Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – Alerts (Chimes/Prompts/Beeps/Audio Attenuation)

APIM Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.2

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Revision History

Date	Version	Notes	
May 31, 2013	**1.0**	**Initial Release**	
September 27, 2016	**1.1**	**Update Release**	
	ALERT-IIR-REQ-014715/C-Alert Method Descriptions (TcSE ROIN-40348-13)		<jmyslin2> Updated with adjustable chime signals
	ALERT-FUN-REQ-195348/B-Adjustable Chime Strategy		<JM> Addition of the adjustable chimes strategy
	ALERT-UC-REQ-233120/B-Chime event using an Adjustable Chime setting		<jmyslin2> New use case adjustable chimes
May 03, 2017	**1.2**	**Update Release**	
	ALERT-IIR-REQ-014715/D-Alert Method Descriptions (TcSE ROIN-40348-13)+		<jmyslin2> updated signal table for Chime ID signals
	ALERT-SR-REQ-014741/G-Cluster Chime Requests (TcSE ROIN-40360-1)+		<jmyslin2> Updated requirement for multiple chime requests for speakers with the same directionality
	ALERT-SR-REQ-014745/E-Mute/Unmute Alert Channel (TcSE ROIN-40365-5)		<jmyslin2> No change to requirement. Just added a note for clarification to see sequence diagrams for examples
	ALERT-SR-REQ-014755/E-Chime ID Assignments (TcSE ROIN-167427-3)		<jmyslin2> Updated as a placeholder chime table for digital audio chime files (stereo chimes)
	ALERT-SR-REQ-237862/A-Chime_ID signal+		<Jim Gregoire / Jmyslin2> new Chime ID signal added for AHU and Clusters. Required to support adjustable chimes
	ALERT-SR-REQ-014759/G-Chime Error States / Fault handling (TcSE ROIN-40443-11)		<jmyslin2> added clarification to reference the IDS and referenced setting Chime_Supported back to Inactive
	ALERT-SD-REQ-014763/D-Cluster ending Continuous Chime event, or Fixed Repetition Chime event where Cluster ends chime before repetitions finished (TcSE ROIN-40403-4)		<jmyslin2> Updated with the Chime ID signal required for adjustable chimes
	ALERT-SR-REQ-014783/E-Prompt Audio Source response to prompt request (TcSE ROIN-41512-5)		<jmyslin2> Updated to include VSEM requirement number when before had old TcSe requirement number. No change to requirement content clarification only
	ALERT-UC-REQ-195369/D-Set rear park aid chime volume level while no other chime is active		<jmyslin2> Updated use case to note HMI for adjustable settings should only be shown in Run
	ALERT-UC-REQ-195370/D-Set front park aid chime volume level while no other chime is active		<jmyslin2> Updated that the Adjustable Chime HMI is only shown in Run
	ALERT-UC-REQ-195371/E-Set front/rear park aid chime volume level while another chime is playing through the same speakers (Front or Rear speakers)		<jmyslin2> Update so that the HMI for adjustable chimes is only shown in Run
	ALERT-UC-REQ-195372/F-Set front/rear park aid chime volume level while the front/rear park aid chime is already playing		<jmyslin2> Updated so that adjustable chime setting HMI is only shown when igntion is in Run
	ALERT-UC-REQ-209067/E-Adjust chime volume while adjustable chime is playing feedback chimes		<jmyslin2> updated so that the HMI for adjustable chimes settings is only shown in Run
	ALERT-UC-REQ-233120/C-Chime event using an Adjustable Chime setting		<jmyslin2> Updated so the HMI for adjustable chime settings is only shown in Run
	ALERT-SR-REQ-232946/D-Feature Based Message Protocol usage for adjustable chimes HMI Settings		<jmyslin2> Updated so Query operation for adjustable chimes begins after Ignition goes to Run.

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1 Architectural Design

1.1 Alert Interface Requirements

1.1.1 ALERT-IIR-REQ-014715/F-Alert Method Descriptions (TcSE ROIN-40348-13)

Method	Notes	Parameters
IPC_Infotainment	Event-Periodic message from the Chime Client to the Infotainment System	Chime_Source (Signal) 0x0 Invalid 0x1 Infotainment_System 0x2 Cluster Attn_Info_Audio (Signal) – Attenuates the Infotainment Audio 0x0 No Attenuation of Audio 0x1 Attenuation_1 0x2 Attenuation_2 cont. 0x6 Attenuation_6 (higher attenuation number indicates a greater increase in audio attenuation) 0x7 Unknown New_Attn_Event (Signal) 0x0 Inactive 0x1 Active Power_Up_Chime_Modules (Signal) 0x0 Inactive 0x1 Active
IPC_Chime	Event-Periodic message from the Chime Client to the Chime Generator Server and Chime Audio Source Server informing the infotainment system the state of the vehicle Chimes.	Chime (Signal) – Chime Sound ID 0x0 Inactive 0x1 No_Chime (Chime_0) 0x2 Chime_1 0x3 Chime_2 0x4 Chime_3 cont. 0x3F Chime_62 Chime_Vol_Level (signal) 0x0 Inactive (no change to stored chime volume - 100% of stored chime volume) 0x1 99% (of stored chime volume) 0x2 98% (of stored chime volume) 0x3 97% (of stored chime volume) .... 0x62 2% (of stored chime volume) 0x63 1% (of stored chime volume) 0x64 Reserved Chime_Directionality (Signal) 0x0 Inactive / OFF 0x1 All 0x2 Front 0x3 Rear Chime_Time_Criticality (Signal) 0x0 Inactive 0x1 Criticality_High (Immediately end current Chime and play the new chime) 0x2 Criticality_Low (Finish playing current Chime and switch to new chime when finished) OFF_Time_Btwn_Chime 0x0 Inactive 0x1 Continuously (repeat continuously) 0x2 5 msec

