battery connection as a default value)

Upper = Upper Feature Volume border

Lower = Lower Feature Volume border

Static rules = rules when there is no user volume change during the Feature event

Dynamic rules = rules when there is a volume adjustment by a user during the Feature event

- F.V.<sub>stored</sub> Variables shall be independent from each other (separate volume settings in memory).
- The Feature Volume will be stored at the end of every feature event. This setting shall be maintained unless battery disconnect occurs or further user adjustments within the "storable" range occur.
- Feature Volume adjustments outside of the volume borders are possible. However, this volume level shall not be stored.
- Independent of the actual adjusted volume, the stored Feature Volume shall be limited to the borders lower or upper if adjusted outside of the borders.

**Static Rules:**

Feature Event	Behavior
---------------	----------



Call Ring Volume	B
Phone Call Volume	B
Navigation / Prompt Volume (Mix) / Voice Recognition Volume	B
Radio Announcement (ex Traffic Announcement / NEWS / Alarm Volume)	A
Chimes (Mix)	C
Touchscreen Feedback Beep	C

**Dynamic Rules:**

The dynamic rules only apply to adjust the value of F.V.<sub>stored</sub> while a Feature Event is occurring and the user is adjusting the volume. During this time, use these rules to set F.V.<sub>stored</sub> then apply it to the Static Rules.

- IF user adjusts F.V. > Upper, THEN F.V.<sub>stored</sub> = Upper
- IF user adjusts Lower ≤ F.V. ≤ Upper THEN F.V.<sub>stored</sub> = F.V.
- IF user adjusts F.V. < Lower, THEN F.V.<sub>stored</sub> = Lower

**Behaviors****A**

Tied to M.V. per conditions below, adjustable per the dynamic rules

- IF M.V. ≥ F.V.<sub>stored</sub>, THEN F.V. = M.V.
- IF M.V. < F.V.<sub>stored</sub>, THEN F.V. = F.V.<sub>stored</sub>

**B**

For this Feature Event, F.V. = F.V.<sub>Stored</sub>

See "*VOLv2-REQ-412241-Emergency Call Volume Level*" for emergency assist phone volume border. This includes storing the last phone volume level for emergency assist call.

**C**

- a) Chimes are developed and calibrated for each vehicle, follow Alerts SPSS.
- b) Touchscreen Feedback Beep volume tuned during chimes development, follow ALERT-GREQ-014726-Alert Beep Tone – DSP.
  - The only user control is on/off.

**The Audio Settings Server shall follow the following requirements:**

- The audio head unit / DSP AMP must take care of the Speed Sensitive Volume Control while utilizing User Volumes.
- The Bass, Mid, Treble, Balance, Fade, Speed Sensitive Volume or Occupancy mode settings shall not be updated if media is off.
  - An exception is convertible Occupancy mode which is updated in the background regardless if audio is OFF or not.
- Upon entering any of the following modes: VR, Phone, Call Ring, Beeps (Prompt not included because directionality controlled by APIM Phoenix Domain Controller), the bass, treble, mid and balance levels shall each be set to detent and the fade level shall be set to full-front (if AHU / DSP AMP supports fade).
- Upon entering any of the following modes: Radio Announcements (ex TA, News or Alarm) the bass, treble, mid and balance levels shall not change; the fade level shall be set to full-front (if AHU / DSP AMP supports fade).
- Speed Compensated Volume is off in zone mode
- BTMBF is not adjustable in zone mode

**2.5.6 VOLv2-FUR-REQ-412240/A-Emergency Call Volume Setting**

The APIM Phoenix Domain Controller (PDC) shall meet the following Emergency Call Volume requirements when an Emergency Call is in progress:

- The Emergency Call minimum volume border strategy as defined in “[VOL-SR-REQ-014825-Emergency Call Volume Level](#)”) shall be used when the AudioSource.St is set as follows: (SourceType = Priority Assist, SourceTypeStatus = Granted) AND (SourceType = Phone, SourceTypeStatus = Granted). Both are granted concurrently
- Emergency Call Volume adjustments are possible outside the Emergency Phone Volume border(s). However, this Emergency Phone volume shall not be stored. The adjusted Emergency Phone volume shall be stored as phone volume within the phone volume border

**2.5.7 VOLv2-FUR-REQ-412241/A-Emergency Call Volume Level****eCall Phone Volume:**

The emergency phone call volume borders are defined as follows:

min. eCall Phone Volume = Volume-Step 18

max. eCall Phone Volume = Maximum Audio Phone Volume Step

If the last active phone volume was below the min eCall Phone volume then the eCall Phone volume shall be the min eCall Phone Volume.

If the last active phone volume was above the min eCall Phone Volume then the eCall volume shall equal the last phone volume above the min eCall Phone Volume.

Note for eCall this supersedes any other phone volume border requirements.

**eCall Prompt Volume:**

If an emergency call is in progress and emergency Mixable Prompts (see Android priorities for emergency prompt) become active then the eCall prompt volume borders are defined as follows:

min. eCall Prompt Volume = Volume-Step 12

max. eCall Prompt Volume = Maximum Audio Prompt Volume Step

Note: every time a new eCall mixable prompt becomes active during an eCall phone call the prompt volume shall never re-enter playing the new prompt below the min eCall Prompt Volume:





If the last active prompt volume was below the min eCall prompt volume then the eCall prompt volume shall be the min eCall prompt Volume.

If the last active prompt volume was above the min eCall Prompt Volume then the eCall prompt volume shall equal the last prompt volume above the min eCall Prompt Volume.

Note: for eCall this supersedes any other Prompt volume border requirements.

Note2: eCall for this requirement is equivalent to Emergency Assistance called out in the EA SPSS.

#### 2.5.8 VOL-FUR-REQ-412239/A-Zone Mode Volume rules

There shall be a Global Volume controlled by the driver that shall affect all zones. There will be a relative offset for each zone that shall be adjustable. The offset volume applies to all volume settings - Media, Temporary sources, and mixable sources. The volume settings are Media, Temporary sources – e.g. Phone, Radio Announcement (RA), Call ring, and Mixable sources – e.g. Prompt, VR. Non-mixable prompts or VR shall also use the zone mode volume setting for temporary sources. These volume settings are all affected by changes to either the Global Volume or the offset volume.

Upon entering zone mode, the zone volume setting for the Global Volume shall be applied and the cabin mode volume settings shall be stored. When exiting zone mode, the cabin mode volume settings shall be restored.

Upon entering zone mode, the default volume setting shall be applied.

The default volume setting for Global Volume is volume step **TBD**.

The max volume allowed in zone mode is **TBD**

The zone mode volume control settings and gains are described in **REQ-TBD**.

While in zone mode, volume adjustments shall be allowed and maintained until exiting zone mode. Zone mode volume settings shall not be stored between zone mode instances (ex Zone → Cabin → Zone) or power mode cycles (HMI Audio Mode ON → OFF → ON).

Upon entering a Temporary source (Phone, RA, or Call Ring) instance (one of those sources Granted) or Prompt source (Mixable Prompt, VR) instance for any zone, if the Global Volume is lower than the lower volume border, the Temporary or Mixable volume setting for that zone shall go to the lower border setting, but the Media volume for that zone will remain at the Global Volume.

Upon the Driver (ie zone 1) entering a Temporary source (Phone, RA or Call Ring) instance (one of those sources Granted) or Prompt source (mixable prompts, VR) instance, if the Global Volume is higher than the cutback volume setting, then the Global Volume shall go the volume cutback setting and the Temporary or Mixable source shall follow the Global Volume. Upon the Zone 1 returning to Media as the Granted source the volume shall return to the level it was before the volume cutback.

Upon entering a Mixable Prompt instance, the zone volume setting for Media sources shall be attenuated (if there is an attenuation level) to the level specified in “VOLv2-REQ-412097-Volume Attenuation / Restoration – variant 2” if the volume setting is above the attenuation level desired.

The lower volume border for temporary sources and prompts is **TBD**.

The upper cut-back volume when temporary sources or prompts become active for zone 1 (ie the driver) is **TBD**.

The gain settings of the offset volume is as follows:





Logical Signal Name	Literals	Offset Volume gain (relative to Global Volume)
Offset_Vol_Zone	-3	-3 dB
	-2	-2 dB
	-1	-1 dB
	0	0 dB
	+1	+1 dB
	+2	+2 dB
	+3	+3 dB
	Unused	

#### 2.5.9 VOLv3-FUR-REQ-412245/A-Automatic Volume Cutback

**If the target module is on the Netcom bus, the following 4 paragraphs only apply.**

The Volume Settings Server shall support the automatic volume cutback feature as described in the requirements below for Audio Volume. For these requirements, "default" is defined as the volume control setting -15 dB relative to maximum volume ([volume step 18](#)). (Does not apply to "Fixed Line Level")

If the volume is set above the "default" listening level when the infotainment system is powered OFF with HMIAudioMode = OFF and Ignition\_Status = OFF upon subsequent reactivation of the infotainment system with HMIAudioMode = ON, the volume shall return to the default level (note: if requirement "[VOLv3-REQ-412192-User Volume Behavior](#)" has a volume border less than the default volume then use the volume border).

If the volume is set at or below the "default" listening level when the infotainment system is powered OFF with HMIAudioMode = OFF and Ignition\_Status = OFF upon subsequent reactivation of the infotainment system with HMIAudioMode = ON, the volume shall return to the previously set level (not default).

If the audio has been turned off with the <HMI volume on/off> button (audio stack empty with HMIAudioMode = ON) then the volume shall return to the previous level (whether it exceeds the default level or not) when the audio is turned back on with the <HMI volume on/off> button.

**If the target module is not on the Netcom bus, only apply the following portion of this requirement.**



The module shall support the automatic volume cutback feature as described in the requirements below for Audio Volume. For these requirements, "default" is defined as the volume control setting -15 dB relative to maximum volume ([volume step 18](#)).

If the volume is set above the "default" listening level when the module is powered, upon subsequent transition to the operational state, the volume shall return to the default level.

If the volume is set at or below the "default" listening level when the module is powered, upon subsequent transition to the operational state, the volume shall return to the previously set level (not default).

If the audio has been turned off by the component power button and not via the Run/ACC input, then the volume shall return to the previous level (whether it exceeds the default level or not) when the audio is turned back on.

#### 2.5.10 VOL-FUR-REQ-414065/A-Volume Control

The AHU/PAC, PDC, and DSP AMP shall provide the gain characteristics versus volume step control operation shown in the figure below.

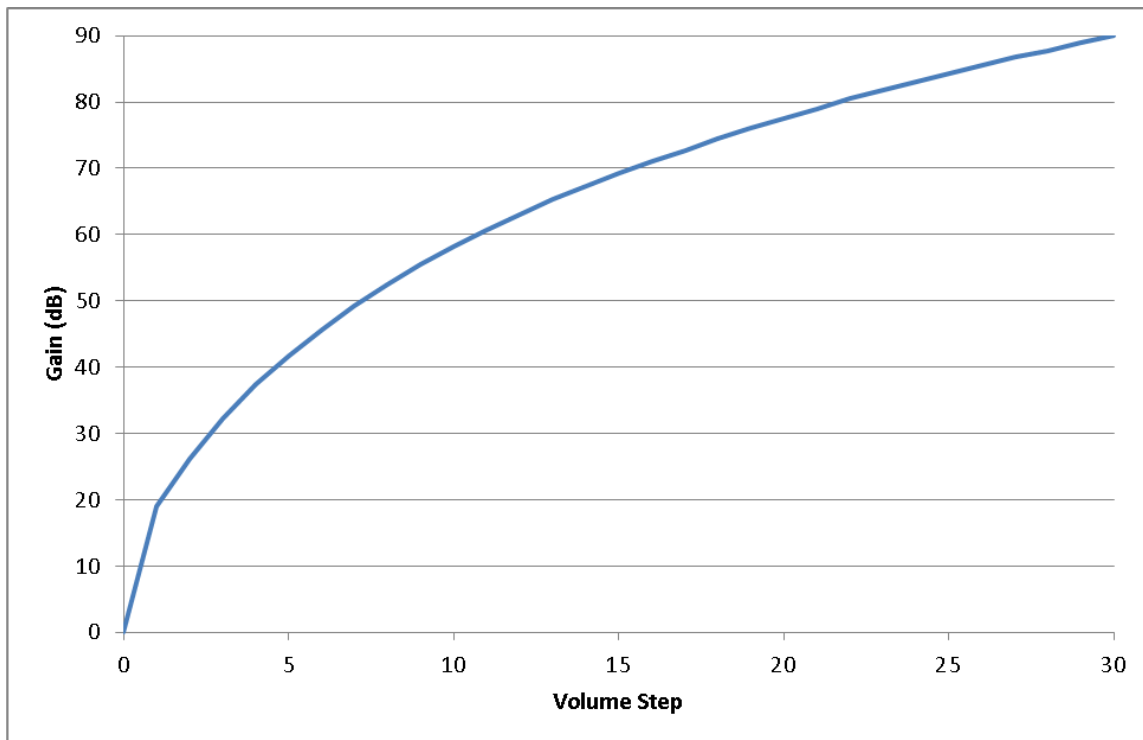


Figure: Volume Control

The AHU/PAC, PDC, and DSP AMP shall provide volume control characteristics as summarized in the table below.



Table: Volume Control Values

Step	Gain at Volume Step	dB Gain at Volume Step	dB Gain Increment
0	0.0000	0.00	0.00
1	0.0003	19.00	19.00
2	0.0006	26.25	7.25
3	0.0013	32.25	6.00
4	0.0024	37.50	5.25
5	0.0039	41.75	4.25
6	0.0061	45.75	4.00
7	0.0092	49.25	3.50
8	0.0133	52.50	3.25
9	0.0188	55.50	3.00
10	0.0259	58.25	2.75
11	0.0345	60.75	2.50
12	0.0447	63.00	2.25
13	0.0579	65.25	2.25
14	0.0729	67.25	2.00
15	0.0917	69.25	2.00
16	0.1122	71.00	1.75
17	0.1372	72.75	1.75
18	0.1679	74.50	1.75
19	0.1995	76.00	1.50
20	0.2371	77.50	1.50
21	0.2818	79.00	1.50
22	0.3350	80.50	1.50
23	0.3868	81.75	1.25
24	0.4467	83.00	1.25
25	0.5158	84.25	1.25
26	0.5957	85.50	1.25
27	0.6879	86.75	1.25
28	0.7718	87.75	1.00
29	0.8913	89.00	1.25
30	1.0000	90.00	1.00

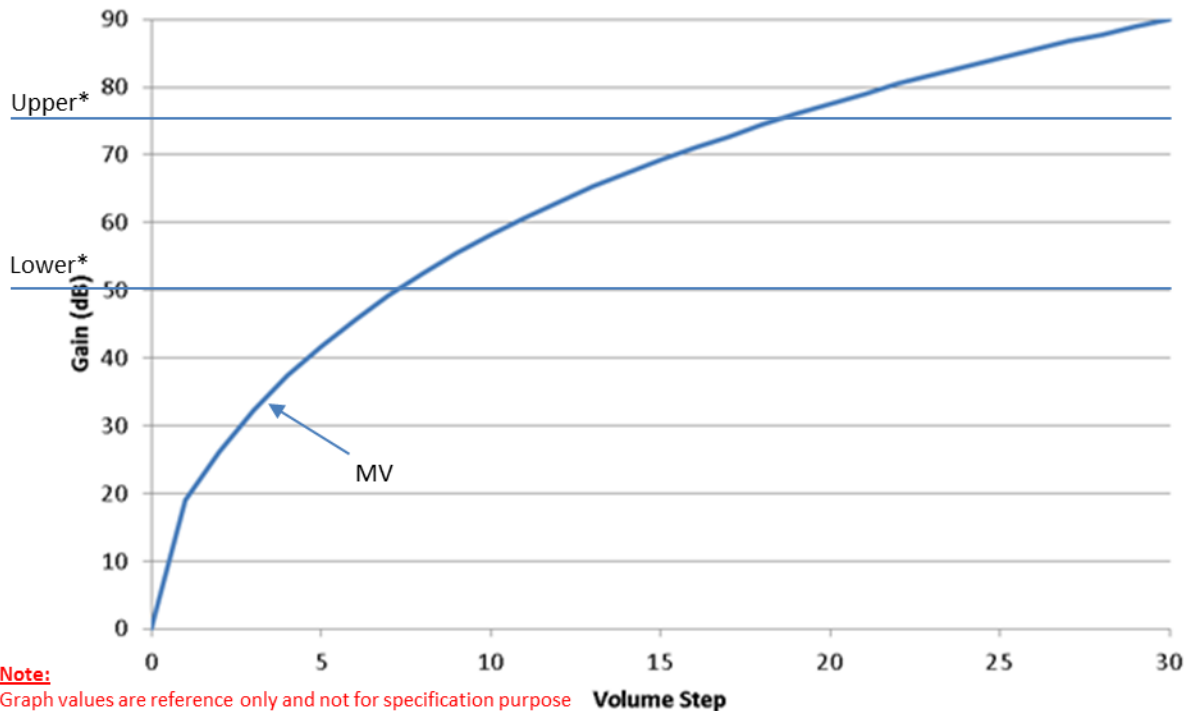
All volume targets shall be met within +/- 1 dB.



## 2.6 VOLv2-CLD-REQ-412244/A-Volume Controller - Functional Requirements

### 2.6.1 VOLv3-FUR-REQ-412192/A-User Volume and Audio Settings Behavior

**The Volume Settings Server shall follow the following volume requirements:**



\* The limits for all feature volumes are:

Upper = 18

Lower = 7

#### **Definitions:**

M.V. = Media volume

M.V.<sub>Atten</sub> = The last level of the Media Volume before an attenuation event.

F.V. = Feature volume during event (see list of Feature Events below in the Static Rules chart)

F.V.<sub>stored</sub> = stored Feature volume in memory (initially set at the battery connection as a default value)

Upper = Upper Feature Volume border

Lower = Lower Feature Volume border

Static rules = rules when there is no user volume change during the Feature event

Dynamic rules = rules when there is a volume adjustment by a user during the Feature event

- F.V.<sub>stored</sub> variables shall be independent from each other (separate volume settings in memory).
- The Feature Volume will be stored at the end of every feature event. This setting shall be maintained unless battery disconnect occurs or further user adjustments within the "storable" range occur.
- Feature Volume adjustments outside of the volume borders are possible. However, this volume level shall not be stored.



- Independent of the actual adjusted volume, the stored Feature Volume shall be limited to the borders lower or upper if adjusted outside of the borders.

**Static Rules:**

Feature Event	Behavior
Call Ring Volume	B
Phone Call Volume	B
Navigation / Prompt Volume (Mix) / Voice Recognition Volume	B
Radio Announcement (ex Traffic Announcement / NEWS / Alarm Volume)	A
Chimes (Mix)	C
Touchscreen Feedback Beep	C

**Dynamic Rules:**

The dynamic rules only apply to adjust the value of  $F.V._{stored}$  while a Feature Event is occurring and the user is adjusting the volume. During this time, use these rules to set  $F.V._{stored}$  then apply it to the Static Rules.

- IF user adjusts  $F.V. > Upper$ , THEN  $F.V._{stored} = Upper$
- IF user adjusts  $Lower \leq F.V. \leq Upper$  THEN  $F.V._{stored} = F.V.$
- IF user adjusts  $F.V. < Lower$ , THEN  $F.V._{stored} = Lower$

**Behaviors****A**

Tied to M.V. per conditions below, adjustable per the dynamic rules

- IF  $M.V. \geq F.V._{stored}$ , THEN  $F.V. = M.V.$
- IF  $M.V. < F.V._{stored}$ , THEN  $F.V. = F.V._{stored}$

**B**

For this Feature Event,  $F.V. = F.V._{Stored}$

See "*VOLv2-REQ-412241-Emergency Call Volume Level*" for emergency assist phone volume border. This includes storing the last phone volume level for emergency assist call.