		0x3 10 msec 0x4 15 msec 0x5 20 msec 0x6 40 msec 0x7 60 msec (increment is 20 msec steps until 800 msec) cont.... 0x2C 800 msec 0x2D 850 msec 0x2E 900 msc 0x2F 1 sec 0x30 1.5 sec 0x31 2 sec 0x32 3 sec 0x33 4 sec 0x34 5 sec Chime_Occurence (Signal) – Determines the number of repetitions the chime sound to be played or for the chime to be played continuously 0x0 Inactive 0x1 Play once 0x2 2 Repititions 0x3 3 Repititions 0x4 4 repititions 0x5 5 repetitions … 0xE 14 repetitions 0xF Continuous AdjustableChimeVol 0x0: Inactive / 0 adjustable chime volume level / Default Volume 0x1: - 6 Reserved, do not use 0x2: - 5 Reserved, do not use 0x3: -4 Reserved, do not use 0x4: - 3 adjustable chime volume level 0x5: -2 adjustable chime volume level 0x6: - 1 adjustable chime volume level 0x7: +1 adjustable chime volume level 0x8 +2 adjustable chime volume level 0x9: +3 adjustable chime volume level 0xA: +4 Reserved, do not use 0xB: +5 Reserved, do not use 0xC: + 6 Reserved, do not use 0xD: Reserved, do not use 0xE: Reserved, do not use 0xF: Reserved, do not use ChimeID_No_Rq (Signal) 0x0 Inactive 0x1 - ID 1 0x2 – ID 2 0x3 – ID 3 0x4 – ID 4 cont. 0xFF – ID 255
IPC_Chime2	Event-Periodic message from the Chime Client to the Chime Generator Server and Chime Audio Source Server informing the infotainment system the state of the vehicle Chimes.	Chime2 (Signal) – Chime Sound ID 0x0 Inactive 0x1 No_Chime (Chime_0) 0x2 Chime_1 0x3 Chime_2 0x4 Chime_3 cont. 0x3F Chime_62

		Chime_Vol_Level2 (signal) 0x0 Inactive (no change to stored chime volume - 100% of stored chime volume) 0x1 99% (of stored chime volume) 0x2 98% (of stored chime volume) 0x3 97% (of stored chime volume) .... 0x62 2% (of stored chime volume) 0x63 1% (of stored chime volume) 0x64 Reserved Chime_Directionality2 (Signal) 0x0 Inactive / OFF 0x1 All 0x2 Front 0x3 Rear Chime_Time_Criticality2 (Signal) 0x0 Inactive 0x1 Criticality_High (Immediately end current Chime and play the new chime) 0x2 Criticality_Low (Finish playing current Chime and switch to new chime when finished) OFF_Time_Btwn_Chime2 0x0 Inactive 0x1 Continuously (repeat continuously) 0x2 5 msec 0x3 10 msec 0x4 15 msec 0x5 20 msec 0x6 40 msec 0x7 60 msec (increment is 20 msec steps until 800 msec) cont.... 0x2C 800 msec 0x2D 850 msec 0xE 900 msc 0x2F 1 sec 0x30 1.5 sec 0x31 2 sec 0x32 3 sec 0x33 4 sec 0x34 5 sec Chime_Occurence2 (Signal) – Determines the number of repetitions the chime sound to be played or for the chime to be played continuously 0x0 Inactive 0x1 Play once 0x2 2 Repititions 0x3 3 Repititions 0x4 4 repititions 0x5 5 repetitions … 0xE 14 repetitions 0xF Continuous AdjustableChimeVol2 0x0: Inactive / 0 adjustable chime volume level / Default Volume 0x1: - 6 Reserved, do not use 0x2: - 5 Reserved, do not use 0x3: -4 Reserved, do not use 0x4: - 3 adjustable chime volume level 0x5: -2 adjustable chime volume level 0x6: - 1 adjustable chime volume level

		0x7: +1 adjustable chime volume level 0x8 +2 adjustable chime volume level 0x9: +3 adjustable chime volume level 0xA: +4 Reserved, do not use 0xB: +5 Reserved, do not use 0xC: + 6 Reserved, do not use 0xD: Reserved, do not use 0xE: Reserved, do not use 0xF: Reserved, do not use Chime2ID_No_Rq (Signal) 0x0 Inactive 0x1 - ID 1 0x2 – ID 2 0x3 – ID 3 0x4 – ID 4 cont. 0xFF – ID 255
AHU_Alert	Event-Periodic message from AHU to the applicable Alert components AHU_Chimes_Supported: Method from the AHU indicating to the Chime Master (ie Cluster) if chimes are supported by the AHU AHU_Chime_Not_Recognized: Method from the AHU Chime Generator to Cluster letting the Cluster know the chime requested is not recognized. If the Chime is recognized the signal remains set to inactive. AHU_Chime_Active: Method from the AHU Chime Generator to the Cluster indicating what chime is active. Note: the AHU sets this signal to No_Chime when it is not the Chime Generator (ex. when Cluster is Chime Generator). Alert_ChannelX: Method from the AHU Prompt Audio Source to the Prompt Generator indicating the status of the Prompt Audio Source input Alert Channel. Note set to Inactive if no separate Prompt Generator (ie SYNC) Chime_Alert_Chan: Method to mute the Chime Audio Source Alert channel after the Chime Generator is done producing the chime	AHU_Chimes_Supported (Signal) 0x0 Inactive 0x1 Supported 0x2 Not_Supported AHU_Chime_Not_Recognized (Signal) 0x0 Inactive 0x1 Chime_Not_Recognized AHU_Chime2_Not_Recognized (Signal) 0x0 Inactive 0x1 Chime_Not_Recognized AHU_Chime_Active (Signal) 0x0 Inactive 0x1 No_Chime 0x2 Chime_1 0x3 Chime_2 0x4 Chime_3 cont. 0x3F Chime_62 AHU_Chime2_Active (Signal) 0x0 Inactive 0x1 No_Chime 0x2 Chime_1 0x3 Chime_2 0x4 Chime_3 cont. 0x3F Chime_62 Alert_Channel1 (Signal) 0x0 Inactive 0x1 Initialized for Prompts 0x2 Muted 0x3 Reserved Chime_Alert_Chan (Signal) 0x0 Inactive 0x1 Mute 0x2 Reserved Chime_Alert_Chan 2 (Signal) 0x0 Inactive 0x1 Mute 0x2 Reserved AHU_AdjustableChimeVolSupported (Signal): 0x0 Inactive 0x1 Adjust Chime Sound Not Supported 0x2 Adjustable Chime Sound Supported

		AHU_AdjustableChimeVolSupported2 (Signal): 0x0 Inactive 0x1 Adjust Chime Sound Not Supported 0x2 Adjustable Chime Sound Supported ChimeID_No_Stat (Signal) 0x0 Inactive 0x1 - ID 1 0x2 – ID 2 0x3 – ID 3 0x4 – ID 4 cont. 0xFF – ID 255 Chime2ID_No_Stat (Signal) 0x0 Inactive 0x1 - ID 1 0x2 – ID 2 0x3 – ID 3 0x4 – ID 4 cont. 0xFF – ID 255
DSP_AMP_Alert	Event-Periodic message from DSP AMP to the applicable Alert components DSP_Chimes_Supported: Method from the DSP AMP indicating to the Chime Generator if chimes are supported by the DSP AMP Alert_ChannelX: Method from the DSP AMP Alert Source to the Alert Generator indicating the status of the Alert Channels.	DSP_Chime_Not_Recognized (Signal) 0x0 Inactive 0x1 Chime_Not_Recognized DSP_Chime2_Not_Recognized (Signal) 0x0 Inactive 0x1 Chime_Not_Recognized DSP_Chimes_Supported (Signal) 0x0 Inactive 0x1 Supported 0x2 Not_Supported Alert_Channel1 (Signal) 0x0 Inactive 0x1 Reserved 0x2 Muted 0x3 Initialized for Chimes Alert_Channel2 (Signal) 0x0 Inactive 0x1 Reserved 0x2 Muted 0x3 Initialized for Chimes Alert_Channel3 (Signal) 0x0 Inactive 0x1 Initialized for Prompts 0x2 Muted 0x3 Reserved DSP_AdjustableChimeVolSupported (Signal): 0x0 Inactive 0x1 Adjust Chime Sound Not Supported 0x2 Adjustable Chime Sound Supported DSP_AdjustableChimeVolSupported2 (Signal): 0x0 Inactive 0x1 Adjust Chime Sound Not Supported 0x2 Adjustable Chime Sound Supported

SYNC_Alerts	Event-Periodic message from SYNC to the applicable Alert components Alert_ChanX: Method from the SYNC Prompt Generator to the Prompt Audio Source to control the Alert channels Attn_Info_Audio: From the SYNC Prompt Generator to the Prompt Audio Source for attenuating the active audio source. New_Attn_Event: From the SYNC Prompt Generator to the Prompt audio source for an attenuation event. PromptX_Directionality: From the SYNC Prompt Generator to the Prompt audio source indicating what speaker(s) to play the prompt(s) through. Audible_Beep: Event-Periodic signal from the SYNC Beep Client to the Beep Generator so the Beep Generator can produce an audible beep	Alert_Chan (Signal) 0x0 OFF_Inactive (prompts OFF) 0x1 Mute 0x2 Initialize for Prompts (keep set while prompts are active) Attn_Info_Audio (Signal) – Attenuates the Infotainment Audio 0x0 No Attenuation of Audio 0x1 Attenuation_1 0x2 Attenuation_2 cont. 0x6 Attenuation_6 (higher attenuation number indicates a greater increase in audio attenuation) 0x7 Unknown New_Attn_Event (Signal) 0x0 Inactive 0x1 Active Prompt_Directionality (Signal) 0x0 Inactive / OFF 0x1 All 0x2 Front 0x3 Rear Audible_Beep(Signal) 0x0 Inactive 0x1 Active
_Chimes_Supported	Signal from the chime component indicating to the Chime Generator if chimes are supported	0x0 Inactive 0x1 Supported 0x2 Not_Supported
_Audible_Beep	Event-Periodic signal from the Beep Client to the Beep Generator so the Beep Generator can produce an audible beep	0x0 Inactive 0x1 Active

1.1.2 ALERT-IIR-REQ-014716/B-Turn Signal Chime Method Descriptions (TcSE ROIN-263780-1)

Method	Notes	Parameters
TurnLghtLeftOn_B_Stat	Signal from the Turn Signal Client to the Turn Signal Chime Server and Turn Signal Visual Indicator Server for indicating the Left Turn Signal is activated	0x0 OFF 0x1 ON

TurnLghtRightOn_B_Stat	Signal from the Turn Signal Client to the Turn Signal Chime Server and Turn Signal Visual Indicator Server for indicating the Right Turn Signal is activated	0x0 OFF 0x1 ON

1.1.3 ALERT-IIR-REQ-233049/B-AdjustableChimeVolumeSelection - FBMP

1.1.3.1 ALERT-MD-REQ-232947/E-rearParkAidChimeVolumeSelection - FBMP

For this feature when performing the “Set” or “Query” operation the Feature Number and Configuration Number in the Feature.Rq and Feature.St messages shall be used below.

If Enhanced Memory is supported the Active Personality Profile shall be used for PersIndex. If Enhanced Memory is not supported PersIndex shall be set to Vehicle. See Feature Based Message Protocol SPSS for details.

Feature Description	Feature Number	Configuration Number	Configuration Name / HMI selection
Rear Park Aid Adjustable Volume Selection and Status rearParkAidChimeVolSelection signal in SPSS	0x0910	0x00	-6 Reserved / Do not use
		0x01	-5 Reserved / Do not use
		0x2	-4 Reserved / Do not use
		0x3	-3 adjustable volume level
		0x4	-2 adjustable volume level
		0x5	-1 adjustable volume level
		0x6	0 Adjustable chime volume / Default Volume
		0x7	+1 adjustable volume level
		0x8	+2 adjustable volume level
		0x9	+3 adjustable volume level
		0xA	+ 4 Reserved / Do not use
		0xB	+ 5 Reserved / Do not use
		0xC	+ 6 Reserved / Do not use

1.1.3.2 ALERT-MD-REQ-233050/C-frontParkAidChimeVolumeSelection - FBMP

For this feature when performing the “Set” or “Query” operation the Feature Number and Configuration Number in the Feature.Rq and Feature.St messages shall be used below.