**C**

- a) Chimes are developed and calibrated for each vehicle, follow Alerts SPSS.
- b) Touchscreen Feedback Beep volume tuned during chimes development, follow ALERT-GREQ-014726-Alert Beep Tone – DSP.
  - o The only user control is on/off.

**The Audio Settings Server shall follow the following requirements:**

- The audio head unit / DSP AMP must take care of the Speed Sensitive Volume Control while utilizing User Volumes.
- The Bass, Mid, Treble, Balance, Fade, Speed Sensitive Volume or Occupancy mode settings shall not be updated if media is off.
  - An exception is convertible Occupancy mode which is updated in the background regardless if audio is OFF or not.
- Upon entering any of the following modes: VR, Phone, Call Ring, Beeps (Prompt not included because directionality controlled by APIM Phoenix Domain Controller), the bass, treble, mid and balance levels shall each be set to detent and the fade level shall be set to full-front (if AHU / DSP AMP supports fade).
- Upon entering any of the following modes: Radio Announcements (ex TA, News or Alarm) the bass, treble, mid and balance levels shall not change; the fade level shall be set to full-front (if AHU / DSP AMP supports fade).
- Speed Compensated Volume is off in zone mode
- BTMBF is not adjustable in zone mode

**2.6.2 VOLv3-FUR-REQ-412277/B-Audio Attenuation Mute / Unmute Ramps - variant 3****Audio Attenuation / Mute ramps**

Fade in and fade out of audio sources.

As basic principle any distortions like pop noise must not be audible under every circumstance.

The mute ramp times are dependent of the source to which the user switches and not from the actual source.

The mute attack time for every volume source shall use the fast ramp – mute attack time curve.

The table 1 shows the allocation of the timing and the attenuation of the volume.

The table 2 shows the allocation of the source and the mute ramps.

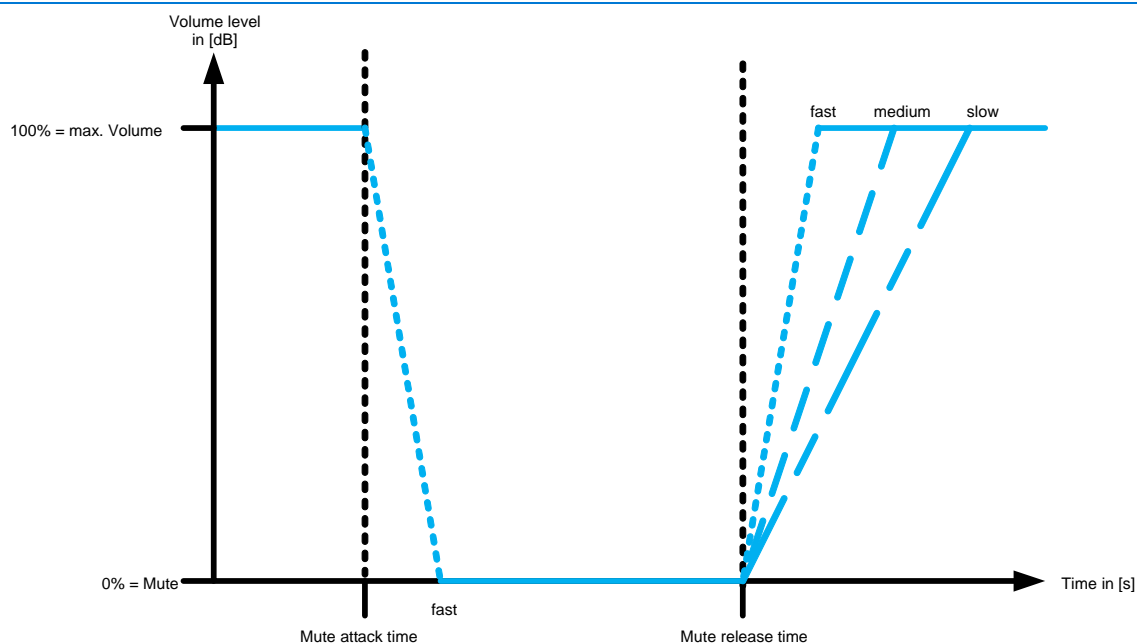
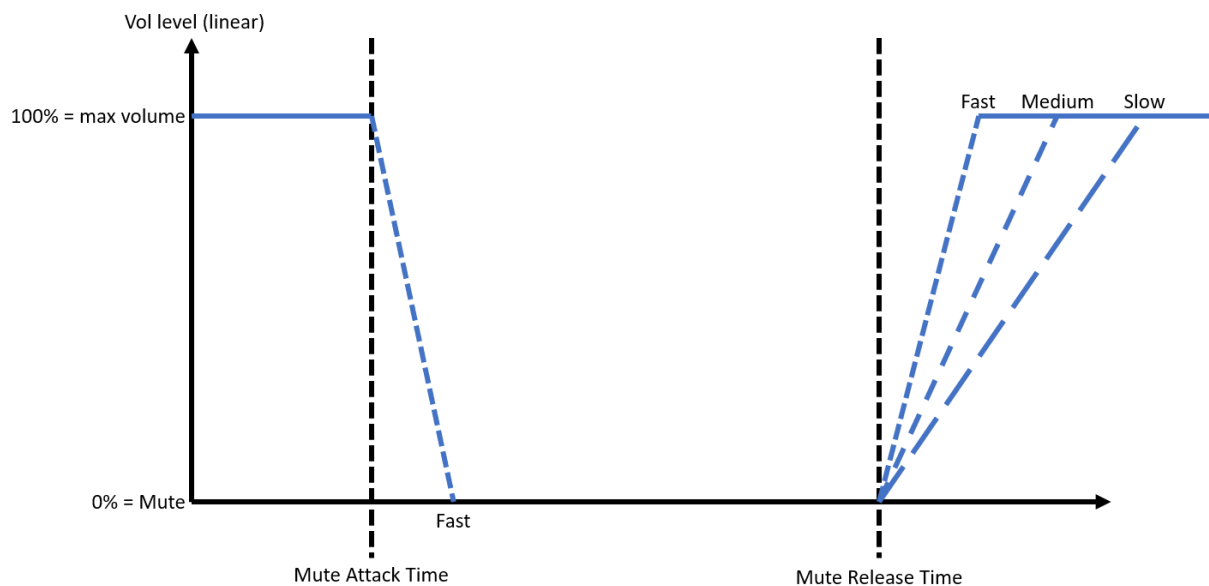
~~The table 3 shows the smoothing timing for volume step increases and decreases.~~

~~The table 3 shows the smoothing timing for volume step changes less than 10 dB.~~

~~The table 4 shows the smoothing timing for a volume step increase and decrease for changes greater than 10 dB.~~

The values are default values and they must be flexible in 10 ms steps from 0ms to 1000ms for each ramp.

[Mute/Unmute graph](#)



Ramp type	Time volume max. to mute	Time mute to volume max.	Tolerance
Fast ramp – mute attack time	320 ms	N/A	+/- 5ms
Fast ramp – Mute release time	N/A	100 ms	+/- 10ms
Medium ramp	N/A	250 ms	+/- 10ms
Slow ramp	N/A	450 ms	+/- 10ms

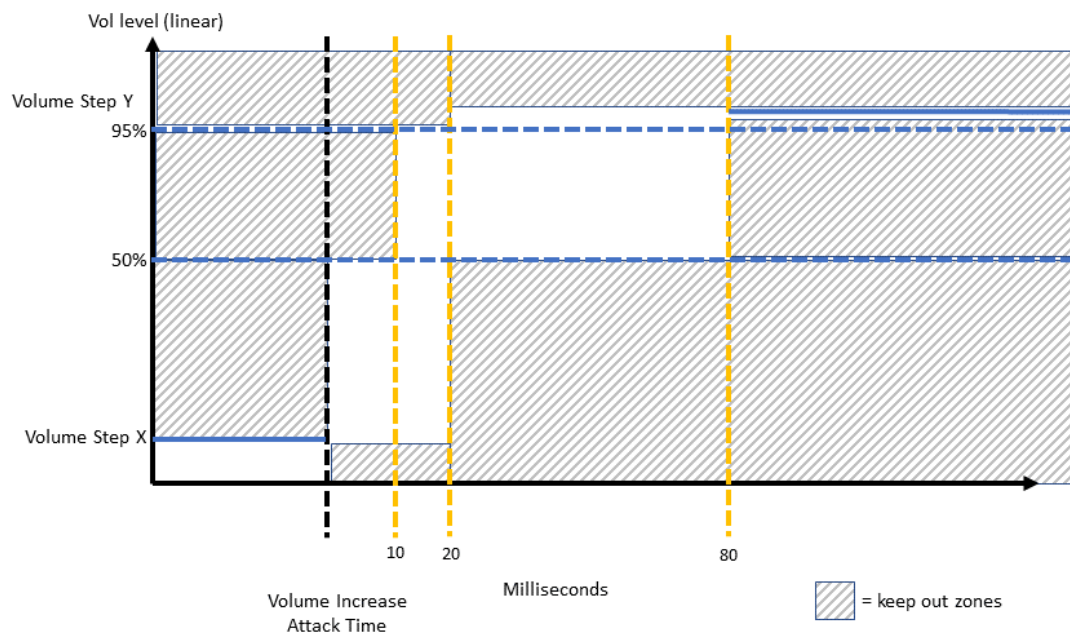
Table 1

Audio source	Initiation	Mute Release Time – Ramp Type
Voice	Start of the new audio content	Fast ramp
Phone	Start of the new audio content	Medium ramp
Chimes <sup>1 2</sup>	Start of the new audio content	Fast ramp

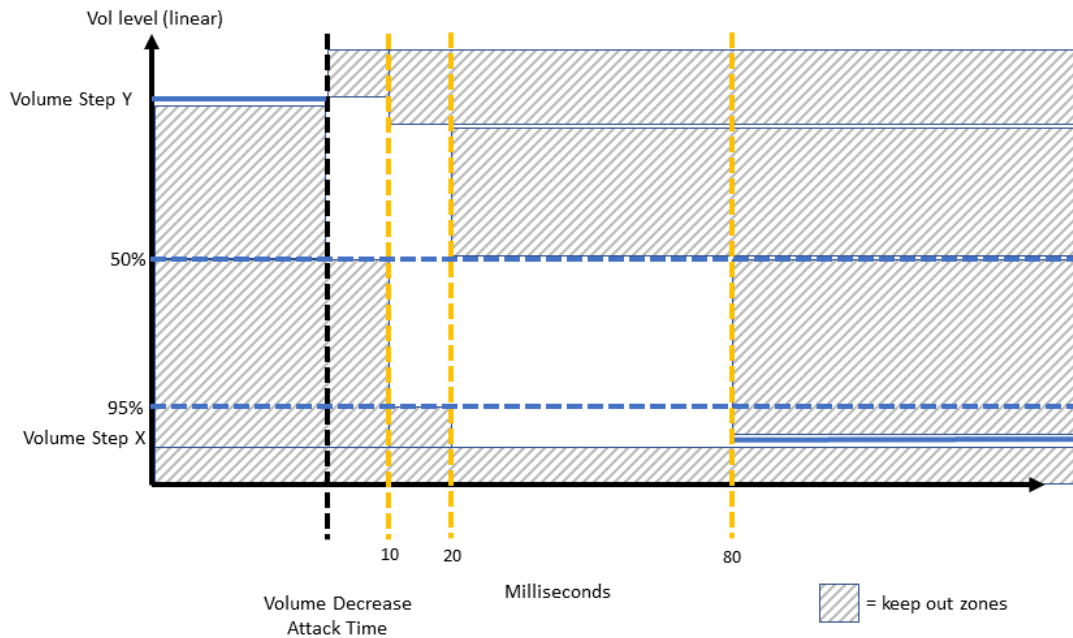


Audio source	Initiation	Mute Release Time – Ramp Type
Mixable prompts <sup>1</sup>	Start of the new audio content	Fast ramp
Radio Announcements (TA, News Alarm)	Start of the new audio content	Medium ramp
Analogue radio sources (AM/FM)	Start of the new audio content	Slow ramp
Digital radio sources (DAB, Sirius,...)	Start of the new audio content	Slow ramp
Media sources (CD, USB,...)	Start of the new audio content	Slow ramp

Table 2

[Note 1: Audio Attenuation unmute event](#)[Note 2: Chime event](#)[Volume event increase \(less than 10 dB\) graph](#)[Volume event decrease \(less than 10 dB\) graph](#)





<u>Volume event (less than 10 dB)</u>	<u>Time to 50% of new value</u>	<u>Time to new value (≥95% of value)</u>
<u>Volume step – decrease</u>	<u>10 – 20 ms</u>	<u>20 – 80 ms</u>
<u>Volume step – increase</u>	<u>10 – 20 ms</u>	<u>20 – 80 ms</u>

<u>Volume event</u>	<u>Ramp Time or Type</u>	<u>Tolerance</u>
<u>Volume step – decrease</u>	<u>20 ms</u>	<u>+/- 5ms</u>
<u>Volume step – increase (less than 10 dB)</u>	<u>20 ms</u>	<u>+/- 5ms</u>
<u>Volume step – increase (greater than 10 dB)</u>	<u>Medium ramp</u>	<u>N/A</u>

Table 3

<u>Volume event (greater than 10 dB)</u>	<u>Time to 50% of new value</u>	<u>Time to new value (≥95% of value)</u>
<u>Volume step – decrease</u>	<u>10 – 20 ms</u>	<u>20 – 80 ms</u>
<u>Volume step – increase</u>	<u>10 – 20 ms</u>	<u>20 – 80 ms</u>
<u>Timing per 10 dB of increase</u>		<u>20 – 80 ms</u>

Table 4**Audio Attenuation unmute event:**

For an Audio Attenuation unmute event the infotainment system shall follow the behavior described in Table 3 for volume step increases.

**Chime event:**

The 'mute ramp' requirement shall be applied to the audio leading into the Chime event, and the audio played after the Chime event. The 'mute ramp' shall not be applied to the Chime waveform itself

**Phoenix Architecture specific muting/unmuting on source changes using mute ramps:**



For an audio source change in the Phoenix distributed system which requires muting/unmuting on both the PDC and AHU/DSP AMP only one module shall perform the Fast, Medium or Slow unmute ramp called out in this requirement.

- The PDC module sending the A2B audio stream shall perform the Fast, Medium and Slow unmute ramps called out in this requirement.
- The AHU/DSP AMP Module receiving the A2B audio stream from the PDC, if muting and unmuting is required for a source change, shall fully unmute within 30 msec from the time the unmuting begins
- If the AHU/DSP AMP module is generating the audio itself and not receiving it from the PDC then the AHU/DSP AMP shall follow the Fast, Medium and Slow unmute ramps called out in this requirement
  - Example: at the time this spec was written (may have changed since then) for the My Seat Space zonal audio system the PAC (ie AHU high end) played rear zone Bluetooth phone audio without sending the audio to the PDC. In this case the PAC would follow the Fast, Medium or Slow unmute curve since not receiving the A2B audio from the PDC.

General Note:

In the event of a spec conflict related to the timing of an event, this requirement shall not supersede.

### 2.6.3 VOLv2-FUR-REQ-412097/A-Volume Attenuation / Restoration - variant 2

#### **Audio Volume Attenuation**

The Volume Setting Server shall meet the following requirements when supporting an *Attn\_Info\_Audio* audio attenuation event:

- Audio Attenuation for chimes (ex. IPC\_Infotainment : *Attn\_Info\_Audio*) shall apply to the active audio source (media, phone, call ring, VR, Radio Announcements, all zone audio sources), Captains Announcement (see note below), In Car Communication (see note below) and alerts (mixable prompts and beeps). The Chime is not attenuated.
  - Exception: Audio Attenuation for chimes shall not apply to emergency phone call conditions as defined in "Volv2-REQ-412240-Emergency Call Volume Setting".
  - Note: for beeps at a minimum Attenuation 6 shall be supported (full mute). Reference applicable beep attenuation requirements/specifications if Attenuation 1 – Attenuation 5 are supported for beeps.
- Audio Attenuation for mixable prompts shall apply to the active audio source (media, phone, call ring, VR, TA), Captains Announcement, In Car Communication and shall NOT attenuate mixable prompts, chimes and beeps.
  - Exception: Audio Attenuation for prompts shall not apply to emergency phone call conditions as defined in "Volv2-REQ-412240-Emergency Call Volume Setting".
    - Note: for zone mode it shall be determined case by case by the Volume Setting Server if a targeted prompt for a specific zone audio attenuation applies to just that zone or all the vehicle zones
- The audio volume shall only be attenuated if the volume step is above the specified attenuation level in the table below
- The volume shall not be user-adjustable during a Full Mute Audio Volume Attenuation event, unless otherwise noted. Upon exiting a full mute Audio Volume Attenuation event, the volume shall either be restored to the level just prior to the Audio Volume Attenuation event or to the next highest Audio Volume Attenuation level if another attenuation request is active.
- If the volume is NOT user adjusted during an Audio Volume Attenuation event, upon exiting, the volume shall either be restored to the level just prior to the Audio Volume Attenuation event or to the next highest Audio Volume Attenuation level if another attenuation request is active.
- If the user adjusts the volume during a partial Audio Volume Attenuation or Audio Volume Restoration event, the Audio Volume Attenuation or Audio Volume Restoration shall be cancelled and the volume level shall follow the user adjustment, except as noted above for a full mute attenuation.
- The Volume Setting Server shall meet the Audio Volume Restoration requirements when transitioning to a new attenuation level.



Attenuation Level	Volume Step
Attenuation 0	No Attenuation
Attenuation 1	18
Attenuation 2	15
Attenuation 3	13
Attenuation 4	12
Attenuation 5	5
Attenuation 6	Full Mute
Unknown	No Attenuation

**Audio Volume Restoration**

When an Audio Volume Attenuation changes to a less restrictive audio attenuation level, the Volume Setting Server shall restore the volume level as defined in SPSS requirement "VOL-FUR-REQ-352882-Volume Attenuation / Restoration – variant 2".

**Audio Volume Attenuation Fault Conditions**

If the above signal is not received for 5 seconds or the signal state is set to 0x7 (Unknown), the Volume Setting Server shall default to a "No Attenuation" condition.

**Note about Captains Announcement and In Car Communication**

For the requirements above when the PAC/DSP AMP modules do Captains Announcement and In Car Communication then in that case the PAC/DSP AMP is considered the Volume Settings Server only for those two features and shall do the audio attenuation based on the Attn\_Info\_Audio signal(s) it receives.

- Note: above doesn't apply if the APIM Phoenix Domain Controller generates the Captains Announcement and In Car Communication in a future architecture. Above only applies what Captains Announcement and ICC audio comes from the PAC (Phoenix Audio Controller)/DSP AMP

For Captain's Announcement and In Car Communication, the PAC/DSP AMP modules shall apply Attenuation 6 when requested. The attenuation behavior for the other attenuation levels will be defined later and is currently **TBD**.



#### 2.6.4 VOL-FUR-REQ-414065/A-Volume Control

The AHU/PAC, PDC, and DSP AMP shall provide the gain characteristics versus volume step control operation shown in the figure below.