If Enhanced Memory is supported the Active Personality Profile shall be used for PersIndex. If Enhanced Memory is not supported PersIndex shall be set to Vehicle. See Feature Based Message Protocol SPSS for details.

Feature Description	Feature Number	Configuration Number	Configuration Name / HMI selection
Front Park Aid Adjustable Volume Selection and Status frontParkAidChimeVolSelection signal in SPSS	0x0911	0x00	-6 Reserved / Do not use
		0x01	-5 Reserved / Do not use
		0x2	-4 Reserved / Do not use
		0x3	-3 adjustable volume level
		0x4	-2 adjustable volume level
		0x5	-1 adjustable volume level
		0x6	0 Adjustable chime volume / Default Volume
		0x7	+1 adjustable volume level
		0x8	+2 adjustable volume level
		0x9	+3 adjustable volume level
		0xA	+ 4 Reserved / Do not use
		0xB	+ 5 Reserved / Do not use
		0xC	+ 6 Reserved / Do not use

1.2 ALERT-CLD-REQ-014717/C-Chime Client (TcSE ROIN-202535-1)

The Chime Client is the chime master that tells the infotainment system what chime(s) to play

1.3 ALERT-CLD-REQ-014718/B-Chime Generator Server (TcSE ROIN-202536-1)

The Chime Generator Server produces the chime signal for a respective chime

1.4 ALERT-CLD-REQ-014719/B-Chime Audio Source Server (TcSE ROIN-202537-1)

The Chime Audio Source Server produces the chime sound heard in the infotainment system

1.5 ALERT-CLD-REQ-014720/B-Prompt Client/Generator Server (TcSE ROIN-202538-1)

The Prompt Client/Generator Server is responsible for the prompt function and will produce a prompt signal for the Prompt Audio Source

1.6 ALERT-CLD-REQ-014721/B-Prompt Audio Source Server (TcSE ROIN-202539-1)

The Prompt Audio Source Server is responsible for playing the prompt sound through the infotainment system

1.7 ALERT-CLD-REQ-014722/B-Beep Client (TcSE ROIN-202534-1)

The Beep Client requests the Beep Generator to produce the beep

1.8 ALERT-CLD-REQ-014723/B-Beep Generator Server (TcSE ROIN-202533-1)

The Beep Generate Server creates the signal for the beep

1.9 ALERT-CLD-REQ-014724/B-Beep Audio Source Server (TcSE ROIN-202532-1)

The Beep Audio Source Server produces the sound for the beep through the infotainment system

1.10 ALERT-CLD-REQ-232214/B-Adjustable Chime Client

The Adjustable Chime Client is the interface with the HMI and tells the Adjustable Chime Server what adjustable chime selections where made

1.11 ALERT-CLD-REQ-232215/B-Adjustable Chime Server

The Adjustable Chime Server receives the requests for adjustable chime levels from the Adjustable Chime Client to be used by the Chime Arbitrator/Chime Client to make the chime requests to the infotainment system.

2 General Requirements

2.1 ALERT-SR-REQ-014730/C-Alert Configuration Table (TcSE ROIN-40349-4)

The Alert Generator and Alert Audio Source will vary depending on the infotainment system module availability. The Infotainment System Alert set-up will follow the table below.

Modules Present	Chime Client (Chime Master)	Beep Generator	Prompt Generator	Chime Generator	Alert Audio Source (Module to Play & Mix Audio)
AHU / SYNC / DSP AMP	Cluster	DSP AMP	SYNC	AHU	DSP AMP
SYNC / AHU	Cluster	AHU	SYNC	AHU	AHU
AHU / DSP AMP	Cluster	DSP AMP	N/A	AHU	DSP AMP
AHU	Cluster	AHU	N/A	AHU	AHU

Alert Configuration Table

3 Functional Definition

3.1 ALERT-FUN-REQ-014731/B-Chimes (TcSE ROIN-119786-1)

3.1.1 Chime Activation Requirements

3.1.1.1 ALERT-SR-REQ-014732/C-Infotainment System Chime Source (TcSE ROIN-40351-1)

The Cluster shall use the IPC_Infotainment : Chime_Source signal to indicate if the Infotainment System or Cluster is currently the chime source responsible for playing chimes. The Infotainment System shall NOT be the chime source unless the IPC_Infotainment.St() message has signal 'Chime_Source = Infotainment_System'.

3.1.1.2 ALERT-SR-REQ-014733/C-Infotainment Components Power Mode signals (TcSE ROIN-40352-1)

The Infotainment Chime Components shall be capable of producing chimes from Chime Requests (IPC_Chime / IPC_Chime2) when:

'Power_Up_Chime_Modules == Active' AND the Infotainment System is the Chime Source 'IPC_Infotainment.St() : Chime_Source == Infotainment_System'.

The infotainment components responsible for chimes shall be capable of producing chimes regardless of the HMIAudioMode status when Chimes is enabled through the Infotainment System.

3.1.1.3 ALERT-SR-REQ-014734/C-Chime Power Mode signal usage (TcSE ROIN-40353-1)

The Cluster shall wake and keep up the Infotainment bus (if not already awake) and set 'Power_Up_Chime_Modules = Active' for predictive triggers (ex. open door) as defined in the Cluster engineering specification.

When a predictive trigger does occur then the minimum time the signal 'Power_Up_Chime_Modules' is set equal to 'Active' is 180 seconds.
An exception would be for error states such as the AHU setting AHU_Chime_Supported = Not_Supported where the Cluster would set Power_Up_Chime_Modules = Inactive when it receives Not_Supported.

When the predictive triggers are no longer valid then the signal 'Power_Up_Chime_Modules = Inactive'.

3.1.1.4 ALERT-SR-REQ-014735/E-Power-up time for infotainment components (TcSE ROIN-40354-4)

The infotainment chime components shall be capable of producing chime audio within 2.0 seconds of 'Power_Up_Chime_Modules = Active'.

For supporting time to first infotainment chime audio reference the Infotainment Diagnostic Specification (IDS) for chime diagnostics start-up using the Power_Up_Chime_Module signal.

3.1.1.5 ALERT-SR-REQ-014736/C-Chime Power mode signal usage when Chimes are not through the infotainment system (TcSE ROIN-40355-2)

~~If chimes are not configured to use the Infotainment Audio System (IPC_Infotainment : Chime_Source = Cluster) then infotainment components shall not use the Power_Up_Chime_Module signal and the Cluster shall set the 'Power_Up_Chime_Module = Inactive'.~~

Requirement deleted.

Reference IDS for chime diagnostics start-up

3.1.1.6 ALERT-SR-REQ-014737/C-Timing for single Chime Source module to produce Chime audio (TcSE ROIN-40356-3)

When the Chime Generator and Chime Audio Source are the same Chime Source module then the Chime Source module shall start producing chime audio within 70 msec of receiving the new chime request message.

3.1.1.7 ALERT-SR-REQ-014738/D-Chime initialization timing when there is a separate Chime Generator and Chime Audio Source (TcSE ROIN-40357-4)

When there is both a separate Chime Generator and Chime Audio Source on the vehicle at the same time then the Chime Generator shall generate the line level signal to the Chime Audio Source once Chime Generator receives the Chime Request signal from the Chime Client AND once it receives "Alert_Channel = Initialized for Chimes" signal from the Chime Audio Source.

If the Chime Generator receives "Alert_Channel = Initialized for Chimes" within 50 msec of receiving IPC_Chime.St chime request message from the Chime Client then the Chime Generator shall produce the chime line level signal to the Chime Audio Source within 70 msec of receiving IPC_Chime.St

If the Chime Generator receives "Alert_Channel = Initialized for Chimes" between 50 – 90 msec of receiving IPC_Chime.St chime request message from the Chime Client then the Chime Generator shall produce the chime line level signal to the Chime Audio Source within 20 msec of receiving "Alert_Channel = Initialized for Chimes"

If the Chime Generator does NOT receive "Alert_Channel = Initialized for Chimes" after 90 msec has elapsed from receiving the IPC_Chime.St chime request message from the Chime Client then the Chime Generator shall generate the chime line level signal to the Chime Audio Source within 20 msec from 90 msec elapsing

Note: see applicable requirements and sequence diagrams if a chime is currently being played with the same directionality when a new chime request comes in (ex low priority chime – requesting a new chime on a different alert channel with the same directionality).

3.1.1.8 ALERT-SR-REQ-014739/C-Timing for Chime Audio Source being capable of producing chime audio (TcSE ROIN-40358-3)

When there is both a separate Chime Generator and Chime Audio Source on the vehicle at the same time AND a new Chime is activated (no chime previously active so audio source input muted) then the infotainment Chime Audio Source shall be capable of producing the Chime audio within 70 msec of receiving the chime request from the Cluster.

This includes the Chime Audio Source initializing and unmuting the dedicated Alert input channel for chimes.

'IPC_Chime: Chime = Chime_X' initializes and unmutes Alert channel 1 on the Chime Audio Source. Within 70 msec of receiving the Chime Request signal the Chime Audio Source shall respond with "initialized for chimes". The Chime Audio Source keeps the state as "Initialized for Chimes" for the duration of the chime.

'IPC_Chime2: Chime2 = Chime_X' initializes and unmutes Alert channel 2 on the Chime Audio Source. Within 70 msec of receiving the Chime Request signal the Chime Audio Source shall respond with "initialized for chimes". The Chime Audio Source keeps the state as "Initialized for Chimes" for the duration of the chime.

3.1.1.9 ALERT-SR-REQ-014740/H-Chime overwriting another chime (TcSE ROIN-40359-3)

When there is a chime active and then an "IPC_Chime/IPC_Chime2 (Chime = No_Chime; Chime_Time_Criticality = Criticality_Low)" is received by the Chime Generator and Chime Audio Source to end the current chime then if a new "IPC_Chime/IPC_Chime2 (Chime = New_Chime)" is received for the same speakers while the first chime is still active then: ~~a new chime request is received by the Chime Generator and Chime Audio Source on the same Alert channel then:~~

Criticality_High:

1. When the Chime Generator receives the new chime request with the signal Chime_Time_Criticality = Criticality_High it shall generate the new chime within 90 msec of receiving the new chime request or sooner if it receives Alert_Chan = Intialized_for_Chimes (old chime) → Inactive / Muted → Initialized for Chimes (new chime) from the Chime Audio Source.

2. When the Chime Audio Source receives the new chime in the IPC_Chime/IPC_Chime2 CAN message with the signal Chime_Tim_Criticality = Criticality_High it shall change its chime parameters (ex. volume, speakers directionality) to the new settings within 70 msec of receiving the new chime request.

When the Chime Audio Source receives the new chime request with Criticality_High then the Chime Audio Source shall set Alert_Channel = Inactive / Muted and within 70 msec of receiving the new chime request and then the Chime Audio Source shall set Alert_Channel = Initialized_for_chimes. Note: the Chime Audio Source sets Alert_Channel = Inactive if the conditions for setting Alert_Channel = Muted are not met. See requirement ALERT-GREQ-40365-Mute/Unmute Alert Channel on Muting for when Chime Audio Source sets Alert_Channel = Muted.

Criticality_Low:
1. When the Chime Generator receives the new chime request with the signal Chime_Time_Criticality = Criticality_Low it shall finish playing the currently playing chime sound (ex. DNA B) and then set AHU_Alert : AHU_Chime_Active = No_Chime and then set to the new chime.

2. When the Chime Audio Source receives the new chime in the IPC_Chime/IPC_Chime2 CAN message with the signal Chime_Time_Criticality = Criticality_Low it shall continue playing the currently playing chime sound (ex. DNA B) with the existing chime parameters (ex volume, directionality) while the AHU_Alert : AHU_Chime_Active has not changed from the currently playing chime (hasn't changed to No_Chime).