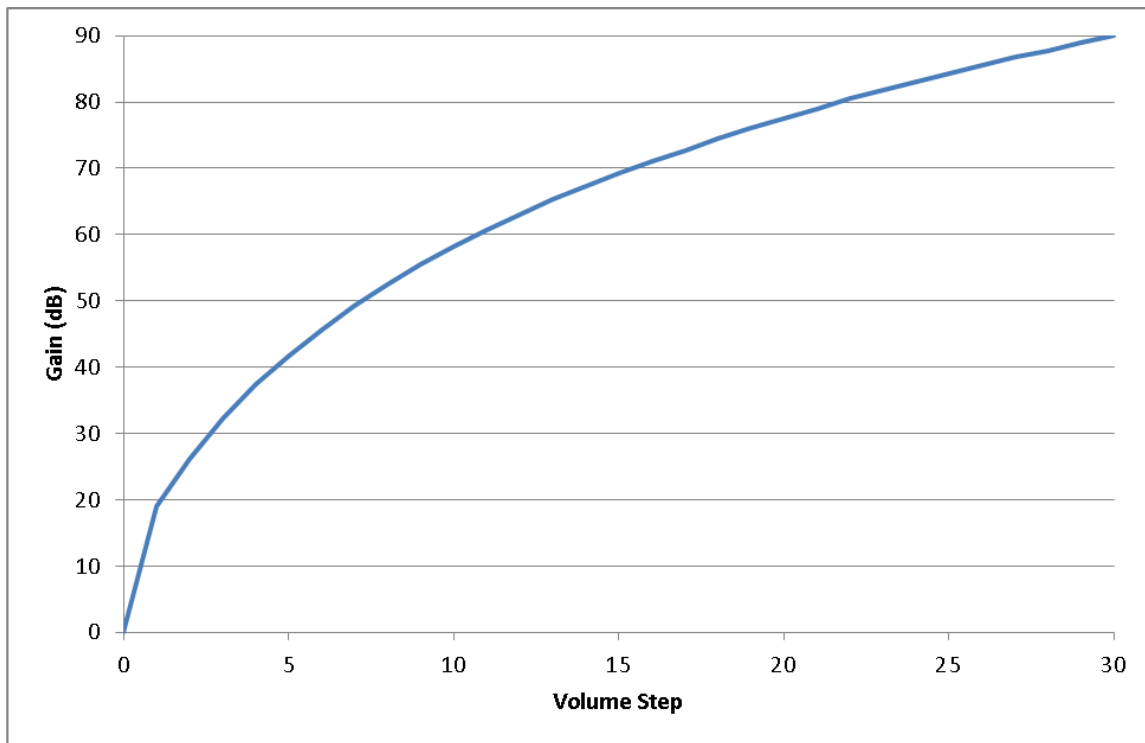


Figure: Volume Control

The AHU/PAC, PDC, and DSP AMP shall provide volume control characteristics as summarized in the table below.



Table: Volume Control Values

Step	Gain at Volume Step	dB Gain at Volume Step	dB Gain Increment
0	0.0000	0.00	0.00
1	0.0003	19.00	19.00
2	0.0006	26.25	7.25
3	0.0013	32.25	6.00
4	0.0024	37.50	5.25
5	0.0039	41.75	4.25
6	0.0061	45.75	4.00
7	0.0092	49.25	3.50
8	0.0133	52.50	3.25
9	0.0188	55.50	3.00
10	0.0259	58.25	2.75
11	0.0345	60.75	2.50
12	0.0447	63.00	2.25
13	0.0579	65.25	2.25
14	0.0729	67.25	2.00
15	0.0917	69.25	2.00
16	0.1122	71.00	1.75
17	0.1372	72.75	1.75
18	0.1679	74.50	1.75
19	0.1995	76.00	1.50
20	0.2371	77.50	1.50
21	0.2818	79.00	1.50
22	0.3350	80.50	1.50
23	0.3868	81.75	1.25
24	0.4467	83.00	1.25
25	0.5158	84.25	1.25
26	0.5957	85.50	1.25
27	0.6879	86.75	1.25
28	0.7718	87.75	1.00
29	0.8913	89.00	1.25
30	1.0000	90.00	1.00

All volume targets shall be met within +/- 1 dB.



## 2.7 Logical to Physical mapping

### 2.7.1 VOL-SR-REQ-452697/A-Logical to Physical CAN signal mapping - Volume (Phoenix)

This CAN signal mapping table below maps the Volume logical signals to the physical CAN signals.

Note: This is for reference only. If there is a conflict between the name in the CAN signal name column and what is found in the actual CAN dB then the CAN dB takes precedent. Please bring to Ford's attention if there is a conflict.

Signals Grouped	Logical Signal Name	CAN signal name	Comments
N/A	SetVolume (carryover) – rotary knob	SetVolume (EFP) RACM_SetVolume	APIM PDC receives these
N/A	SetVolume	DISP_SetVolume_Rq	APIM PDC transmits to TCU only
N/A	SetVolume (LIN) – (carryover) – rotary knob	N/A – see LIN dB	APIM Receives
Grouped together	SWC Volume (carryover) – volume push button	ICl_BtnID_A ICl_BtnID_B ICl_BtnID_C ICl_BtnID_D ICl_Coding_BtnID_A ICl_Coding_BtnID_B ICl_Coding_BtnID_C ICl_Coding_BtnID_D	
Grouped	SHC Volume - Volume push button	StewSwTchPrim_D_Stat StewSwTchPrimPos_D_St	
Grouped	SHC Volume - Volume push button	StewSwTchScnd_D_Stat StewSwTchScndPos_D_St	
Grouped	SHC Volume - Volume push button	ButtonID ButtonActivationStat  Note: not CAN signals	VIP sends to CCPU internal to PDC. See input translation matrix
Grouped together	Audio_Vol_Level	CabnMedVolLvl_D_Stat	Need to be in the same message PDC Tx
	Audio_Vol_Updated	MedVolUpdt_B_Stat	
N/A	VolCntrl_Audio_Vol_Level	CabnMedVolCtl_D_Stat	PAC Tx
N/A	VolCntrl_Audio_Vol_Level	CabnMedVolCtl_D_Stat2	DSP AMP Tx
Grouped together	Phone_Vol_Level	CabnPhonVolLvl_D_Stat	Need to be in the same message PDC Tx
	Phone_Vol_Updated	PhonVolUpdt_B_Stat	
Grouped together	Prompt_Vol_Level	CabnPrmptVolLvl_D_Stat	Need to be in the same message PDC Tx
	Prompt_Vol_Updated	PrmptVolUpdt_B_Stat	
Grouped together	RA_Vol_Level	CabnRaVolLvl_D_Stat	Need to be in the same message PDC Tx
	RA_Vol_Updated	RaVolUpdt_B_Stat	
N/A	VolCntrl_RA_Vol_Level	CabnRaVolCtl_D_Stat	PAC Tx
N/A	VolCntrl_RA_Vol_Level	CabnRaVolCtl_D_Stat2	DSP Tx
Grouped together	CallRing_Vol_Level	CabnCallRngVolLvl_D_St	Need to be in the same message PDC Tx
	CallRing_Vol_Updated	CallRngVolUpdt_B_Stat	
N/A	ManAudioMute.St	N/A – logically internal to PDC	N/A – logically internal to PDC
	Audio_Vol_Level_Zone1	MedVolLvlZone1_D_Stat	



Grouped together	Audio_Vol_Level_Zone2	MedVolLvlZone2_D_Stat	Need to be in the same message  PDC Tx
	Audio_Vol_Level_Zone3	MedVolLvlZone3_D_Stat	
	Audio_Vol_Level_Zone4	MedVolLvlZone4_D_Stat	
	Audio_Vol_Level_Zone5	MedVolLvlZone5_D_Stat	
	Audio_Vol_Level_Zone6	MedVolLvlZone6_D_Stat	
	Audio_Vol_Zone1_Updated	MedVolUpdtZone1_B_Stat	
	Audio_Vol_Zone2_Updated	MedVolUpdtZone2_B_Stat	
	Audio_Vol_Zone3_Updated	MedVolUpdtZone3_B_Stat	
	Audio_Vol_Zone4_Updated	MedVolUpdtZone4_B_Stat	
	Audio_Vol_Zone5_Updated	MedVolUpdtZone5_B_Stat	
	Audio_Vol_Zone6_Updated	MedVolUpdtZone6_B_Stat	
Grouped together	VolCntlr_Audio_Vol_Level_Zone1	MedVolCtlZone1_D_Stat	Need to be in the same message  PAC Tx
	VolCntlr_Audio_Vol_Level_Zone2	MedVolCtlZone2_D_Stat	
	VolCntlr_Audio_Vol_Level_Zone3	MedVolCtlZone3_D_Stat	
	VolCntlr_Audio_Vol_Level_Zone4	MedVolCtlZone4_D_Stat	
	VolCntlr_Audio_Vol_Level_Zone5	MedVolCtlZone5_D_Stat	
	VolCntlr_Audio_Vol_Level_Zone6	MedVolCtlZone6_D_Stat	
Grouped together	VolCntlr_Audio_Vol_Level_Zone1	MedVolCtlZone1_D_Stat2	Need to be in the same message  DSP AMP Tx
	VolCntlr_Audio_Vol_Level_Zone2	MedVolCtlZone2_D_Stat2	
	VolCntlr_Audio_Vol_Level_Zone3	MedVolCtlZone3_D_Stat2	
	VolCntlr_Audio_Vol_Level_Zone4	MedVolCtlZone4_D_Stat2	
	VolCntlr_Audio_Vol_Level_Zone5	MedVolCtlZone5_D_Stat2	
	VolCntlr_Audio_Vol_Level_Zone6	MedVolCtlZone6_D_Stat2	
Grouped together	Prompt_Vol_Level_Zone1	PrmptVolLvlZone1_D_St	Need to be in the same message  PDC Tx
	Prompt_Vol_Level_Zone2	PrmptVolLvlZone2_D_St	
	Prompt_Vol_Level_Zone3	PrmptVolLvlZone3_D_St	
	Prompt_Vol_Level_Zone4	PrmptVolLvlZone4_D_St	
	Prompt_Vol_Level_Zone5	PrmptVolLvlZone5_D_St	
	Prompt_Vol_Level_Zone6	PrmptVolLvlZone6_D_St	
	Prompt_Vol_Zone1_Updated	PrmptVolUpdtZone1_B_St	
	Prompt_Vol_Zone2_Updated	PrmptVolUpdtZone2_B_St	
	Prompt_Vol_Zone3_Updated	PrmptVolUpdtZone3_B_St	
	Prompt_Vol_Zone4_Updated	PrmptVolUpdtZone4_B_St	
	Prompt_Vol_Zone5_Updated	PrmptVolUpdtZone5_B_St	
	Prompt_Vol_Zone6_Updated	PrmptVolUpdtZone6_B_St	
Grouped together	TempSource_Vol_Level_Zone1	PhonRaVolLvlZone1_D_St	Need to be in the same message  PDC Tx
	TempSource_Vol_Level_Zone2	PhonRaVolLvlZone2_D_St	
	TempSource_Vol_Level_Zone3	PhonRaVolLvlZone3_D_St	
	TempSource_Vol_Level_Zone4	PhonRaVolLvlZone4_D_St	
	TempSource_Vol_Level_Zone5	PhonRaVolLvlZone5_D_St	
	TempSource_Vol_Level_Zone6	PhonRaVolLvlZone6_D_St	
	TempSource_Vol_Zone1_Updated	PhonRaVolUpdtZon1_B_St	
	TempSource_Vol_Zone2_Updated	PhonRaVolUpdtZon2_B_St	
	TempSource_Vol_Zone3_Updated	PhonRaVolUpdtZon3_B_St	
	TempSource_Vol_Zone4_Updated	PhonRaVolUpdtZon4_B_St	
	TempSource_Vol_Zone5_Updated	PhonRaVolUpdtZon5_B_St	
	TempSource_Vol_Zone6_Updated	PhonRaVolUpdtZon6_B_St	
Grouped together	VolCntlr_TempSource_Vol_Level_Zone1	PhonRaVolCtlZone1_D_St	Need to be in the same message  PAC Tx
	VolCntlr_TempSource_Vol_Level_Zone2	PhonRaVolCtlZone2_D_St	
	VolCntlr_TempSource_Vol_Level_Zone3	PhonRaVolCtlZone3_D_St	
	VolCntlr_TempSource_Vol_Level_Zone4	PhonRaVolCtlZone4_D_St	
	VolCntlr_TempSource_Vol_Level_Zone5	PhonRaVolCtlZone5_D_St	
	VolCntlr_TempSource_Vol_Level_Zone6	PhonRaVolCtlZone6_D_St	
Grouped together	VolCntlr_TempSource_Vol_Level_Zone1	PhonRaVolCtlZon1_D_St2	Need to be in the same message
	VolCntlr_TempSource_Vol_Level_Zone2	PhonRaVolCtlZon2_D_St2	
	VolCntlr_TempSource_Vol_Level_Zone3	PhonRaVolCtlZon3_D_St2	





	VolCntlr_TempSource_Vol_Level_Zone4	PhonRaVolCtlZon4_D_St2	DSP AMP Tx
	VolCntlr_TempSource_Vol_Level_Zone5	PhonRaVolCtlZon5_D_St2	
	VolCntlr_TempSource_Vol_Level_Zone6	PhonRaVolCtlZon6_D_St2	
Grouped together	Offset_Vol_Zone1	OffstVolZone1_No_Actl	Need to be in the same message
	Offset_Vol_Zone2	OffstVolZone2_No_Actl	
	Offset_Vol_Zone3	OffstVolZone3_No_Actl	
	Offset_Vol_Zone4	OffstVolZone4_No_Actl	
	Offset_Vol_Zone5	OffstVolZone5_No_Actl	
	Offset_Vol_Zone6	OffstVolZone6_No_Actl	
	Offset_Vol_Zone1_Updated	OffstVolUpdtZone1_B_St	
	Offset_Vol_Zone2_Updated	OffstVolUpdtZone2_B_St	
	Offset_Vol_Zone3_Updated	OffstVolUpdtZone3_B_St	
	Offset_Vol_Zone4_Updated	OffstVolUpdtZone4_B_St	
	Offset_Vol_Zone5_Updated	OffstVolUpdtZone5_B_St	
	Offset_Vol_Zone6_Updated	OffstVolUpdtZone6_B_St	
Grouped together	VolCntlr_Offset_Vol_Zone1	OffstVolCtlZon1_No_Act	Need to be in the same message
	VolCntlr_Offset_Vol_Zone2	OffstVolCtlZon2_No_Act	
	VolCntlr_Offset_Vol_Zone3	OffstVolCtlZon3_No_Act	
	VolCntlr_Offset_Vol_Zone4	OffstVolCtlZon4_No_Act	
	VolCntlr_Offset_Vol_Zone5	OffstVolCtlZon5_No_Act	
	VolCntlr_Offset_Vol_Zone6	OffstVolCtlZon6_No_Act	
Grouped together	VolCntlr_Offset_Vol_Zone1	OffstVolCtlZon1_No_Act2	Need to be in the same message
	VolCntlr_Offset_Vol_Zone2	OffstVolCtlZon2_No_Act2	
	VolCntlr_Offset_Vol_Zone3	OffstVolCtlZon3_No_Act2	
	VolCntlr_Offset_Vol_Zone4	OffstVolCtlZon4_No_Act2	
	VolCntlr_Offset_Vol_Zone5	OffstVolCtlZon5_No_Act2	
	VolCntlr_Offset_Vol_Zone6	OffstVolCtlZon6_No_Act2	

## 2.8 Interface Requirements

### 2.8.1 MD-REQ-275444/B-SetVolume

Message Type: Request

Signal for incrementing / decrementing volume (used with a rotary volume knob)

Logical Signal Name	Literals	Value	Description
SetVolume	-30 steps	0x0	
	-29 steps	0x1	
	-28 steps	0x2	
	...continued		
	-2 steps	0x1C	
	-1 step	0x1D	Decrements volume
	Not Pressed / Inactive	0x1E	
	+1 step	0x1F	Increments volume
	+2 steps	0x20	
	+3 steps	0x21	
	...continued		
	+30 steps	0x3C	



**2.8.2 MD-REQ-276073/A-SetVolume (LIN network only)**

Message Type: Request

LIN signal (as opposed to CAN) for incrementing / decrementing volume (used with a rotary volume knob)

Logical Signal Name	Literals	Value	Description
SetVolume (LIN network only)	-7 steps	0x0	
	-6 steps	0x1	
	-5 steps	0x2	
	cont.		
	-2 steps	0x5	
	-1 steps	0x6	Decrements volume
	Not Pressed / Inactive	0x7	
	+1 steps	0x8	Increments volume
	+2 steps	0x9	
	cont.		
	+5 steps	0xC	
	+6 steps	0xD	
	+7 steps	0xE	

**2.8.3 MD-REQ-411822/A-Audio\_Vol\_Level.St - variant 2**

Message Type: Status

Signal from the Volume Setting Server indicating the volume level for the media sources (ex AM, FM, Aux\_Media...) in cabin mode.

Logical Signal Name	Literals	Value	Description
Audio_Vol_Level	No Volume	0x0	
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

**2.8.4 MD-REQ-411824/A-Audio\_Vol\_Updated - variant 2**

Message Type: Status

Signal from the Volume Settings Server used to indicate if the Audio\_Vol\_Level volume level should be updated on the HMI for media sources (ex AM, FM, Aux\_Media...) in cabin mode.

Logical Signal Name	Literals	Value	Description
Audio_Vol_Updated	No Update	0x0	This signal needs to be in the same message as the Audio_Vol_Level.St signal.
	Updated	0x1	

**2.8.5 MD-REQ-411821/A-VolCntlr\_Audio\_Vol\_Level.St**

Message Type: Status



This is the signal from the Volume Controller to the Volume Settings Server indicating the volume level for media sources (ex AM, FM, Aux\_Media...) in cabin mode.

The Volume Controller updates the VolCntlr\_Audio\_Vol\_Level signal to the value set by the Volume Settings Server in the Audio\_Vol\_Level signal.

Logical Signal Name	Literals	Value	Description
VolCntlr_Audio_Vol_Level	No Volume	0x0	
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

#### 2.8.6 MD-REQ-411837/A-Phone\_Vol\_Level - variant 2

Message Type: Status

Signal from the Volume Setting Server indicating the volume level for the Phone source in cabin mode.

Logical Signal Name	Literals	Value	Description
Phone_Vol_Level	No Volume	0x0	
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

#### 2.8.7 MD-REQ-411839/A-Phone\_Vol\_Updated - variant 2

Message Type: Status

Signal from the Volume Settings Server used to indicate the Phone\_Vol\_Level volume level should be updated on the HMI for phone in cabin mode

Logical Signal Name	Literals	Value	Description
Phone_Vol_Updated	No Update	0x0	This signal needs to be in the same message as the Phone_Vol_Level.St signal.
	Updated	0x1	

#### 2.8.8 MD-REQ-411841/A-Prompt\_Vol\_Level - variant 2

Message Type: Status

Signal from the Volume Setting Server indicating the volume level for the mixable prompt and VR source in cabin mode.

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Level	No Volume	0x0	
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

**2.8.9 MD-REQ-411843/A-Prompt\_Vol\_Updated - variant 2****Message Type:** Status

Signal from the Volume Settings Server used to indicate the Prompt\_Vol\_Level volume level should be updated on the HMI for mixable prompts or VR in cabin mode.

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Updated	No Update	0x0	This signal needs to be in the same message as the Prompt_Vol_Level.St signal.
	Updated	0x1	

**2.8.10 MD-REQ-411846/A-RA\_Vol\_Level - variant 2****Message Type:** Status

Signal from the Volume Setting Server indicating the volume level for the Radio Announcement source (ie TA, News, Alarm...) in cabin mode.