When the AHU_Alert : AHU_Chime_Active = No_Chime (chime generator finished generating the previous chime sound) then the Chime Audio Source shall set Alert_Channel = Inactive / Muted and within 70 msec of receiving AHU_Chime_Active = No_Chime the Chime Audio Source shall initialize for the new chime request from the Cluster and set Alert_Channel = Initialized_for_chimes.

- Note: AHU/DSP AMP shall play the new chime as long as the Cluster has not sent the No chime for the new chime request (ex. IPC_Chime/IPC_Chime2 (Chime = Chime_New (Chime = No_Chime)) when the AHU/DSP AMP finishes playing the old chime sound (Chime_X)).
- Note: the Chime Audio Source sets Alert_Channel = Inactive if the conditions for setting Alert_Channel = Muted are not met. See requirement ALERT-GREQ-40365-Mute/Unmute Alert Channel on Muting for when Chime Audio Source sets Alert_Channel = Muted.

3.1.1.10 ALERT-SR-REQ-014741/I-Cluster Chime Requests (TcSE ROIN-40360-1)

Once the Cluster receives a chime request (from the vehicle network) it shall process and transmit to the Infotainment System within 60 msec the applicable IPC_Chime message to the infotainment system with the chime signal parameters set.

If there is a currently playing chime the Cluster shall determine the priority of the currently playing chime to see if it should be overwritten by the new chime request. If the new chime request has a higher priority then a currently playing fixed repetitive chime then the Cluster may want to monitor the AHU_Chime_Active signal to see if the new chime can be delayed until the current chime is complete or if it should immediately be overwritten.

The Cluster shall set all the signals in the IPC_Chime (1 or 2) messages and keep all the signals populated and unchanged as long as the chime is active (exception OFF_Time_Btwn_Chime signal). Only when the Chime is done should the IPC_Chime signals be set to No_Chime and Inactive.

The Cluster shall send a No_Chime for the currently playing chime before sending any new chime requests with the directionality for the same speakers. See sequence diagrams for examples of when chime requests are sent by the Cluster.

Note: If anything in the Cluster chime arbitrator spec contradicts what is in the chime section of the SPSS it should be brought to Ford's attention.

Multiple Chime Requests for speakers with the same directionality:
If the AHU is playing a chime (ex AHU_Chime_Active = Chime_Y) and if the Cluster needs to end the chime and play a new chime using the same speakers/directionality, then once the Cluster sends the No_Chime chime request to end Chime_Y the Cluster shall wait for the AHU to respond back with "AHU_Chime_Active = No_Chime" before making the new chime request. The AHU shall respond back to the Cluster No_Chime request within 75 msec with a No_Chime.

- Note: because of legacy Clusters the AHU cannot assume the Cluster will always wait for the AHU No_Chime response as stated above if two chime requests occur on different alert channels (ie IPC_Chime/IPC_Chime2). For the AHU's if they receive a cluster chime request (Chime_Y) on one Alert channel and then receive the No_Chime request on the same Alert channel the Cluster could send a chime request for the same speakers/directionality on a

different alert channel before the AHU responds back with a No_Chime and the AHU still has to support. See sequence diagrams with examples.

If the AHU is not playing a chime (AHU_Chime_Active = No_Chime) and if the Cluster sends a chime request such as IPC_Chime(Chime = Chime_X) and then the Cluster quickly sends a No_Chime before the AHU responds to the original Chime_X request with AHU_Chime_Active = Chime_X then the Cluster shall not send a new chime request until:

- The AHU responded back with AHU_Chime_Active = Chime_X and then AHU_Chime_Active = No_Chime, OR
- If the AHU does not respond back to the original Chime_X response (stays at AHU_Chime_Active = No_Chime) the Cluster shall wait 75 msec before making any new chime requests

3.1.1.11 ALERT-SR-REQ-014742/C-Chime_Vol_Level signal (TcSE ROIN-40361-3)

The Chime Audio Source stores the volume levels for each of the individual chimes. The Chime Audio Source will use the Chime_Vol_Level signal from the Cluster to determine how much lower the chime should be played from the stored volume level.

If the stored chime volume level in the chime audio source is to be played at 100% of the stored volume level then the Cluster shall set the signal Chime_Vol_Level = Inactive.

Once a chime is selected by the Cluster and broadcast on the infotainment bus the Cluster shall not change the selected chime volume level until the chime has ended or until there is a new chime activated.

3.1.1.12 ALERT-SR-REQ-014743/C-Chime Mixing (TcSE ROIN-40362-1)

The Chime Audio Source shall be capable of mixing the Chimes together with the main audio source as defined in the applicable Chime Audio Source component engineering specifications.

3.1.1.13 ALERT-SR-REQ-014744/G-_Chime_Not_Recognized signal and intotainments components supporting a chime they do not recognize (TcSE ROIN-40364-4)

If the Chime Generator receives a command from the Cluster to play a particular chime that the Chime Generator does not recognize (Chime_X were X is unknown) then the Chime Generator shall send the 'XXX_Chime_Not_Recognized = Chime_Not_Recognized' signal within 75msec of receiving the chime command.

When the Chime Generator sets the signal Chime_Not_Recognized = Chime_Not_Recognized then at the same time in the same message the AHU_Chime_Active signal will be used to say what Chime the Chime Generator cannot play.

- For the case where the chime generator receives two different chime requests for the same alert channel without receiving a Chime = No_Chime from the Cluster between chime requests (ex two different IPC_Chime : Chime_X and Chime_Y requests with no IPC_Chime : Chime = No_Chime in between):
  - the Chime Generator shall end whatever chime it was playing (finish playing chime sound) before the chime generator was requested to play a chime it did not recognize, and
  - At the same time set Chime_Not_Recognized for the new chime request.

The Cluster shall monitor the Chime Generators _Chime_Not_Recognized signal and when it equals Chime_Not_Recognized the Cluster shall then play the requested Chime indicated in the AHU_Chime_Active signal and update the IPC_Chime / IPC_Chime2 message to reflect the chime is no longer requested for the infotainment system.

When there is a separate Chime Generator and Chime Audio Source then the Chime Audio Source shall go to its default volume when it receives a chime request for a chime it does not recognize.

3.1.1.14 ALERT-SR-REQ-014745/E-Mute/Unmute Alert Channel (TcSE ROIN-40365-5)

The Chime Generator shall send a message to the Chime Audio Source to Mute it's Alert channel when it is finished producing it's chime AND after "IPC_Chime : Chime" is updated to "0x0 No Chime". The Chime generator shall mute the Chime Audio Source by sending the signal 'AHU_Alert : Chime_Alert_Chan = Mute' and then set the signal AHU_Alert : Chime_Alert_Chan = Inactive'. See sequence diagrams with examples of when the Chime Generator sends the Chime_Alert_Chan equal to Mute and Inactive.

The Chime Audio Source shall mute its Chime Alert input channel when it receives AHU_Alert : Chime_Alert_Chan = Mute AND IPC_Chime : Chime = No Chime. When muted the Chime Audio Source shall set Alert_Channel = Muted.

If the Chime Audio Source doesn't receive the mute command within 30 seconds of 'IPC_Chime : Chime = No_Chime' then the Alert channel shall be muted by the Chime Audio Source.

When a chime is first played the Chime Audio Source unmutes the alert channel based off the new chime request (regardless of the AHU_Alert : Chime_Alert_Chan status). Since the Chime Audio Source is unmuted for all new IPC_Chime requests and doesn't know if the Chime Generator will play the chime or not (ie Chime_Not_Recognized) the Chime Generator shall always be responsible for muting the chime alert channel for every chime request whether the Chime Generator excepts the request or not.

When a Chime is active and if the AHU sends AHU_Chime_Active = No_Chime without sending Muted then the Chime Audio Source would respond with Alert_Channel = Inactive (the AHU will send it this way for a fixed periodic chime where the AHU is ending the fixed periodic chime since it is done with all the chime repetitions). See sequence diagram "ALERT-GSD-167429-Fixed Repetitive Chime Event" which has an example.

3.1.1.15 ALERT-SR-REQ-014746/D-OFF_Time_Between_Chime signal (TcSE ROIN-40366-1)

The Cluster shall tell the Chime Generator how long there is no chime audio between playing a particular chime sound using the OFF_Time_Btwn_Chime signal (ex. pauses between repeating Chime_17 Reverse Park Aid sound). For the same chime this value may change.

Within a particular Chime Request from the Cluster the OFF_Time_Btwn_Chime signal could change for the same chime but this should not change the state of the Chime Audio Source Alert input channel settings (ex volume, directionality). While the OFF_Time_Btwn_Chime signal is changing for the same chime the Alert_Channel would remain Initialized_For_Chimes.

For example for a reverse park aid chime as the vehicle backs up the OFF_Time_Btwn_Chime signal could change to increase the beep rate by making the OFF_Time_Btwn_Chime time a smaller value.

Ex:
1. RPA Chime event occurs
2. The Cluster sends IPC_Chime/IPC_Chime2 (Chime = RPA_Chime; Chime_Occurance = Continuous; OFF_Time_Btwn_Chime = Zone1 Rate…)
3. The AHU starts playing the RPA chimes and sends AHU_Alert (AHU_Chime_Active = RPA_Chime).
4. The vehicle goes into another zone and sends IPC_Chime/IPC_Chime2 (Chime = RPA_Chime; Chime_Occurance = Continuous; OFF_Time_Btwn_Chime = Zone2 Rate…) without sending a No_Chime and only changes the OFF_Time_Btwn_Chime signal.
5. The AHU plays the RPA chimes at the rate for Zone 2 and continues to send (AHU_Chime_Active = RPA_Chime).

Note: in the above example both the Cluster and AHU did not send a No_Chime when only the OFF_Time_Btwn_Chime signal changed.

3.1.1.16 ALERT-SR-REQ-014747/J-Chime_Time_Criticality = Criticality_High (TcSE ROIN-40367-1)

The Cluster shall set 'Chime_Time_Criticality = Criticality_High' if a new Chime is a chime that needs the currently playing chime sound (ex Chime_8 Ford DNA B) to be immediately ended so the new Chime can be played as quickly as possible (ex. FCW).

If the Chime Generator received a Criticality_High Cluster No_Chime Chime Request to end the currently playing chime then if the chime sound is playing (ex DNA B) the Chime Generator shall immediately end playing that chime sound. See AHU hardware spec for what is the longest it can take to end a chime sound with no distortions or pops (ex 10 msec or whatever defined in AHU hardware spec).

If the Chime Generator received a criticality low No_Chime request from the Cluster to end the current chime and while the Chime Generator is still playing the current chime sound (ex AHU_Chime_Active = Chime_X) if the Chime Generator then

receives a criticality_high chime request for the same speakers from the Cluster then the Chime Generator shall immediately end the current chime (ie immediately end Chime_X sound). See sequence diagrams for detailed examples.

Ex.
Pre-Condition:
Infotainment Chime Generator and Chime Audio Source are playing a continuous chime.

Event:
Chime Clients ends the chime with Criticality_High No Chime event. Chime Client sends IPC_Chime (Chime = No Chime, Chime_Time_Criticality = Criticality_High, Chime_Vol_level = Inactive; Chime_Directionality = Inactive; OFF_Time_Btwn_Chime = Inactive; Chime_Occurence = Inactive)

Post-Condition:
The Chime Generator ends it currently playing Chime_X sound (ex DNB) before it is finished and immediately sets AHU_Chime_Active = No Chime

3.1.1.17 ALERT-SR-REQ-014748/I-Chime_Time_Criticality = Criticality_Low (TcSE ROIN-40368-1)

The Cluster shall set 'Chime_Time_Criticality = Criticality Low' if a new Chime is a chime that can wait for the currently playing chime to finish playing the chime sound (ex. finish Ford DNA B sound) before playing the new chime.

If the Chime Generator receives a Criticality_Low Cluster No_Chime request to end the current chime then if the Chime Generator is playing a chime sound (ex Ford DNA B sound) it shall finish playing the chime sound and then end the chime (ie set AHU_Chime_Active = No_Chime).