Logical Signal Name	Literals	Value	Description
RA_Vol_Level	No Volume	0x0	
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

**2.8.11 MD-REQ-411845/A-RA\_Vol\_Updated - variant 2****Message Type:** Status

Signal from the Volume Settings Server used to indicate the RA\_Vol\_Level volume level should be updated on the HMI for Radio Announcement (ie TA, News, Alarm...) in cabin mode.

Logical Signal Name	Literals	Value	Description
RA_Vol_Updated	No Update	0x0	This signal needs to be in the same message as the RA_Vol_Level.St signal.
	Updated	0x1	

**2.8.12 MD-REQ-413539/A-VolCntlr\_RA\_Vol\_Level****Message Type:** Status

This is the signal from the Volume Controller to the Volume Settings Server indicating the volume level for Radio Announcement source (ie TA, News, Alarm...) in cabin mode.

The Volume Controller updates the VolCntlr\_RA\_Vol\_Level signal to the value set by the Volume Settings Server in the RA\_Vol\_Level signal.

Logical Signal Name	Literals	Value	Description
VolCntlr_RA_Vol_Level	No Volume	0x0	
	Vol_Step1	0x1	
	Vol_Step2	0x2	



	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

**2.8.13 MD-REQ-411848/A-CallRing\_Vol\_Level****Message Type:** Status

Signal from the Volume Setting Server indicating the volume level for the Call Ring source in cabin mode.

Logical Signal Name	Literals	Value	Description
CallRing_Vol_Level	No Volume	0x0	
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

**2.8.14 MD-REQ-411850/A-CallRing\_Vol\_Updated****Message Type:** Status

Signal from the Volume Settings Server used to indicate the CallRing\_Vol\_Level volume level should be updated on the HMI in cabin mode.

Logical Signal Name	Literals	Value	Description
CallRing_Vol_Updated	No Update	0x0	This signal needs to be in the same message as the CallRing_Vol_Level.St signal.
	Updated	0x1	

**2.8.15 MD-REQ-411879/A-ManualAudioMute****Message Type:** Status

Signal from the Volume Setting Server indicating manual audio mute is active and audio is muted.

Logical Signal Name	Literals	Value	Description
ManAudioMute.St	No Mute	0x0	
	Mute	0x1	

**2.8.16 VOL-IIR-REQ-422935/A-Media Zone Volume signals - Volume Setting Server**

All the signal MD's in this Interface requirement for Audio\_Vol\_Level\_Zone(1 – 6) and Audio\_Vol\_Zone(1-6)\_Updated need to be in the same message.

**2.8.16.1 MD-REQ-423004/A-Audio\_Vol\_Level\_ZoneX****Message Type:** Status



Signals from the Volume Setting Server indicating the Media volume level for the applicable zones. This is only applicable if zone mode is supported.

Logical Signal Name	Literals	Value	Description
Audio_Vol_Level_Zone1	No Volume	0x0	Media volume for zone 1
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
Audio_Vol_Level_Zone2	No Volume	0x0	Media volume for zone 2
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
Audio_Vol_Level_Zone3	No Volume	0x0	Media volume for zone 3
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
Audio_Vol_Level_Zone4	No Volume	0x0	Media volume for zone 4
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
Audio_Vol_Level_Zone5	No Volume	0x0	Media volume for zone 5
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
	No Volume	0x0	Media volume for zone 6
	Vol_Step1	0x1	



Audio_Vol_Level_Zone6	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

**2.8.16.2 MD-REQ-423005/A-Audio\_Vol\_ZoneX\_Updated**

Signals from the Volume Settings Server used to indicate if the Audio\_Vol\_Level\_ZoneX volume level should be updated on the HMI for the applicable zone HMI.

Logical Signal Name	Literals	Value	Description
Audio_Vol_Zone1_Updated	No Update	0x0	Media Volume Updated for zone 1
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Audio_Vol_Zone2_Updated	No Update	0x0	Media Volume Updated for zone 2
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Audio_Vol_Zone3_Updated	No Update	0x0	Media Volume Updated for zone 3
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Audio_Vol_Zone4_Updated	No Update	0x0	Media Volume Updated for zone 4
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Audio_Vol_Zone5_Updated	No Update	0x0	Media Volume Updated for zone 5
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Audio_Vol_Zone6_Updated	No Update	0x0	Media Volume Updated for zone 6
	Updated	0x1	

**2.8.17 VOL-IIR-REQ-422937/A-Media Zone Volume Signals - Volume Controller**

All the signal MD's in this Interface requirement for VolCntlr\_Audio\_Vol\_Level\_Zone(1 – 6) need to be in the same message.

**2.8.17.1 MD-REQ-423006/A-VolCntlr\_Audio\_Vol\_Level\_ZoneX**

Message Type: Status

In zone mode these are the signals from the Volume Controller to the Volume Settings Server indicating the Media volume levels for zone 1 – zone 6. This is only applicable if zone mode is supported.



Logical Signal Name	Literals	Value	Description
VolCntlr_Audio_Vol_Level_Zone1	No Volume	0x0	The Volume Controller updates the VolCntlr_Audio_Vol_Level_Zone1 signal to the value set by the Volume Settings Server in the Audio_Vol_Level_Zone1 signal.
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
VolCntlr_Audio_Vol_Level_Zone2	No Volume	0x0	The Volume Controller updates the VolCntlr_Audio_Vol_Level_Zone2 signal to the value set by the Volume Settings Server in the Audio_Vol_Level_Zone1 signal.
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
VolCntlr_Audio_Vol_Level_Zone3	No Volume	0x0	The Volume Controller updates the VolCntlr_Audio_Vol_Level_Zone3 signal to the value set by the Volume Settings Server in the Audio_Vol_Level_Zone1 signal.
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
VolCntlr_Audio_Vol_Level_Zone4	No Volume	0x0	The Volume Controller updates the VolCntlr_Audio_Vol_Level_Zone4 signal to the value set by the Volume Settings Server in the Audio_Vol_Level_Zone1 signal.
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
VolCntlr_Audio_Vol_Level_Zone5	No Volume	0x0	The Volume Controller updates the VolCntlr_Audio_Vol_Level_Zone5 signal to the value set by the Volume Settings Server in the Audio_Vol_Level_Zone1 signal.
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
VolCntlr_Audio_Vol_Level_Zone6	No Volume	0x0	The Volume Controller updates the VolCntlr_Audio_Vol_Level_Zone6 signal to the value set by the Volume Settings Server in the Audio_Vol_Level_Zone1 signal.
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

**2.8.18 VOL-IIR-REQ-422963/A-Prompt Zone Volume Signals - Volume Setting Server**

All the signal MD's in this Interface requirement for Prompt\_Vol\_Level\_Zone(1 – 6) and Prompt\_Vol\_Zone(1 – 6)\_Updated need to be in the same message.

**2.8.18.1 MD-REQ-423008/A-Prompt\_Vol\_Level\_ZoneX**

**Message Type:** Status

Signal from the Volume Setting Server indicating the volume level for the mixable prompt and VR in zone X.

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Level_Zone1	No Volume	0x0	Prompt Volume for Zone 1
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Level_Zone2	No Volume	0x0	Prompt Volume for Zone 2
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Level_Zone3	No Volume	0x0	Prompt Volume for Zone 3
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Level_Zone4	No Volume	0x0	Prompt Volume for Zone 4
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Level_Zone5	No Volume	0x0	Prompt Volume for Zone 5
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	





	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Level_Zone6	No Volume	0x0	Prompt Volume for Zone 6
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

**2.8.18.2 MD-REQ-423009/A-Prompt\_Vol\_ZoneX\_Updated****Message Type:** Status

Signal from the Volume Settings Server used to indicate if the Prompt\_Vol\_Level\_ZoneX volume level should be updated on the HMI for zone X.

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Zone1_Updated	No Update	0x0	Prompt Volume Updated for Zone 1.
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Zone2_Updated	No Update	0x0	Prompt Volume Updated for Zone 2.
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Zone3_Updated	No Update	0x0	Prompt Volume Updated for Zone 3.
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Zone4_Updated	No Update	0x0	Prompt Volume Updated for Zone 4.
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Zone5_Updated	No Update	0x0	Prompt Volume Updated for Zone 5.
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Prompt_Vol_Zone6_Updated	No Update	0x0	Prompt Volume Updated for Zone 6.
	Updated	0x1	

**2.8.19 VOL-IIR-REQ-422975/A-Transient Zone Volume Signals (Phone, Call Ring, Radio Announcement) - Volume Setting Server**

All the signal MD's in this Interface requirement for TempSource\_Vol\_Level\_Zone(1 – 6) and TempSource\_Vol\_Zone(1-6)\_Updated need to be in the same message.

**2.8.19.1 MD-REQ-423021/A-TempSource\_Vol\_Level\_ZoneX**

**Message Type:** Status

Signals from the Volume Setting Server indicating the Temporary Source (ie Phone, Call Ring, Radio Announcement) volume level for the applicable zones. This is only applicable if zone mode is supported.

Logical Signal Name	Literals	Value	Description
TempSource_Vol_Level_Zone1	No Volume	0x0	Temporary Source volume for zone 1
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
TempSource_Vol_Level_Zone2	No Volume	0x0	Temporary Source volume for zone 2
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
TempSource_Vol_Level_Zone3	No Volume	0x0	Temporary Source volume for zone 3
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
TempSource_Vol_Level_Zone4	No Volume	0x0	Temporary Source volume for zone 4
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
	No Volume	0x0	Temporary Source volume for zone 6
	Vol_Step1	0x1	



TempSource_Vol_Level_Zone5	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
TempSource_Vol_Level_Zone6	No Volume	0x0	Temporary Source volume for zone 6
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

#### 2.8.19.2 MD-REQ-423023/A-TempSource\_Vol\_ZoneX\_Updated

Signals from the Volume Settings Server used to indicate if the TempSource\_Vol\_Level\_ZoneX volume level (ie Phone, Call Ring and Radio Announcement) should be updated on the HMI for the applicable zone HMI.

Logical Signal Name	Literals	Value	Description
TempSource_Vol_Zone1_Updated	No Update	0x0	Temporarily Source Volume Updated for zone 1
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
TempSource_Vol_Zone2_Updated	No Update	0x0	Temporarily Source Volume Updated for zone 2
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
TempSource_Vol_Zone3_Updated	No Update	0x0	Temporarily Source Volume Updated for zone 3
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
TempSource_Vol_Zone4_Updated	No Update	0x0	Temporarily Source Volume Updated for zone 4
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
TempSource_Vol_Zone5_Updated	No Update	0x0	Temporarily Source Volume Updated for zone 5
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
TempSource_Vol_Zone6_Updated	No Update	0x0	Temporarily Source Volume Updated for zone 6
	Updated	0x1	

**2.8.20 VOL-IIR-REQ-423002/A-Transient Zone Volume Signals (Phone, Call Ring, Radio Announcement) - Volume Controller**

All the signal MD's in this Interface requirement for VolCntlr\_TempSource\_Vol\_Level\_Zone(1 – 6) need to be in the same message.

**2.8.20.1 MD-REQ-423026/A-VolCntlr\_TempSource\_Vol\_Level\_ZoneX**

Message Type: Status

In zone mode these are the signals from the Volume Controller to the Volume Settings Server indicating the Transient volume levels (ie Phone, Call Ring, Radio Announcement) for zone 1 – zone 6. This is only applicable if zone mode is supported.

Logical Signal Name	Literals	Value	Description
VolCntlr_TempSource_Vol_Level_Zone1	No Volume	0x0	The Volume Controller updates the VolCntlr_TempSource_Vol_Level_Zone1 signal to the value set by the Volume Settings Server in the TempSource_Vol_Level_Zone1 signal.
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
VolCntlr_TempSource_Vol_Level_Zone2	No Volume	0x0	The Volume Controller updates the VolCntlr_TempSource_Vol_Level_Zone2 signal to the value set by the Volume Settings Server in the TempSource_Vol_Level_Zone2 signal.
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
VolCntlr_TempSource_Vol_Level_Zone3	No Volume	0x0	The Volume Controller updates the VolCntlr_TempSource_Vol_Level_Zone3 signal to the value set by the Volume Settings Server in the TempSource_Vol_Level_Zone3 signal.
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
VolCntlr_TempSource_Vol_Level_Zone4	No Volume	0x0	The Volume Controller updates the VolCntlr_TempSource_Vol_Level_Zone4 signal to the value set by the Volume Settings Server in the TempSource_Vol_Level_Zone4 signal.
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
VolCntlr_TempSource_Vol_Level_Zone5	No Volume	0x0	The Volume Controller updates the VolCntlr_TempSource_Vol_Level_Zone5 signal to the value set by the Volume
	Vol_Step1	0x1	
	Vol_Step2	0x2	



	Vol_Step3	0x3	Settings Server in the TempSource_Vol_Level_Zone5 signal.
	cont.		
	Vol_Step30	0x1E	

Logical Signal Name	Literals	Value	Description
VolCntlr_TempSource_Vol_Level_Zone6	No Volume	0x0	The Volume Controller updates the VolCntlr_TempSource_Vol_Level_Zone6 signal to the value set by the Volume Settings Server in the TempSource_Vol_Level_Zone6 signal.
	Vol_Step1	0x1	
	Vol_Step2	0x2	
	Vol_Step3	0x3	
	cont.		
	Vol_Step30	0x1E	

## 2.8.21 VOL-IIR-REQ-422995/A-Offset Zone Volume Signals - Volume Setting Server

All the signal MD's in this Interface requirement for Offset\_Vol\_Zone(1 – 6) and Offset\_Vol\_Zone(1-6)\_Updated need to be in the same message.

### 2.8.21.1 MD-REQ-423011/A-Offset\_Vol\_ZoneX

**Message Type:** Status

Signal from the Volume Setting Server indicating the offset volume for Zone (1 – 6).

For the signals below 0x3 needs to be the CAN init value

Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone1	-3	0x0	Offset Volume for Zone 1
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	
	+2	0x5	
	+3	0x6	
	Unused	0x7	

Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone2	-3	0x0	Offset Volume for Zone 2
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	
	+2	0x5	
	+3	0x6	
	Unused	0x7	



Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone3	-3	0x0	Offset Volume for Zone3
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	
	+2	0x5	
	+3	0x6	
	Unused	0x7	

Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone4	-3	0x0	Offset Volume for Zone 4
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	
	+2	0x5	
	+3	0x6	
	Unused	0x7	

Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone5	-3	0x0	Offset Volume for Zone 5
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	
	+2	0x5	
	+3	0x6	
	Unused	0x7	

Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone6	-3	0x0	Offset Volume for Zone 6
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	
	+2	0x5	
	+3	0x6	
	Unused	0x7	

**2.8.21.2 MD-REQ-423013/A-Offset\_Vol\_ZoneX\_Updated****Message Type:** Status

Signal from the Volume Settings Server used to indicate if the Offset\_Vol\_ZoneX volume level should be updated on the HMI for zone X.



Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone1_Updated	No Update	0x0	Offset Volume Updated for Zone 1.
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone2_Updated	No Update	0x0	Offset Volume Updated for Zone 2.
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone3_Updated	No Update	0x0	Offset Volume Updated for Zone 3.
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone4_Updated	No Update	0x0	Offset Volume Updated for Zone 4.
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone5_Updated	No Update	0x0	Offset Volume Updated for Zone 5.
	Updated	0x1	

Logical Signal Name	Literals	Value	Description
Offset_Vol_Zone6_Updated	No Update	0x0	Offset Volume Updated for Zone 6.
	Updated	0x1	

## 2.8.22 VOL-IIR-REQ-423003/A-Offset Zone Volume Signals - Volume Controller

All the signal MD's in this Interface requirement for VolCntlr\_Offset\_Vol\_Zone(1 – 6) need to be in the same message.

### 2.8.22.1 MD-REQ-423017/A-VolCntlr\_Offset\_Vol\_ZoneX

Message Type: Status

In zone mode these are the signals from the Volume Controller to the Volume Settings Server indicating the offset volumes for zone 1 – zone 6. This is only applicable if zone mode is supported.

Logical Signal Name	Literals	Value	Description
VolCntlr_Offset_Vol_Zone1	-3	0x0	The Volume Controller updates the VolCntlr_Offset_Vol_Zone1 signal to the value set by the Volume Settings Server in the Offset_Vol_Zone1 signal.
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	
	+2	0x5	
	+3	0x6	
	Unused	0x7	



Logical Signal Name	Literals	Value	Description
VolCntlr_Offset_Vol_Zone2	-3	0x0	The Volume Controller updates the VolCntlr_Offset_Vol_Zone2 signal to the value set by the Volume Settings Server in the Offset_Vol_Zone2 signal.
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	
	+2	0x5	
	+3	0x6	
	Unused	0x7	

Logical Signal Name	Literals	Value	Description
VolCntlr_Offset_Vol_Zone3	-3	0x0	The Volume Controller updates the VolCntlr_Offset_Vol_Zone3 signal to the value set by the Volume Settings Server in the Offset_Vol_Zone3 signal.
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	
	+2	0x5	
	+3	0x6	
	Unused	0x7	

Logical Signal Name	Literals	Value	Description
VolCntlr_Offset_Vol_Zone4	-3	0x0	The Volume Controller updates the VolCntlr_Offset_Vol_Zone4 signal to the value set by the Volume Settings Server in the Offset_Vol_Zone4 signal.
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	
	+2	0x5	
	+3	0x6	
	Unused	0x7	

Logical Signal Name	Literals	Value	Description
VolCntlr_Offset_Vol_Zone5	-3	0x0	The Volume Controller updates the VolCntlr_Offset_Vol_Zone5 signal to the value set by the Volume Settings Server in the Offset_Vol_Zone5 signal.
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	
	+2	0x5	
	+3	0x6	
	Unused	0x7	

Logical Signal Name	Literals	Value	Description
VolCntlr_Offset_Vol_Zone6	-3	0x0	The Volume Controller updates the VolCntlr_Offset_Vol_Zone6 signal to the value set by the Volume Settings Server in the Offset_Vol_Zone6 signal.
	-2	0x1	
	-1	0x2	
	0	0x3	
	+1	0x4	





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	+2	0x5	
	+3	0x6	
	Unused	0x7	



### 3 Functional Definition

#### 3.1 VOLv3-FUN-REQ-411990/A-Volume Control

##### 3.1.1 Use Cases

##### 3.1.1.1 VOLv2-UC-REQ-413540/A-Increase Volume

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is powered ON (ie HMIAudioMode = ON) A volume source is active (ie Media, Prompts (VR or mixable prompts), Phone, Call Ring or TA)
<b>Scenario Description</b>	User selects <Increase Volume> via HMI. The Infotainment System adjusts the volume source volume level HMI indicates the volume level as the volume is being adjusted
<b>Post-conditions</b>	HMI indicates the final volume HMI The infotainment system will operate with updated volume level
<b>Notes</b>	Same logic applies for zone mode for zones that support volume display updates. Driver zone always supports zone volume display updates.

##### 3.1.1.2 VOLv2-UC-REQ-413541/A-Increase Volume - Volume currently set to maximum

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is powered ON (ie HMIAudioMode = ON). A volume source is active (ie Media, Prompts (VR or mixable prompts), Phone, Call Ring or TA). The volume is currently at maximum volume.
<b>Scenario Description</b>	User selects Increase Volume via the HMI
<b>Post-conditions</b>	Volume level remains unchanged HMI Indicates volume level
<b>Notes</b>	Same logic applies for zone mode for zones that support volume display updates. Driver zone always supports zone volume display updates.

##### 3.1.1.3 VOLv2-UC-REQ-413542/A-Decrease Volume

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is powered ON (ie HMIAudioMode = ON) A volume source is active (ie Media, Prompts (VR or mixable prompts), Phone, Call Ring or TA)
<b>Scenario Description</b>	User selects <Decrease Volume> via HMI. The Infotainment System adjusts the volume source volume level HMI indicates the volume level as the volume is being adjusted
<b>Post-conditions</b>	HMI indicates the final volume HMI The infotainment system will operate with updated volume level
<b>Notes</b>	Same logic applies for zone mode for zones that support volume display updates. Driver zone always supports zone volume display updates.

**3.1.1.4 VOLv2-UC-REQ-413543/A-Decrease Volume - Volume currently set to minimum**

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is powered ON (ie HMIAudioMode = ON). A volume source is active (ie Media, Prompts (VR or mixable prompts), Phone, Call Ring or TA). Volume level is currently at minimum volume (no volume).
<b>Scenario Description</b>	User selects <Decrease Volume> via HMI
<b>Post-conditions</b>	Volume Level remains unchanged HMI indicates the volume level
<b>Notes</b>	Same logic applies for zone mode for zones that support volume display updates. Driver zone always supports zone volume display updates.

**3.1.1.5 Use Cases - Zone Mode only****3.1.1.5.1 VOL-UC-REQ-423157/A-Increase Offset Volume - Zone mode only**

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is powered ON (ie HMIAudioMode = ON).  A Media sources is Granted for zone 3 (could apply to any zone) with the Media volume level set to volume level X.  The Offset Volume is set to 0
<b>Scenario Description</b>	User selects <Increase Offset Volume> via HMI to offset value of +2.
<b>Post-conditions</b>	The Media volume increases in zone 3 from Volume Level X to Volume Level X plus a volume offset of +2
<b>Notes</b>	Used Media Volume in this use case but the volume offset would apply just the same if a Temporary Audio source was Granted (ex Phone, Call Ring) or Prompt (ie mixable prompts, VR) was active

**3.1.1.5.2 VOL-UC-REQ-423219/A-Decrease Offset Volume - Zone mode only**

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is powered ON (ie HMIAudioMode = ON).  A Media sources is Granted for zone 4 (could apply to any zone) with the Media volume level set to volume level X.  The Offset Volume is set to 0
<b>Scenario Description</b>	User selects <Increase Offset Volume> via HMI to offset value of -3.
<b>Post-conditions</b>	The Media volume in zone 4 decreases from Volume Level X to Volume Level X minus a volume offset of -3



<b>Notes</b>	Used Media Volume in this use case but the volume offset would apply just the same if a Temporary Audio source was Granted (ex Phone, Call Ring) or Prompt (ie mixable prompts, VR) was active
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### 3.1.1.5.3 VOL-UC-REQ-423159/A-Increase Global Volume - Zone Mode only

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is powered ON (ie HMIAudioMode = ON). The vehicle is in zone mode. The Global Volume is set to volume step X. A Media sources is active for zone 1 (ie driver) playing at Global Volume X. A Media source is active for zone 2 and zone 3 playing at Global Volume X. A Phone call is active for zone 4 for playing at the Global Volume X. <ul style="list-style-type: none"><li>• The phone call is above the phone volume border</li></ul> The Offset Volume for individual zones is a don't care.
<b>Scenario Description</b>	Zone 1 (ie Driver) occupant selects <Increase Global Volume> via HMI to volume step Y.
<b>Post-conditions</b>	The Global Volume is set to volume step Y. The Media source active for zone 1 (ie driver) is playing at Global Volume Y. The Media source active for zone 2 and zone 3 is playing at Global Volume Y. The Phone Call active for zone 4 is playing at Global Volume Y. The Offset volume for individual zones remains unchanged by the Global Volume change.
<b>Notes</b>	

### 3.1.1.5.4 VOL-UC-REQ-425077/A-Decrease Global Volume - Zone Mode only

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is powered ON (ie HMIAudioMode = ON). The vehicle is in zone mode. The Global Volume is set to volume step X. A Media sources is active for zone 1 (ie driver) playing at Global Volume X. A Media source is active for zone 2 and zone 3 playing at Global Volume X. A Phone call is active for zone 4 for playing at the Global Volume X. <ul style="list-style-type: none"><li>• The phone call is above the phone volume border</li></ul> The Offset Volume for individual zones is a don't care.
<b>Scenario Description</b>	Zone 1 (ie Driver) occupant selects <Decrease Global Volume> via HMI to volume step Z.
<b>Post-conditions</b>	The Global Volume is set to volume step Z. The Media source active for zone 1 (ie driver) is playing at Global Volume Z. The Media source active for zone 2 and zone 3 is playing at Global Volume Z. The Phone Call active for zone 4 is playing at Global Volume Z. <ul style="list-style-type: none"><li>• The phone call is still above the phone volume border</li></ul> The Offset volume for individual zones remains unchanged by the Global Volume change.
<b>Notes</b>	

**3.1.1.5.5 VOL-UC-REQ-423217/A-Driver increases temporary audio source volume (Phone, Call Ring, RA, Prompt) - Zone Mode only**

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	<p>Infotainment System is powered ON (ie HMIAudioMode = ON).</p> <p>The vehicle is in zone mode.</p> <p>The Global Volume is set to volume step X.</p> <p>A Media sources is active for zone 1 (ie driver) playing at Global Volume X.</p> <p>A Media source is active for zone 2 and zone 3 playing at Global Volume X.</p> <p>A Phone call is active for zone 4 for playing at the Global Volume X.</p> <ul style="list-style-type: none"><li>The phone call is above the phone volume border</li></ul> <p>The Offset Volume for individual zones is a don't care.</p>
<b>Scenario Description</b>	<p>Zone 1 (ie Driver) get a Phone call at volume level X</p> <ul style="list-style-type: none"><li>Note: if the global volume is below the volume border then the zone 1 phone volume would become active at the volume border</li></ul> <p>Zone 1 (ie Driver) occupant selects &lt;Increase Phone Volume&gt; via HMI to volume step Z.</p>
<b>Post-conditions</b>	<p>The Global Volume remains at volume step X.</p> <p>The Phone source active for zone 1 (ie driver) is playing at Volume Z.</p> <p>The Media source active for zone 2 and zone 3 is playing at Global Volume X.</p> <p>The Phone Call active for zone 4 is playing at Global Volume X.</p> <p>The Offset volume for individual zones remains unchanged by the Global Volume change.</p>
<b>Notes</b>	<p>When the Phone call ends zone 1 (ie Driver) Media audio would be played again at Global Volume X</p> <p>This use case was for Driver phone call but would apply the same to Driver Call Ring, Radio Announcement, VR or mixable prompt. For mixable prompt the drivers media audio might be attenuated.</p>

**3.1.1.5.6 VOL-UC-REQ-425079/A-Volume Border - non-driver temporary audio source (Phone, Call Ring, RA, Prompt) - Zone Mode only**

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	<p>Infotainment System is powered ON (ie HMIAudioMode = ON).</p> <p>The vehicle is in zone mode.</p> <p>The Global Volume is set to volume step 1</p> <p>All the zones have media sources active</p> <p>The Offset Volume for individual zones is a don't care.</p>
<b>Scenario Description</b>	<ol style="list-style-type: none"><li>Zone X (any zone other than zone 1) get a Phone call</li><li>The Global Volume remains at volume step 1.</li><li>Zone X volume is at the volume border for temporary sources (not at global volume)<ul style="list-style-type: none"><li>If a zone other than zone 1 then the only adjustment to the Phone volume would be through the offset volume. The phone volume level couldn't be changed</li></ul></li></ol>



	4. Zone 1 (ie Driver) occupant selects <Increase Global Volume> via HMI to a volume step higher than the volume border for temporary sources.
<b>Post-conditions</b>	All the zones media sources are at the Global Volume  Zone X with the phone call is at the Global Volume  The Offset volume for individual zones remains unchanged by the Global Volume change.
<b>Notes</b>	This use case was for phone for zone X call but would apply the same to Call Ring, Radio Announcement, VR or mixable prompt

#### 3.1.1.5.7 VOL-UC-REQ-425100/A-Volume Cutback - Driver Temporary audio source volume (Phone, Call Ring, RA, Prompts) - Zone Mode only

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is powered ON (ie HMIAudioMode = ON). The vehicle is in zone mode. The Global Volume is set to volume step X (higher than the cutback global volume). A Media sources is active for zone 1 (ie driver) playing at Global Volume X. A Media source is active for zone 2 and zone 3 playing at Global Volume X. A Phone call is active for zone 4 for playing at the Global Volume X. <ul style="list-style-type: none"><li>The phone call is above the phone volume border</li></ul> The Offset Volume for individual zones is a don't care.
<b>Scenario Description</b>	Zone 1 (ie Driver) get a Phone call
<b>Post-conditions</b>	The drivers phone call and the other zones are all at the Volume Cutback volume Y <ul style="list-style-type: none"><li>The driver (ie zone 1) could increase their Phone volume above the Volume Cutback volume level</li></ul> The Offset volume for individual zones remains unchanged by the Global Volume change.
<b>Notes</b>	When the Phone call ends zone 1 (ie Driver) Media audio would be played again at Global Volume X  This use case was for Driver phone call but would apply the same to Driver Call Ring, Radio Announcement, VR or mixable prompt

#### 3.1.1.5.8 VOL-UC-REQ-425131/A-Driver gets a mixable prompt with media audio attenuated - Zone mode only

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is powered ON (ie HMIAudioMode = ON). The vehicle is in zone mode. The Global Volume is set to volume step X. A Media sources is active for zone 1 (ie driver) playing at Global Volume X. A Media source is active for zone 2 and zone 3 playing at Global Volume X. A Phone call is active for zone 4 for playing at the Global Volume X.



	<ul style="list-style-type: none"><li>The phone call is above the phone volume border</li></ul> The Offset Volume for individual zones is a don't care.
<b>Scenario Description</b>	Zone 1 (ie Driver) get a mixable prompt at volume level X with zone 1 Media volume attenuated <ul style="list-style-type: none"><li>Note: if the global volume is below the volume border then the zone 1 prompt volume would become active at the volume border</li></ul> Zone 1 (ie Driver) occupant selects <Increase Prompt Volume> via HMI to volume step Z.
<b>Post-conditions</b>	The Global Volume remains at volume step X. The Prompt source active for zone 1 (ie driver) is playing at Volume Z. The Media source active for zone 1 (ie driver) is playing at an attenuated volume level The Media source active for zone 2 and zone 3 is playing at Global Volume X. The Phone Call active for zone 4 is playing at Global Volume X. The Offset volume for individual zones remains unchanged by the Global Volume change.
<b>Notes</b>	When the Mixable prompt ends zone 1 (ie Driver) Media audio would be played again at Global Volume X

### 3.1.2 Requirements

#### 3.1.2.1 VOLv2-SR-REQ-412368/A-Storage of volume levels by the Volume Settings Server

The Volume Settings Server is responsible for maintaining the last know state of the volume levels for the volume sources (Media, Phone, Call Ring, Prompt, TA) during all modes of operation and transition of power modes.

This applies for both full Cabin Mode and Zone Mode.

#### 3.1.2.2 VOLv2-SR-REQ-412373/A-Volume Settings Server updating its Volume Status signals from the Volume Setting Button Input Client

The Volume Settings Server shall update the signal XXX\_Vol\_Level = volume level and shall set the signal XXX\_Vol\_Updated = Updated within Tvol\_update of the Volume Settings Server receiving the volume button press from the Volume Setting Button Input Client (ex SWC vol button).

The Volume Settings Server shall update the signal XXX\_Vol\_Level = volume level and shall set the signal XXX\_Vol\_Updated = Updated within Tvol\_update of the Volume Settings Server receiving the volume setVolume button press from the Volume Setting Button Input Client (ex CAN EFP or LIN ICP rotary knob, RACM rotary knob).

#### 3.1.2.3 VOL-SR-REQ-423163/A-Zone Mode - Volume Settings Server updating its Volume Status signals from the Volume Settings Button Input Client

The Volume Settings Server shall update the applicable XXX\_Vol\_Level\_Zone1 signal (ie XXX = Audio, Prompt and TempSource) and shall set the signal XXX\_Vol\_Zone1\_Updated = Updated within Tvol\_update of the Volume Settings Server receiving the volume button press from the Volume Setting Button Input Client (ex SWC vol button).

- If Audio\_Vol\_Level\_Zone1 for Media volume is being updated then the Global Volume is being updated and the other zones volume level signals XXX\_Vol\_Level\_Zone(2 – 6) and XXX\_Vol\_Zone(2-6)\_Updated shall be set to the same volume level and Updated respectively if those zones are following the Global Volume Level (there are exceptions, see zone mode volume rules requirements for details)
  - Ex. XXX\_Vol\_Level\_Zone(2-6) includes Audio\_Vol\_Level\_Zone(2-6), Prompt\_Vol\_Level\_Zone(2-6) and TempSource\_Vol\_Level\_Zone(2-6). So XXX also represents Audio, Prompt and TempSource for XXX\_Vol\_Zone(2-6)\_Updated also.





- If TempSource\_Vol\_Level\_Zone1 or Prompt\_Vol\_Level1 is being updated, then the Global Volume is not being updated. See zone mode requirements for details

The Volume Settings Server shall update the applicable XXX\_Vol\_Level\_Zone1 signal (ie XXX = Audio, Prompt and TempSource) and shall set the signal XXX\_Vol\_Level\_Zone1\_Updated = Updated within Tvol\_update of the Volume Settings Server receiving the volume setVolume button press from the Volume Setting Button Input Client (ex CAN EFP or LIN ICP rotary knob).

- If Audio\_Vol\_Level\_Zone1 for Media volume is being updated then the Global Volume is being updated and the other zones volume level signals XXX\_Vol\_Level\_Zone(2 – 6) and XXX\_Vol\_Level\_Zone(2-6)\_Updated shall be set to the same volume level and Updated respectively if those zones are following the Global Volume Level (there are exceptions, see zone mode volume rules requirements for details)
  - Ex. XXX\_Vol\_Level\_Zone(2-6) includes Audio\_Vol\_Level\_Zone(2-6), Prompt\_Vol\_Level\_Zone(2-6) and TempSource\_Vol\_Level\_Zone(2-6). So XXX also represents Audio, Prompt and TempSource for XXX\_Vol\_Level\_Zone(2-6)\_Updated also
- If TempSource\_Vol\_Level\_Zone1 or Prompt\_Vol\_Level1 is being updated, then the Global Volume is not being updated. See zone mode requirements for details

The Volume Settings Server shall update the applicable zone Offset\_Vol\_Level\_Zone(1-6) signal and shall set the signal Offset\_Vol\_Level\_Zone(1-6)\_Updated = Updated within Tvol\_update of the Volume Settings Server receiving the volume button press from the Volume Settings Button Input Client.

- Updating one zones Offset\_Vol\_Level\_Zone(1-6) signal does not impact any other zones Offset\_Vol\_Level\_Zone(1-6) signal.
- Offset\_Vol\_Level\_Zone(1-6) is completely independent from the Global Volume.

#### 3.1.2.4 VOLv2-SR-REQ-412374/A-Volume Display Updates

The HMI Output shall update the display (if applicable per HMI) within Tdisplay\_update of receiving the signal 'XXX\_Vol\_Level\_Zone1\_Updated = Updated'.

The Volume Setting Server should set "XXX\_Vol\_Level\_Zone1\_Updated = No Update" unless there is a requirement specifying "XXX\_Vol\_Level\_Zone1\_Updated = Updated" for a specified volume event or unless it is specified for the Volume Setting Server to update the Volume HMI.

Note: The XXX\_Volume\_Level.St signals should reflect the volume or stored volume level. The XXX\_Volume\_Level.St signals changing would not cause an HMI update and an HMI update would only occur when XXX\_Vol\_Level\_Zone1\_Updated = Updated.

Example using the Vol\_Level\_Zone1\_Updated signal (see HMI for details of what is shown on the HMI):

1. The user had previously turned the Media volume to zero and the Volume Setting Server has the Media\_Volume\_Level.St = 0.
2. While at zero the user turns the volume knob down and the Volume Setting Button Input Client sends SetVolume = -1 volume step (see applicable requirements for details of using setVolume) to the Volume Setting Server. In response the Volume Setting Server leaves unchanged Media\_Volume\_Level.St = 0 but sets Media\_Vol\_Level\_Zone1\_Updated = Updated per SPSS requirement "VOLv2-REQ-412373-Volume Settings Server updating its Volume Status signals from the Volume Settings Button Input Client".
3. The HMI Output displays some sort of minimum volume HMI if applicable.

Note:

- Attn\_Info\_Audio (ex sent for chimes or mixable prompts) there is no requirement to update the signal XXX\_Vol\_Level\_Zone1\_Updated to Updated when attenuating audio. So, in this case the XXX\_Volume\_Level.St would be





attenuated to the lower volume (if was above the attenuation level) but that would not result in XXX\_Vol\_Updated being set to Updated.

- Volume borders there is no requirement to update the XXX\_Vol\_Updated signal to Updated when going to a volume border volume level. So, in this case the XXX\_Volume\_Level.St would go to the applicable volume border level but that would not result in XXX\_Vol\_Updated being set to Updated.

#### Zone Mode:

In this requirement when see “XXX\_Vol\_Updated” signals referenced then if zone mode is supported then the rules above also applies to the zone mode volume updated signals (ie Offset\_Vol\_Zone(1-6)\_Updated = Updated or XXX\_Vol\_Zone(1-6)\_Updated = Updated).

- For the zone mode signals there may or may not be an applicable HMI output for a particular audio zone but signal wise the Volume Settings Server shall follow the rules above for the Offset\_Vol\_Zone(1-6)\_Updated and XXX\_Vol\_Zone(1-6)\_Updated signals.

#### 3.1.2.5 VOLv2-SR-REQ-412437/A-Volume Signal Usage

Note: when reference AudioSource.St message that includes the AudioSourceZoneX.St messages for zone mode, if zone mode applicable.

The Volume Settings Server and Volume Controller (if applicable) shall utilize the AudioSource.St : SourceTypeStatus = Granted (as defined in the Audio Management SPSS) to identify the Active Volume Settings Source for Media, Phone, Call Ring, RA, and Prompt (for VR).

- Note: AudioSource.St : SourceTypeStatus = Granted is only used for Prompt volume when SourceType = VR.

The Volume Controller (if applicable for a certain volume sources) shall adjust its volume to the volume level of the source Granted in the AudioSource.St message and start to unmute as specified in audio management requirement “AUMGNT-REQ-410505-Muting/Unmuting – Audio IO Controller”.

The Volume Settings Server and Volume Controller (if applicable) shall utilize the AudioSource.St MixableCabinPrompts & MixableZonePrompts signals to identify the Prompt Volume Source for mixable prompts.

The Volume Controller (if applicable) shall adjust its prompt volume to the volume level of the mixable zone prompt and start to unmute to play the mixable zone prompt within 50 msec of receiving MixableZonePrompts = Active (from inactive).

- Note: Mixable Cabin Prompts were always unmuted on the audio controller

The Active Volume Setting Source can play its audio through the loud speakers and monitors volume user adjustments for changing the volume level.

Reference Audio Management SPSS requirement “AUMGNT-REQ-410349-Volume Source used for an Active Audio Source” for a list of volume settings sources to be used for a particular setting of the AudioSource.St.

For the Volume Settings Server receiving the SetVolume signal reference:

- For CAN reference requirement “BUTTON-REQ-014707-Receivers of SetVolume Button Presses (CAN)”.
- For LIN reference requirement “BUTTONv2-REQ-096749-Receivers of SetVolume Button presses (LIN)”.

See CAN dB and Input Translation Matrix for volume press sources.

Chimes are independent of the AudioSource.St message and are NOT volume user adjustable.

#### 3.1.2.6 VOL-SR-REQ-292289/A-Volume Press and Hold Error Handling

The receiver of the volume up or volume down button press signal (ex SWCM volume Pressed / Not\_Pressed) shall cancel the volume press and hold feature when:

- A volume button “Pressed” has been on the network without a volume button “Not\_Pressed” for T\_Vol\_RBAP\_Timeout.

OR



- Any volume button press opposite the current volume button press is received (ie volume up vs volume down)
  - Ex. SWC volume Up button is in a volume press and hold state and an EFP rotary volume Down button is set to "Pressed". The SWC volume up press and hold would be cancelled.

When the volume up or a volume down press and hold is cancelled by any of the scenarios in this requirement the receiver of the volume button press signal shall allow the same volume button press or same volume button press and hold function to occur again when:

- The infotainment system has been powered OFF and back ON again
  - Ex. HMIAudioMode = ON when press and hold cancelled and HMIAudioMode went OFF and back ON again

OR

- A Volume button "Not\_Pressed" signal is received for the particular volume signal (ex from SWCM) that previously sent the Volume button Pressed without a Volume button Not\_Pressed.
  - Ex. SWCM volume up press and hold was cancelled because of T\_Vol\_RBAP\_Timeout elapsing without a Volume Up Not\_Press (error on SWCM where didn't send a Not\_Pressed). The user presses the SWCM volume up button again (nothing happens) but when the user releases the SWCM volume up button if this time the SWCM sends a volume up "Not\_Pressed" then the volume button press and volume button press and hold functionality would work on the next volume button press.

Reference requirements:

- VOL-TMR-REQ-292290-T\_Vol\_RBAP\_Timeout
- BUTTON-SR-REQ-014704-Cancelling RBAP

### 3.1.2.7 VOL-TMR-REQ-292290/A-T\_Vol\_RBAP\_Timeout

Name	Description	Units	Range	Resolution	Default
T_Vol_RBAP_Timeout	<p>The time from when a volume button "Pressed" is received without receiving a volume button "Not_Press" before the volume press or press and hold function is cancelled.</p> <p>This is the T_RBAP_Timeout value for cancelling the volume button Receiver Button Activation Process (RBAP) for the volume button in Button SPSS requirement "<u>Button-REQ-014704-Cancelling RBAP</u>"</p> <p>Tolerance for the default value is +/- 100 msec</p> <p>Note: always use the Default Value</p>	msec	5000 - 10000	100	5000

### 3.1.2.8 Zone Mode volume rules for the Volume Setting Server

#### 3.1.2.8.1 VOL-F-REQ-423164/A-Zone Mode - Global Volume and Zone mode volume rules

The Volume Setting Server shall follow all the zone mode rules listed in this requirement:

The Global Volume is the Media volume for the driver when Media source is the Granted source for zone 1. All other zones (2 – 6) shall follow the Global Volume for all the other volume signals unless called out explicitly as an exception otherwise.

In zone mode, when following the Global Volume the signals Audio\_Vol\_Level\_Zone(1-6), Prompt\_Vol\_Level\_Zone(2-6), TempSource\_Vol\_Level\_Zone(2-6) shall all be set to the same value.

- Note above that the zone 1 signals Prompt\_Vol\_Level\_Zone1 and TempSource\_Vol\_Level\_Zone1 were not listed as following the Global Volume.

The volume signals in the same message following the global volume shall all be updated at the same time.

- Ex. If Global volume is being updated and all 6 zones Media volume are following the Global Volume then all 6 Media volume CAN signals shall be updated at the same time (they are all in the same CAN message).

The global volume level does not include the offset volume (ie Offset\_Vol\_Zone(1-6)). The offset volume is allowed to go above and below the Global Volume per zone as called out in requirement "VOL-REQ-412239-Zone Mode Volume Rules". The offset volume for a zone is the same regardless what audio source is Granted



- Ex. If the Offset volume for zone 2 was +3 for a Media source, and then a Phone call becomes Granted for zone 2 then the Offset volume would remain +3 for the Phone call.

### 3.1.2.8.2 VOL-F-REQ-423352/A-Volume levels when a Temporary Source becomes active for Zone 1 (ie Phone, Call Ring, Prompt, Radio Announcement)

The Volume Setting Server shall follow all the zone mode rules listed in this requirement:

When the driver (ie zone 1) gets a non-media Temporary volume source Granted in the AudioSource.St message (ex Phone, Call Ring, Prompt, Radio Announcement) with a non-media temporary source volume (ie Prompt\_Vol\_Level\_Zone1, TempSource\_Vol\_Level\_Zone1) then the starting volume for the temporary source would begin with the Global Volume. The exception is for the lower volume border as defined in “VOL-REQ-412239-Zone Mode Volume Rules”. When the drivers temporary granted source (ex prompts, phone, TA) volume level is adjusted this does not adjust the Global Volume but only the temporary source granted source volume (this volume is not stored). When the Driver (ie zone 1) temporary source is deallocated and Media is Granted again then zone 1 Media volume shall return to the Global volume level before the temporary source became Granted.

- Note: adjusting the volumes above is referring to adjusting the Prompt\_Vol\_Level\_Zone1 or TempSource\_Vol\_Level\_Zone1, it was not referring to adjusting the Offset\_Vol\_Zone1 volume.

While a temporary volume source is Granted (ex Phone, Call Ring, Prompt, Radio Announcement) for the drivers zone the Global Volume remains the same for the other zones as it before the temporary source was granted for the Driver. In other words, Zones 2 – 6 for all audio sources (ie media, temp sources or prompts) those zones shall be following the Global Volume even if zone 1 is not following it because of a Granted temporary audio source. The exception is for Upper Volume Cutback level if it is supported in “VOL-REQ-412239-Zone Mode Volume Rules”.

The Upper Volume Cutback level would reduce the Global Volume to the level defined in “VOL-REQ-412239-Zone Mode Volume Rules” if the Global Volume was above the Global Volume Cutback Level when a non-Media source became Granted for the driver. The Driver and other zones would all go to the Upper Volume Cutback level. The driver could increase their temporary volume source after starting at the Upper Volume Cutback level.

- After the temporary source ended all sources would return to the volume level before the temporary source became active.

When the driver's non-media source is Deallocated and the Media is Granted again then then zone 1 would return to the Global volume level.

Example:

- Pre-condition:
  - Vehicle in zone mode with Media Granted for zone 1.
  - The Global Volume is volume step 11 with volume 11 in all zones
- Event:
  - A prompt in zone 1 becomes Granted at volume step 10 and attenuates the zone 1 Media volume which is now stacked. For this example say zone 1 Media volume goes to volume step 4 when Media is attenuated and stacked.
  - The driver adjusts their prompt volume level and the Prompt\_Vol\_Level\_Zone1 signal is adjusted
  - Zones 2 – 6 still are following the Global Volume Level which is volume step 11
  - The prompt in zone 1 ends
- Post-Condition
  - For zone 1, Prompts are deallocated and Media is Granted again with the Media volume returning to the Global volume level 11

### 3.1.2.8.3 VOL-F-REQ-423353/A-Volume Levels when a Temporary Source becomes Granted for zone 2 - 6 (ie Phone, Call Ring, Prompt, Radio Announcement)

The Volume Setting Server shall follow all the zone mode rules listed in this requirement:

In zone mode, when zone 2 – zone 6 has a temporary source become active the temporary source shall be set to and follow the Global Volume level. The only user volume adjustment allowed specific to that zone is the zone offset volume for that zone.

- The exception to following the Global Volume is if the Global Volume is below the lower volume borders as defined in “VOL-REQ-412239-Zone Mode Volume Rules” and a temporary source become active for zone 2 – zone 6. In this



case the zone 2 – zone 6 shall go to the lower volume border for the temporary audio source. If the Global Volume is adjusted above the lower volume border then the temporary source shall again follow the Global Volume. If the Global Volume is again reduced below the volume border then the Temporary source shall only go down to the lower volume border level. When the Temporary audio source is deallocated and Media becomes Granted again for that zone then the Global Volume level would be followed again.

### **3.1.2.9 Media / Phone / Call Ring / Prompt / Radio Announcement / Zone volume settings**

The Volume Settings Server will have to store multiple volume level settings for different volume sources / prompts and broadcast the volume level status on the Infotainment bus.

Note: Chime volume level strategy is discussed in the Alert SPSS.

#### **3.1.2.9.1 VOLv2-SR-REQ-412672/A-Media Volume**

The Media volume (ex AM / FM / SDARS / DAB / Aux\_Media...) level is indicated via the Volume Settings Server Audio\_Vol\_Level.St() signal.

Refer to the Volume Setting Server component requirements for details on volume level outputs for each volume step.

The Volume Controller shall broadcast the Media volume level outputted to the speakers via the signal VolCntlr\_Audio\_Vol\_Level.St. This signal is only sent to the Volume Settings Server.

#### **3.1.2.9.2 VOLv2-SR-REQ-412737/A-Phone Volume**

The Phone volume level is indicated via the Volume Settings Server Phone\_Vol\_Level.St() signal. Refer to the Volume Settings Server component requirements for details on volume level outputs for each volume step.

#### **3.1.2.9.3 VOLv2-SR-REQ-412739/A-Prompt Volume**

The Prompt volume level is indicated via the Volume Settings Server Prompt\_Vol\_Level.St signal. This signal is used for mixable prompts and VR. Refer to the Volume Setting Server component requirements for details on volume level outputs for each volume step.

#### **3.1.2.9.4 VOLv2-SR-REQ-412740/A-Call Ring**

The Call Ring volume level is indicated via the Volume Settings Server CallRing\_Vol\_Level.St() signal. Refer to the Volume Settings Server component requirements for details on volume level outputs for each volume step.

#### **3.1.2.9.5 VOLv2-SR-REQ-412741/A-RA Volume**

The Radio Announcement (RA) volume level is indicated via the Volume Settings Server RA\_Vol\_Level.St() signal. Refer to the Volume Settings Server component requirements for details on volume level outputs for each volume step.

The Volume Controller shall broadcast the Radio Announcement volume level outputted to the speakers via the signal VolCntlr\_RA\_Vol\_Level.St. This signal is only sent to the Volume Settings Server.

Note: Radio Announcement volume include Traffic Announcements, News, Alarm and other DAB announcements.

#### **3.1.2.9.6 VOL-SR-REQ-412742/A-Zone Volume**

The Media zone volume levels (ie AM / FM / SDARS / DAB / Aux\_Media) are indicated via the Volume Settings Server Audio\_Vol\_Level\_Zone(1 – 6) signals.



The Temporary Sources zone volume levels (ie Phone, Call Ring, Radio Announcement) are indicated via the Volume Settings Server TempSource\_Vol\_Level\_Zone(1 – 6) signals.

The Prompt zone volume levels (ie Mixable Prompts, VR) are indicated via the Volume Settings Server Prompt\_Vol\_Level\_Zone(1 – 6) signals.

The Offset zone volumes are indicated via the Volume Setting Server Offset\_Vol\_Zone(1 – 6) signals.

- The Offset zone volume levels are the offsets from the current volume source (ex Media, Temp Source, Prompt) for a particular zone. The offset volume selection (ex +3) does not change when changing between different audio sources or different volume sources.
  - Example:
    - Pre-condition: Media volume is set to volume level 9 with the Offset volume set at +2.
    - Event: A phone call becomes Granted and the Media is stacked
    - Post-condition: The Phone call with volume level 9 retains the +2 offset volume

See requirement “VOL-REQ-412239-Zone Mode Volume Rules” for the volume rules for each zone.

The Volume Controller shall broadcast the individual zone volume level outputted to the speakers if it is the Volume Controller for a particular volume source via the following signals:

- VolCntlr\_Audio\_Vol\_Level\_Zone(1 – 6) for Media sources (ie AM / FM / SDARS / DAB / Aux\_Media)
- VolCntlr\_TempSource\_Vol\_Level\_Zone(1 – 6) for Temp audio sources (ie Phone, Call Ring, Radio Announcement)
- VolCntlr\_Offset\_Vol\_Zone(1 – 6) for Offset Volume
- See requirement “VOLv2-REQ-412367-Module Deployment and Audio Routing” for what volume sources the Volume Controller is responsible for.

#### 3.1.2.10 VOL-SR-REQ-423093/A-Zone Mode - 4 zone audio system

In a 4 zone audio system the Volume Settings Server shall set zone 3 and zone 5 volume signals to the same volume levels/offset AND set zone 4 and zone 6 volume signals to the same volume levels/offsets.

- The exception is for muting seat zone 5 and seat zone 6. Those volume signals (ex Audio\_Vol\_Level\_Zone5&6) can be set to volume step 0 independent of zone 3 and zone 4 to mute the applicable speakers in those zones for the Granted audio source.

##### Left Hand Drive vehicle

Front of the Vehicle	
Zone 1 – Front Driver	Zone 2 – Front Passenger
Zone 3 – Middle Left Occupant	Zone 4 – Middle Right Occupant
Zone 5 – Rear Left Occupant	Zone 6 – Rear Right Occupant
Rear of the Vehicle	

##### Right Hand Drive vehicle

Front of the Vehicle	
Zone 2 – Front Passenger	Zone 1 – Front Driver
Zone 4 – Middle Left Occupant	Zone 3 – Middle Right Occupant
Zone 6 – Rear Left Occupant	Zone 5 – Rear Right Occupant
Rear of the Vehicle	

**3.1.2.11 VOL-TMR-REQ-014864/C-Tdisplay\_update (TcSE ROIN-39868-1)**

Name	Description	Units	Range	Resolution	Default
Tdisplay_update	Maximum time allowed from when the HMI Output module receives the XXX_Volume_Level message with an update until the new volume level is updated on the display.  Note: use default value	msec	0-1000	10	50

**3.1.2.12 VOLv2-TMR-REQ-421128/A-Tvol\_update**

Name	Description	Units	Range	Resolution	Default
Tvol_update	The maximum time allowed from when the Volume Settings Server receives a request to change volume until the Volume Level Status Message is put on the bus.  Note: use default value	msec			50

**3.1.3 Sequence Diagrams****3.1.3.1 VOLv2-SD-REQ-413552/A-Volume adjustment from Volume Settings Button Input Client to Volume Settings Server**Pre-Condition:

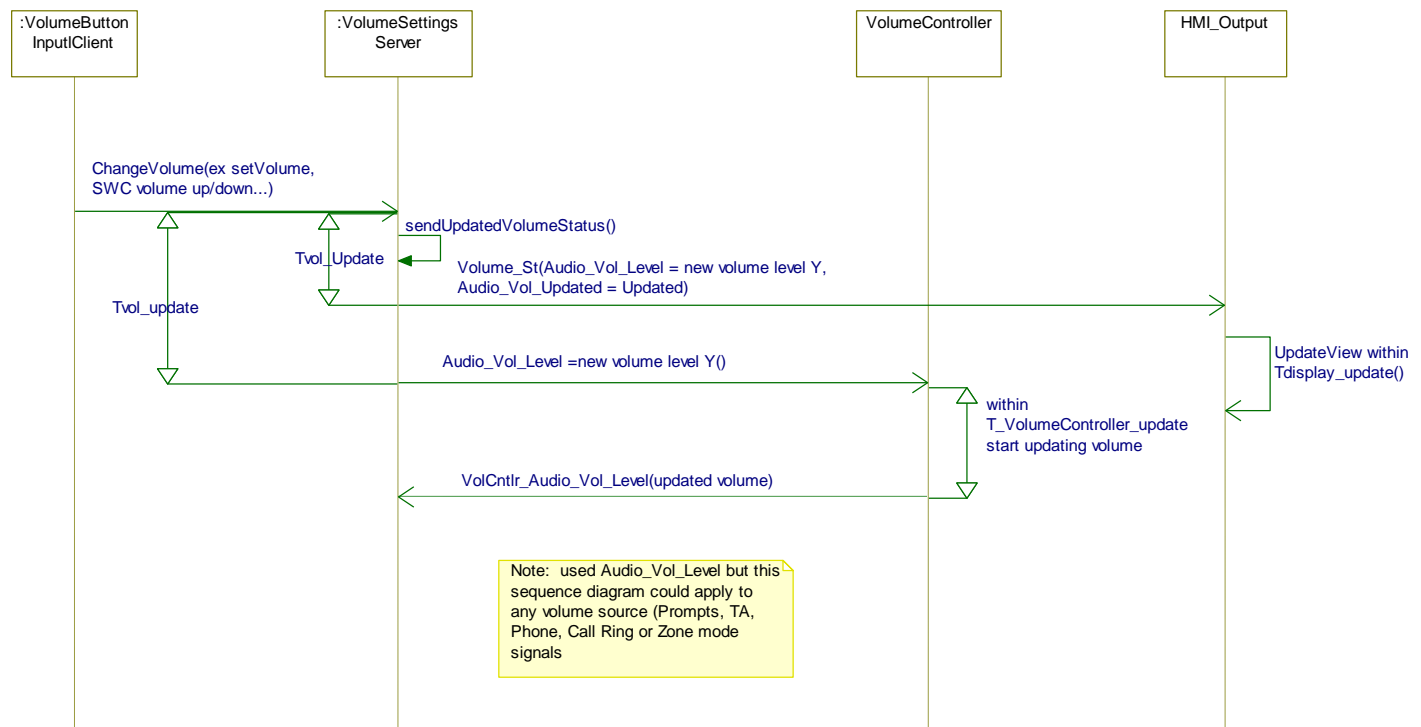
Media volume is at volume level X (ie Audio\_Vol\_Level = Volume Level X)

Event:

User adjusts the volume (ex setVolume rotary knob or SWC volume button press)

Post-Condition:

Adjusted volume level Y heard through the speakers and the volume updated on the display





### 3.1.3.2 VOL-SD-REQ-425051/A-Zone Mode only - Volume Offset adjustment from the Volume Settings Button Input Client to Volume Settings Server

**Pre-condition:**

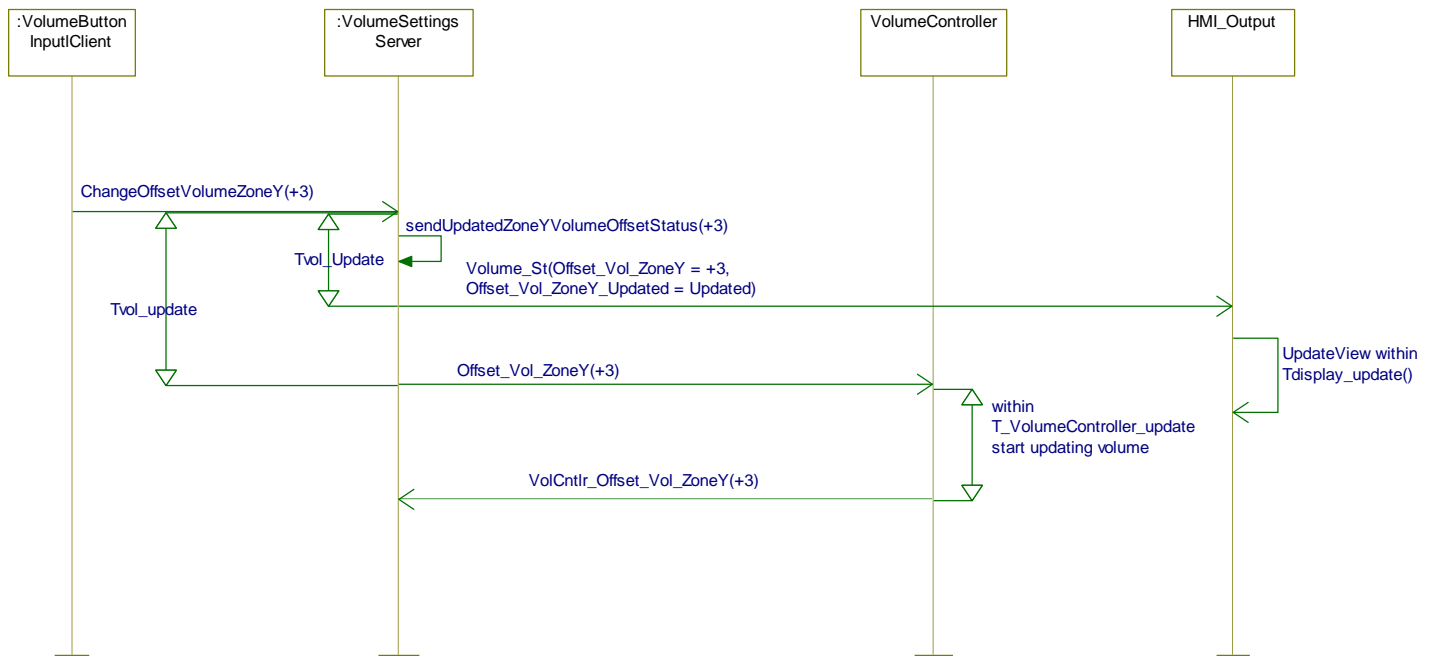
The Offset volume for zone Y is at +2 (ie Offset\_Vol\_ZoneY)

**Event:**

User changes the Offset volume for zone Y to +3

**Post-Condition:**

Adjusted Offset volume of +3 for zone Y is heard through the speakers and the volume is updated on the display (if applicable)







## 3.2 VOL-FUN-REQ-412371/A-Volume Settings Server interface with the Volume Controller

### 3.2.1 Requirements

#### 3.2.1.1 VOLv2-SR-REQ-412797/A-Module that is the Volume Controller when AHU and DSP AMP present

When there is both an AHU and DSP AMP on the vehicle at the same time then the DSP AMP is the Volume Controller. The DSP AMP volume controller signals shall be used by the Volume Settings Server. The AHU volume controller signals shall be treated as don't cares by the Volume Setting Server.

When no DSP AMP is present then the AHU shall be the Volume Controller. The AHU volume controller signals shall be used by the Volume Settings Server.

See requirement "VOL-REQ-412367-Module Deployment and Audio Routing" for details when the AHU/DSP AMP is the Volume Controller for individual volume sources.

#### Note:

- AHU in the volume SPSS applies for both the AHU and PAC (Phoenix Audio Controller). The AHU and PAC are mutually exclusive. If state PAC then it only applies to PAC and not the AHU.

#### 3.2.1.2 VOLv2-REQ-412367/A-Module Deployment and Audio Routing

#### Phoenix Architecture Volume Configuration Table

Volume Source	Source of signal from APIM PDC to Volume Controller	Source of signal from the PAC to Volume Controller	Volume Controller (ex volume gain adjustment)
Media / Radio Announcement (RA) – cabin mode	Fixed amplitude A2B	N/A	DSP AMP when present  AHU when no DSP AMP present
Mixable Prompts (Cabin) / Chimes (non AV) / VR / Beeps	Variable amplitude A2B	N/A	APIM PDC
Phone / Call Ring – Cabin mode	Variable amplitude A2B	N/A	APIM PDC
<u>Zone Mode (driver):</u> Media / RA / Phone / Call Ring from PDC	Fixed amplitude A2B	N/A	DSP AMP
<u>Zone Mode (non-driver zones):</u> Media / RA / Phone / Call Ring from PDC	Fixed amplitude A2B	N/A	DSP AMP
<u>Zone Mode (driver):</u> Target Prompt from PDC	Variable amplitude A2B	N/A	APIM PDC
<u>Zone Mode (non-driver zones):</u> Target Prompt from PDC	Variable amplitude A2B	N/A	APIM PDC
<u>Zone Mode:</u> Bluetooth Media originating from zones 2 - 6	N/A	Fixed amplitude A2B	DSP AMP
<u>Zone Mode:</u> Bluetooth Phone originating from zones 2 - 6	N/A	Fixed amplitude A2B	DSP AMP

Note: for sources such as AM, FM, SDARS, DAB and Radio Announcement these sources originate in the AHU/PAC and send their audio to the APIM PDC. From the APIM PDC the audio is sent to the Audio Controller as specified in the table above.

#### Chimes (Mixable Prompts (Cabin) / Chimes (non AV) / VR / Beeps) audio path muting / unmuting:

For this variable amplitude A2B signal from the PDC for chimes to the AHU/DSP AMP shall *unmute* whenever HMIAudioMode = ON **OR** Power\_Up\_Chime\_Modules = Active. This is true whether in Cabin or Zone mode.





For this variable amplitude A2B signal from the PDC for chimes to the AHU/DSP AMP shall *mute* when HMIAudioMode = OFF **AND** Power\_Up\_Chime\_Modules = Inactive.

### 3.2.1.3 VOL-SR-REQ-412749/A-Volume Settings Server updating Volume Controller volume levels

The Volume Settings Server is responsible for providing the status for what all the volume signals should be set at and providing this information to the Volume Controller.

The Volume Controller shall start updating its volume output and volume status signals (ex VolCntlr\_Audio\_Vol\_Level) to the level in the Volume Settings Servers volume status signals (ex Audio\_Vol\_Level) within T\_VolumeController\_Update of receiving the Volume Settings Servers volume status signals if the source is the Granted active audio source. The Volume Controller shall do this only for the sources it is the Volume Controller for. See requirement "VOLv2-REQ-412367-Module Deployment and Audio Routing" for details.

- Note: the Volume Controller volume status signal might not immediately be at the level in the Volume Settings Server Volume Status signals when following the unmute ramps in requirement "VOLv3-REQ-412277-Audio Attenuation Mute / Unmute Ramps – variant 3". The Volume Controller volume status signals would be updating as the volume was following the unmute ramp.

The Volume Settings Server shall monitor the Volume Controller volume status signals (ex VolCntlr\_Audio\_Vol\_Level) and if the volume level is not what the Volume Setting Server is expecting can take appropriate error handling if need be.

### 3.2.1.4 VOL-SR-REQ-412798/A-Volume Controller storing and acting on the volume status signals

The Volume Controller shall store all the values of the volume signals from the Volume Setting Server (ie Media, Phone, Call Ring, Radio Announcement, Zone volumes...) that it is the Volume Controller for even if that source for the volume level is not Granted. If a source becomes Granted the Volume Controller shall not wait for a new volume status signal from the new active source before outputting the volume.

- Example:

Pre-Condition:

- AudioSource.St has audio OFF (ie SourceType = Inactive, and SourceTypeStatus = Inactive).
- Media Volume = 20 via the Audio\_Vol\_Level.St signal
- Volume Controller has volume step 20 stored for Media volume even though Media is not Granted.

Event:

- Media is Granted in the AudioSource.St

Post-Condition:

- The Volume Controller updates to Volume Step 20 once it receives Media Granted in the AudioSource.St message.
  - Note: The Volume Controller did not wait for volume signal from the Volume Settings Controller after Media Granted before updating its volume

The Volume Controller only stores the volume for a volume source it is the Volume Controller for. See requirement "VOLv2-REQ-412367-Module Deployment and Audio Routing" for details.

### 3.2.1.5 VOL-TMR-REQ-413557/A-T\_VolumeController\_update

Name	Description	Units	Range	Resolution	Default
T_VolumeController_update	Maximum time allowed from when the Volume Controller receives the Volume Setting Server volume status signal set to a new volume level until the updated Volume Controller volume status signal is put on the bus.  Note: use the default value	msec	0-1000	10	50



### 3.2.1.6 VOL-SR-REQ-412799/A-Volume Status signal updates when Volume Source is not Granted

The Volume Settings Server shall have all the volume status signals populated as if a source was Granted when the infotainment system is powered on (ie HMIAudioMode = ON). This include when a source is not Granted.

- Example 1:
  - If Audio is OFF (ie empty audio stack in AudioSource.St) the Volume Settings Server would be sending out the Volume Status for all its source (ex Media, Phone, Call Ring, Prompt and TA) as if they were Granted in the AudioSource.St.
- Example 2:
  - Pre-condition:
    - Media source is Granted playing at volume step 15 (ie Audio\_Vol\_Level = 15)
  - Event:
    - Phone Call audio request comes in
    - Phone\_Vol\_Level = 12
  - Post-Condition:
    - Phone Call is Granted at volume step 12
    - Media source is stacked with no audio (ie audio management) but the Audio\_Vol\_Level signal still equals volume step 15 for media volume

### 3.2.1.7 VOL-SR-REQ-412801/A-Volume Borders

The Volume Setting Server is responsible for volume borders. For volume borders, the Volume Settings Server shall update them in the volume status signals even if that source is not Granted. This includes real time updates for the upper and lower volume borders. See requirement "VOLv3-REQ-412192-User Volume and Audio Settings Behavior" for details on the volume borders. This is so the Volume Controller has that information in case the source is granted/activated.

- Example:
  - Pre-condition:
    - Media source is Granted and is the active audio source
    - The Media volume is volume step 2
    - Volume Setting Server is sending out the RA volume at the Upper volume border level
    - Volume Controller is storing the RA volume level even though it is not Granted.
  - Event:
    - Radio Announcement become Granted
  - Post-Condition:
    - The Volume Controller plays the RA volume at the upper volume border level based on the stored RA volume status signal value.

Note:  
For Zone Mode the Volume Settings Server shall follow requirement "VOL-REQ-412239-Zone Mode Volume rules".

### 3.2.1.8 VOL-SR-REQ-412802/A-Volume at System Shutdown and Start-up

#### System Shutdown:

The Volume Setting Server shall set all the volume status signals to Volume Step 0 (no volume) during infotainment system shutdown before HMIAudioMode transition from ON to OFF. When HMIAudioMode = OFF the Volume Settings Server shall ensure all volume signals are set to 0.

#### System Start-up:

The Volume Setting Server shall have all the volume status signals set to Volume Step 0 for system start-up while HMIAudioMode = OFF. After HMIAudioMode is set to ON then the Volume Settings Server shall update all the Volume Status signals.

#### Volume Controller:



The Volume Controller shall always treat the volume sources (ex Media, Radio Announcement, Zone etc) as volume step 0 regardless what is in the Volume Status signals from the Volume Setting Server (ie error handling) when HMIAudioMode = OFF.

See Station Management SPSS for details and sequence diagrams for system start-up and shutdown.

### 3.2.1.9 VOL-SR-REQ-412869/A-Volume Audio Attenuation event

The Volume Settings Server is responsible for setting the volume status signals for an audio attenuation. For an audio attenuation event, the Volume Setting Server shall update the impacted volume signal(s) to the attenuation level so the Volume Controller can attenuate to the new volume level. When the audio attenuation event ends, the Volume Setting Server is responsible for setting the volume status signals to the unattenuated volume levels.

- Example:

Pre-Condition:

- There is an attenuation event and the Volume Settings Server is setting the Audio\_Vol\_Level.St signal to volume step 5 (was step 12 before the attenuation)
- The Volume Controller updates its VolCntlr\_Audio\_Vol\_Level.St to volume step 5

Event:

- The audio attenuation event ends

Post-Condition:

- The Volume Setting Server updates Audio\_Vol\_Level.St to volume step 12
- The Volume Controller updates audio to volume step 12 and sets VolCntlr\_Audio\_Vol\_Level.St = 12 following the applicable unmute ramp called out in requirement "VOLv2-REQ-41277-Audio Attenuation Mute / Unmute Ramps – variant 3".

Note: For Captains Announcement and In Car Communication if the PAC/DSP AMP generate the audio then they will have to follow the audio attenuation signals (ie Attn\_Info\_Audio) called out in the Alert SPSS to attenuate that audio.

Reference requirement "VOLv2-REQ-412277-Audio Attenuation Mute / Unmute Ramps – variant 3" for the unmute ramps to use when an audio attenuation event ends.

Reference the Alert SPSS for further details on audio attenuation.

### 3.2.1.10 VOL-SR-REQ-412871/A-Cabin and Zone mode volume signal usage

Cabin Mode:

When the signal VehicleAudioMode = Cabin, then the vehicle is in cabin mode and the cabin mode volume signals shall be used.

Example:

- Audio\_Vol\_Level, Audio\_Vol\_Updated, VolCntlr\_Audio\_Vol\_Level
- Phone\_Vol\_Level, Phone\_Vol\_Updated
- Prompt\_Vol\_Level, Prompt\_Vol\_Updated
- RA\_Vol\_Level, RA\_Vol\_Updated, VolCntlr\_RA\_Vol\_Level
- CallRing\_Vol\_Level, CallRing\_Vol\_Updated

Zone Mode:

When the signal VehicleAudioMode = Zone, then the vehicle is in zone mode and the zone mode volume signals shall be used.

Example:

- Audio\_Vol\_Level\_Zone(1-6), Audio\_Vol\_Zone(1-6)\_Updated, VolCntlr\_Audio\_Vol\_Level\_Zone(1-6)
- Prompt\_Vol\_Level\_Zone(1-6), Prompt\_Vol\_Zone(1-6)\_Updated
- TempSource\_Vol\_Level\_Zone(1-6), TempSource\_Vol\_Zone(1-6)\_Updated, VolCntlr\_TempSource\_Vol\_Level\_Zone(1-6)
- Offset\_Vol\_Zone(1-6), Offset\_Vol\_Zone(1-6)\_Updated, VolCntlr\_Offset\_Vol\_Zone(1-6)

See requirement "VOLv2-REQ-412367-Module Deployment and Audio Routing" to see what module is the Audio Controller and therefore what Audio Controller signals are required.



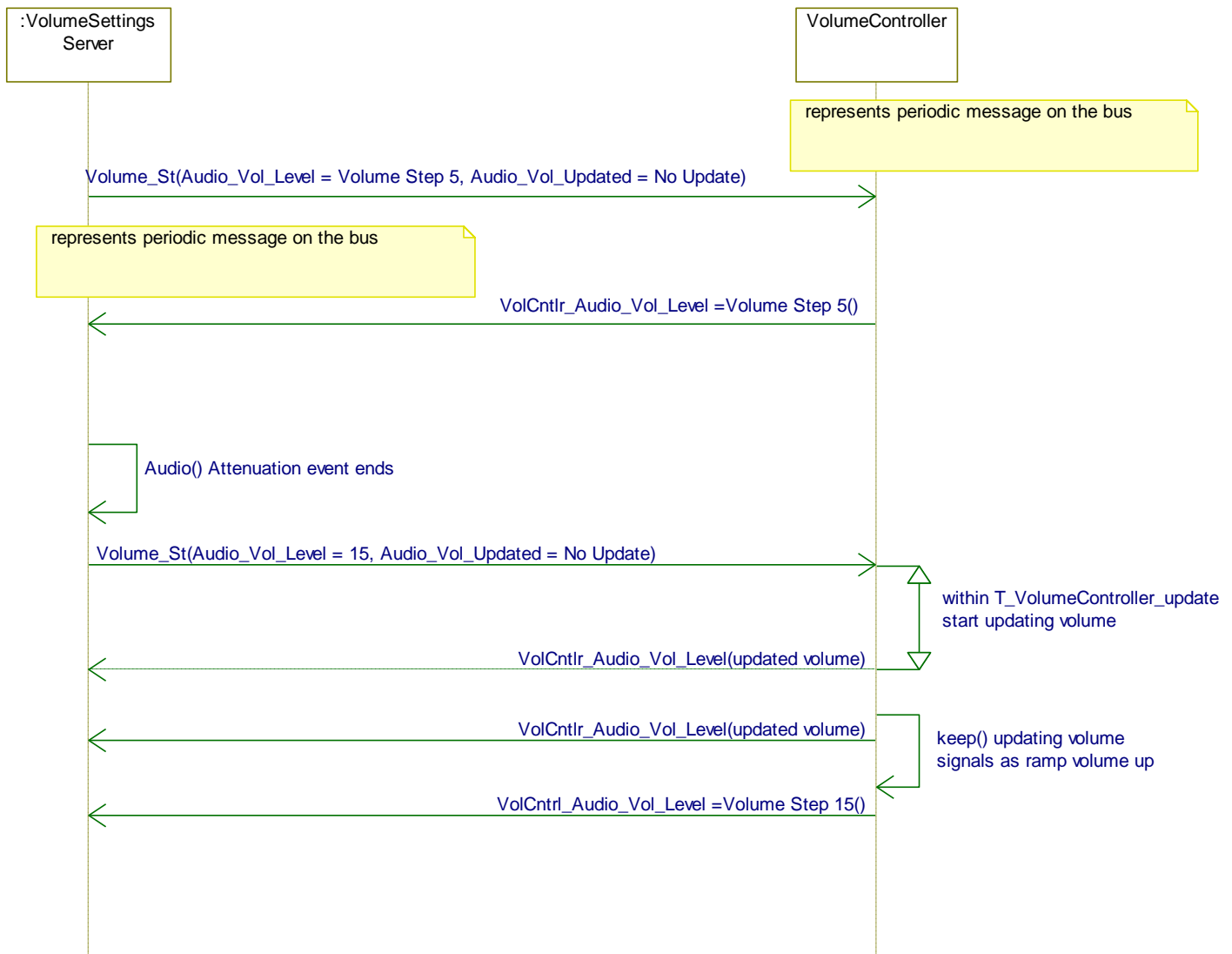
### 3.2.2 Sequence Diagrams

#### 3.2.2.1 VOLv2-SD-REQ-412872/A-Audio Attenuation event ending

Pre-condition:

- There is an audio attenuation event a Media Volume is attenuated to volume step 5
- Media volume was at volume step 15 before the attenuation event

Note: in sequence diagram when states ramp up volume (step 5 to step 15) this is referring to requirement “VOLv3-REQ-412277-Audio Attenuation Mute / Unmute Ramps – variant 3”.

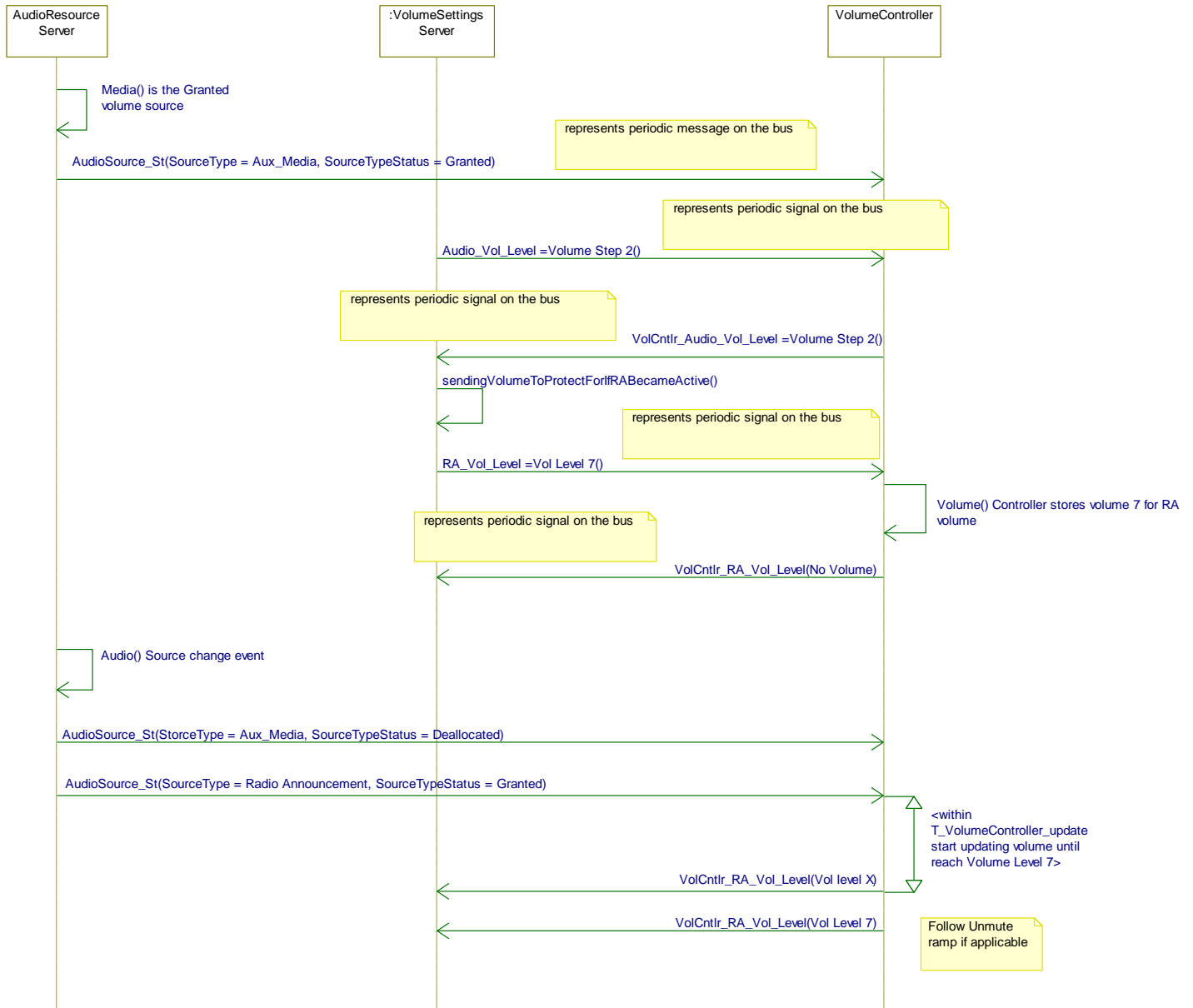


#### 3.2.2.2 VOLv2-SD-REQ-413573/A-Volume Border event

Pre-condition:

- Media source is Granted

Note: this is just an example, see volume border requirement for actual volume borders to use





### 3.3 VOLv2-FUN-REQ-411855/A-Manual Audio Mute

#### 3.3.1 Use Cases

##### 3.3.1.1 VOLv2-UC-REQ-413674/A-Activate Manual Audio Mute

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is ON Media source is active Infotainment System is not muted
<b>Scenario Description</b>	User selects <Activate Mute> via HMI
<b>Post-conditions</b>	The infotainment System sets the media volume to mute. HMI indicates {Mute Activated}.
<b>Notes</b>	

##### 3.3.1.2 VOLv2-UC-REQ-413671/A-Deactivate Manual Audio Mute via the HMI

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System powered ON Audio is muted via manual audio mute
<b>Scenario Description</b>	The user selects <Deactivate Mute> via HMI.
<b>Post-conditions</b>	The infotainment system sets volume to the level, which was selected prior to the mute activation. HMI Indicates {Mute Deactivated}
<b>Notes</b>	

##### 3.3.1.3 VOLv2-UC-REQ-413672/A-System Interrupts without cancelling Manual Audio Mute

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment System is ON Manual Audio Mute is active
<b>Scenario Description</b>	System interrupt source occurs like Radio Announcement, Phone, VR, Call Ring
<b>Post-conditions</b>	When the system interrupt source ends then go back to the "mute" on the Media source
<b>Notes</b>	

#### 3.3.2 Requirements

##### 3.3.2.1 VOLv2-SR-REQ-413661/A-Manual Audio Mute signal activation / deactivation

When a manual audio mute activation event occurs the Volume Setting Server shall set ManAudioMute.St = Mute.

When a manual audio mute activation event ends the Volume Setting Server shall set ManAudioMute.St = Unmute.



### 3.3.2.2 VOLv2-SR-REQ-413655/A-Manual Audio Mute - Volume impact

When a manual audio mute event occurs and ManAudioMute.St signal changes from Unmute to Mute then the Volume Settings Server shall mute the currently active Media source and update the applicable volume status signals. The ManAudioMute.St signal could be logically internal to the PDC or sent over the network bus in case display modules want to use it for their HMI.

The Audio\_Vol\_Status signal will reflect the muted Media volume but the Audio\_Vol\_Updated signal shall NOT be set to "Updated" for a manual audio mute event but remain set as "No Update".

The Volume Controller does not use the ManAudioMute.St signal for volume control. The Volume Controller only looks at the Audio\_Vol\_Status signal for muting audio.

When the Media volume is muted and the manual audio mute is ended (ie ManAudioMute.St = No Mute) then the Volume Setting Server shall unmute the Media volume from the last volume step before the mute event.

While Media volume is muted and the user adjusts the volume (increase or decrease volume) then the Manual Audio Mute event shall be ended (ManAudioMute.St = No Mute) and the Volume Setting Server shall unmute the Media volume from the last volume step before the mute event.

Reference the applicable HMI spec for audio sources besides Media and the impact manual audio mute does or does not have on those audio sources.

In zone mode only zone 1 (ie drivers zone) is impacted by manual audio mute. The Audio\_Vol\_Level\_Zone1 will reflect the muted Media volume but the Audio\_Vol\_Zone1\_Updated signal shall NOT be set to "Updated" for a manual audio mute event but remain set as "No Update".

### 3.3.2.3 VOLv2-SR-REQ-413663/A-Manual Audio Mute - Media source operation

When manual audio mute is active (ie ManAudioMute = Mute) then the Media audio is muted but the Media source is Granted and the Media source shall continue to act as though it is Granted and continue to update all status information on the network bus and process audio commands.

- Ex. If FM is the Granted media source, and the current song changes, the FM source shall continue to update the radio text, PS Name, HD-Radio Text, etc. All information that normally is updated when listening to the stacked source continues to be updated while Manual Audio Mute is active.

### 3.3.2.4 VOLv2-SR-REQ-413668/A-Manual Audio Mute - No Pause of Media

Manual Audio Mute shall only cause a Media Source to be muted/unmuted and shall not pause/unpause the Media source.

### 3.3.2.5 VOLv2-SR-REQ-413670/A-Manual Audio Mute - non Media source change

If Media becomes stacked (ex phone get Granted) that won't cause Manual Audio Mute to be deactivated. After Media is Granted again the Manual Audio Mute will continue to be active and the Media volume will be muted.

### 3.3.2.6 VOLv2-SR-REQ-413665/A-Ending a Manual Audio Mute

The following event shall end a manual audio mute event:

Deactivation event of Manual Audio Mute	Comments
Volume adjustment (increase or decrease volume) by the user	This includes any volume rotary knob adjustment, SWC volume adjustment or other user HMI volume adjustment of Media volume
Deactivate Mute HMI button press	
Media Source change by user	
Preset selection	



Station selection	
Track / File selection on USB	
Anything else defined by the HMI / user experience / feature specs to end a manual audio mute	

### 3.3.2.7 VOLv2-SR-REQ-413662/A-Manual Audio Mute - System start-up and shutdown

Once the infotainment system powers down (ie HMIAudioMode = OFF), then the next time the infotainment system powers up (ie HMIAudioMode = ON) the Manual Audio Mute shall default to Unmuted (ie ManAudioMute = Unmuted). This happens regardless if Manual Audio Mute had been active or not before powering down.





### 3.4 VOL-FUN-REQ-424677/A-RACM Volume Control - Phoenix

#### 3.4.1 Use Cases - Cabin Mode

##### 3.4.1.1 VOL-UC-REQ-087457/A-User changes Media volume using rear volume knob

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment system powered ON Media Volume Source is active
<b>Scenario Description</b>	User <changes Volume> using the rear volume rotary knob
<b>Post-conditions</b>	The Volume level is changed (ex the volume increases through the audio system) Rear Volume HMI is updated
<b>Notes</b>	This also would update the volume HMI in the front of the vehicle
<b>Interfaces</b>	Rear HMI, Rear Button Interface, Front HMI, Audio Out

##### 3.4.1.2 VOL-UC-REQ-087458/A-User tries to adjust non-Media volume source using rear volume knob

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment system powered ON Non-Media Volume Source is active (ex. Phone, VR....)
<b>Scenario Description</b>	User tries to change volume using the rear volume rotary knob
<b>Post-conditions</b>	The Volume is not changed through the audio system No rear volume HMI update shown
<b>Notes</b>	
<b>Interfaces</b>	Rear Button Interface

##### 3.4.1.3 VOL-UC-REQ-087459/A-User changes Media volume from front volume knob

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment system powered ON Media Volume Source is active
<b>Scenario Description</b>	User <changes Volume> using the front volume rotary knob
<b>Post-conditions</b>	The Volume is adjusted (ex increase volume through audio system) Rear Volume HMI is updated
<b>Notes</b>	This would also update the volume HMI in the front of the vehicle
<b>Interfaces</b>	Rear HMI, Front HMI, Front Button Input, Audio Out

##### 3.4.1.4 VOL-UC-REQ-087460/A-User changes non-Media volume source using front volume knob

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment system powered ON Non-Media Volume Source is active (ex. Phone, VR....)



<b>Scenario Description</b>	User <changes Volume> for non-Media volume source using the front volume rotary knob
<b>Post-conditions</b>	The volume level of the audio system is changed No rear volume HMI update is shown
<b>Notes</b>	The front volume HMI update is shown
<b>Interfaces</b>	Front HMI, Front Button Input Interface, Audio Out

#### 3.4.1.5 UC-REQ-087461/A-User changes Media volume from front volume knob when RACM display is powered off

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment system powered ON Media Volume Source is active The RACM display is OFF
<b>Scenario Description</b>	User <changes Volume> using the front volume rotary knob
<b>Post-conditions</b>	The RACM display remains OFF and does not show volume HMI
<b>Notes</b>	The Front HMI is updated for Volume. The volume level is changed for the audio system
<b>Interfaces</b>	Front HMI, Front Button Interface, Audio Out

### 3.4.2 Use Cases - Zone mode

#### 3.4.2.1 VOL-UC-REQ-424757/A-Muting rear seat Media audio with Rear Controls - Zone mode

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment system powered ON Vehicle in zone mode Media Volume Source is active in Zone X with the volume not muted
<b>Scenario Description</b>	User presses the <Mute rear seat zone X> button using the rear HMI
<b>Post-conditions</b>	Seat zone X media audio is muted Seat zone X non-media sources are not muted. (Ex. Phone calls not muted) Rear Volume HMI is updated
<b>Notes</b>	

#### 3.4.2.2 VOL-UC-REQ-424758/A-Unmuting rear seat Media audio with Rear Audio Controls - Zone mode

<b>Actors</b>	Vehicle Occupant
<b>Pre-conditions</b>	Infotainment system powered ON Vehicle in zone mode Media Volume Source is active in Zone X with the volume muted
<b>Scenario Description</b>	User presses the <Unmute rear seat zone X> button using the rear HMI



<b>Post-conditions</b>	Seat zone X media audio is unmuted
	Rear Volume HMI is updated
<b>Notes</b>	

### 3.4.3 Requirements

#### 3.4.3.1 VOLv2-SR-REQ-412366/A-RACM Volume Control and HMI update

The RACM shall only update its volume HMI for Media audio sources as identified in the AudioSource.St message when in Cabin mode.

- Cabin mode is when the signal VehicleAudioMode = Cabin. See audio management SPSS for details
- Zone mode is when the signal VehicleAudioMode = Zone. See audio management SPSS for details
- For Cabin Mode media volume signals use Audio\_Vol\_Level and Audio\_Vol\_Updated.

For rear audio volume control in zone mode reference requirement “RAC-REQ-419481-Rear Audio Control Impact for Phoenix Architecture” in the Rear Audio Control SPSS.

Reference SPSS requirement “AUMGNT-REQ-410349-Volume Sources used for an Active Audio Source” and in the Volume settings column of the table the volume settings column identify what audio sources are Media sources in the AudioSource.St message.

The RACM shall only increment / decrement the volume in the volume request signals it sends (ie volume rotary knob or push button) when a Media source is Granted and is the active volume source (ex Mixable Prompts are not active in AudioSource.St). When a Media source is not Granted in the AudioSource.St message or Prompts are active in the AudioSource.St while Media source is Granted (so Media is not the active volume source) then the RACM shall not increment or decrement the volume.

- Ex. Phone is the active audio source (not a media source). The user turns the RACM volume knob to increase volume but the RACM in the setVolume message has “SetVolume = Inactive / Not\_Pressed” and does not increment volume (ie doesn't sent +1,2 volume steps).

#### 3.4.3.2 VOL-SR-REQ-424763/A-RACM muting/unmuting rear seat Media audio with Rear Controls - Zone Mode

The Rear Audio Control Mute button(s) shall only mute the Media source for the applicable zone. The mute button does not apply to non-media source (ex Phone, Call Ring, Prompts).

The Rear Audio Control Volume Settings Button Client shall be able to send Media audio mute requests to the Volume Settings Server for the following zones:

1. Mute zone 3 (ie Button\_Name\_ID = Mute\_Zone3, Button\_Activation\_State = Pressed – see input translation matrix).
2. Mute zone 4
3. Mute zone 5
4. Mute zone 6
5. Mute zones 3 & 5
6. Mute zones 4 & 6
7. Mute zones 3, 4, 5 and 6

When the Volume Setting Server receives the muting media zone request then the Volume Setting Server shall only mute the Media volume for the applicable zone requesting the mute. The Volume Settings Server shall not mute non-media sources (ie Phone, Call Ring, Prompts).

The Rear Audio Control Volume Settings Button Client can update its HMI to show the requested rear zone media audio is muted when the following signals for that zone are set to volume step 0:

1. Audio\_Vol\_Level\_Zone3 = 0 (zone 3 media muted)
2. Audio\_Vol\_Level\_Zone4 = 0 (zone 4 media muted)
3. Audio\_Vol\_Level\_Zone5 = 0 (zone 5 media muted)



## 4. Audio\_Vol\_Level\_Zone6 = 0 (zone 6 media muted)

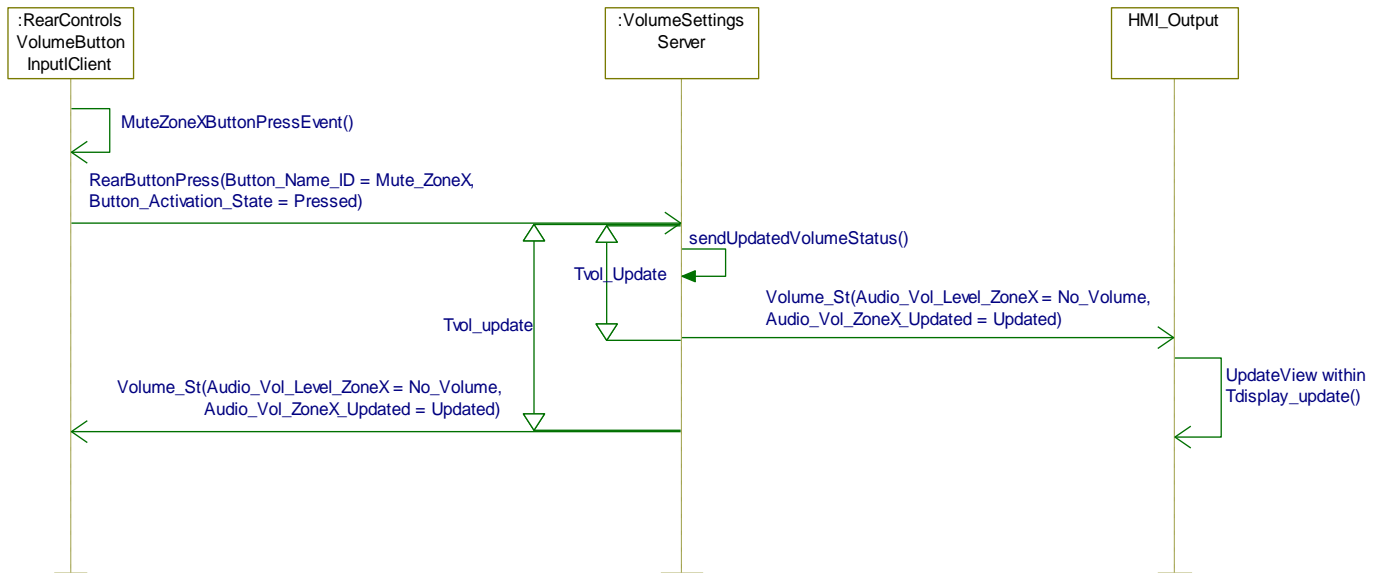
Note: For Phoenix architecture the Rear Audio Control Volume Client and Volume Settings Server use the Rear Audio Controls Button Press signal with the encodings for the zone media mute listed in the input translation matrix.

## 3.4.4 Sequence Diagrams

## 3.4.4.1 VOL-SD-REQ-425043/A-Muting rear seat Media audio with Rear Controls

Pre-Condition:

Seat zone X Media audio is not muted.





## 3.5 VOL-FUN-REQ-443617/A-SetVolume signal usage

### 3.5.1 Requirements

#### 3.5.1.1 VOL-SR-REQ-442537/A-SetVolume signal for TCU eCall

For user volume adjustments the Volume Settings Server shall increment/decrement the SetVolume signal by the amount adjusted by the user via the HMI.

- This includes (but is not limited to):
  - LIN ICP volume rotary knob adjustments
  - CAN EFP volume rotary knob adjustments
  - Steering Wheel Control volume adjustments
  - Steering Horizon Control volume adjustments
  - HMI Touch screen volume adjustments

The SetVolume signal is updated for user adjustments regardless of the state of the audio management stack.

- Ex. The audio stack could be empty and turning the volume knob would not update any volume source volume status signals (ex Media, Phone, Call Ring, RA or Prompt) but the SetVolume signal would still get updated.

Example setVolume usage: The LIN ICP volume rotary knob sends out +3 step, Not Pressed, then +2 steps, Not Pressed and +1 steps Not Pressed then the Volume Settings Server could repeat the same information in its SetVolume CAN signal (ie +3, NP, +2, NP, +1, NP).

- Ideally as shown above the Volume Settings Server should try to repeat the volume steps as received from the LIN ICP so the user has a smoother adjustment of volume (ie not as jumpy). If that cannot always be supported then the events could be accumulated. Ex the LIN ICP +3, NP, +2, NP and +1 NP might on the Volume Setting Server side become +3, NP, +3. NP.

Example: setVolume usage The SWC module sends a volume up Press and then quickly sends a Not Press, then the Volume Setting Server would send +1 and Not Pressed (assuming no press and hold).

See Button SPSS requirement "BUTTON-REQ-014693-Tx SetVolume"

See Button SPSS requirements for 360 Degree Rotary Knob requirements (if applicable).

Note: at the time this requirement was written the SetVolume signal from the Volume Setting Server was only to be used for the TCU eCall feature. Unless specified otherwise, the setVolume signal shall not to be used by the PAC/AHU, DSP AMP or any other infotainment modules for the Phoenix architecture.



## 4 Appendix: Reference Documents

Reference #	Document Title
1	
2	
3	
4	
5	
6	
7	
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9	
10	
11	
12	
13	
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