If the Chime Generator received a criticality_low Cluster chime request "Chime = No_Chime" to end the current chime (ex Chime_X) and while the Chime Generator is still playing the previous chime sound (ex AHU_Chime_Active = Chime_X) the Chime Generator received a new low criticality Chime request for the same speakers then the AHU / DSP AMP shall start to play the new chime after playing the currently playing chime sound finishes (the AHU/DSP AMP shall play the new chime as long as the Cluster has not sent the No chime for the new chime request (ex. IPC_Chime/IPC_Chime2 (Chime = Chime_New → Chime = No_Chime)) by the time the AHU/DSP AMP finishes playing the old chime sound (Chime_X)). See sequence diagrams for examples.

Example 1: If the Chime_Occurance was set to 8 repetitions of the Chime_X sound (ex Ford DNA B) and the 3rd repetition Chime_X sound is currently being played when the new Chime_Y is requested with Chime_Time_Criticality = Criticality Low then the Chime Generator would finish the 3rd repetition of the Chime_X sound and keep AHU_Chime_Active = Chime_X until finished but not play the remaining 5 repetitions but instead switch to the new chime. See sequence diagrams for detailed examples.

Note: The Cluster can always just wait for the chime to complete it's repetitions by monitoring the AHU_Chime_Active = Chime_X signal to avoid having to interrupt a chime.

Example 2.
Pre-Condition:
Infotainment Chime Generator and Chime Audio Source are playing a continuous chime (AHU_Chime_Active = Chime_X).

Event:
Chime Clients ends the chime with Criticality_Low No Chime event. Chime Client sends IPC_Chime (Chime = No Chime, Chime_Time_Criticality = Criticality_Low, Chime_Vol_level = Inactive; Chime_Directionality = Inactive; OFF_Time_Btwn_Chime = Inactive; Chime_Occurence = Inactive)

Post-Condition:
The Chime Generator ends it currently playing Chime_X sound (ex DNA B) after the Chime Generator is finished producing the Chime_X sound and sets ChimeGenerator_Chime_Active = No_Chime after it is done producing the sound

3.1.1.18 ALERT-SR-REQ-014749/H-Chime Directionality signal (TcSE ROIN-40369-5)

The Cluster shall tell the Chime Audio Source what speakers to play the chime through using the signal Chime_Directionality.

If the AHU Chime Generator has one polyphonic chime generator and one non-polyphonic simple chime generator the following rules apply:

Vehicle with Front and Rear Speakers:
- if the Chime_Directionality = Front then the chime generator shall use the polyphonic chime generator.
  - Exception: if the Chime_Directionality = Front AND IPC_Chime/IPC_Chime2 : Chime/Chime2 = Chime_33 or Chime_34, then the chime generator shall use the click/clack or equivalent waveform chime generator
- if the Chime_Directionality = All then the chime generator shall use the polyphonic chime generator.
- If the Chime_Directionality = Rear then the chime generator shall use only the simple chime generator (ie polyphonic chimes cannot be produced when Chime_Directionality = Rear).

Vehicle with Front Speakers Only (no rear speakers):
- if the Chime_Directionality = Front then then the chime generator shall use the polyphonic chime generator.
  - Exception: if the Chime_Directionality = Front AND IPC_Chime/IPC_Chime2 : Chime/Chime2 = Chime_33 or Chime_34, then the chime generator shall use the click/clack or equivalent waveform chime generator
- if the Chime_Directionality = All then the chime generator shall use the polyphonic chime generator.
- If the Chime_Directionality = Rear then the chime generator shall use only the simple chime generator (ie polyphonic chimes cannot be produced when Chime_Directionality = Rear).

Note: Could have both polyphonic and simple chimes coming out of the front speakers if one chime request for front speakers and another for rear speakers. Example: Chime_Directionality = Front and Chime_Directionality2 = Rear both active at the same time.

On vehicles that have only Front Speakers the Chime Generator and Chime Audio Source shall be configured for Front speakers so they know when to play directionality = rear chimes out of the front speakers.

The Cluster shall only set one chime active at a time in the front speakers and only one chime active for the rear speaker at the same time. See below for allowable combinations for the Cluster to send.

Allowable Combinations (vehicle with Front and Rear speakers):
1. 1 chime Front speakers only (Chime_Directionality = Front)
2. 1 chime Rear speakers only (Chime_Directionality = Rear)
3. 1 chime out for Front speakers and one chime out of Rear speakers at the same time
4. 1 chime out of All speakers (second chime request the AHU would respond with Chime_Not_Recognized)

If the AHU chime generator receives 2 chime requests for the same speakers (ie Chime_Directionality & Chime_Directionality2 both equal Front, both equal to Rear, or All plus Front/Rear/All) then the second chime request the AHU shall respond with AHU_Chime_Not_Recognized / AHU_Chime_Not_Recognized2 = Chime_Not_Recognized and shall not be played by the AHU (would be played by the Cluster).

Example two chimes requested with the same directionality on different alert channels.
Pre-Condition:
1. Cluster sending "IPC_Chime (Chime =Chime_X; Directionality = Front)" and "IPC_Chime2 (Chime2 = No_Chime; Directionality = Inactive)".
2. The AHU is sending "AHU_Alert (AHU_Chime_Active = Chime_X; AHU_Chime2_Active = No_Chime)".

Event:
1. While the Cluster is sending "IPC_Chime (Chime = Chime_X; Directionality = Front)" it also sends "IPC_Chime2 (Chime2 = Chime_Y; Directionality2 = Front)"

Post-Condition:
1. AHU responds by sending AHU_Alert (AHU_Chime_Active = Chime_X; AHU_Chime_Not_Recognized = Inactive; AHU_Chime_Active2 = Chime_Y; AHU_Chime2_Not_Recognized = Chime_Not_Recognized);
   - The AHU would not play the 2nd chime since it is not a valid chime request on the same speakers but would set Chime_Not_Recognized for that chime
   - The Cluster would see Chime_Y set to Chime_Not_Recognized and would play that chime in the Cluster

Chime Generator supporting Chime_33 and Chime_34:
If the Chime Generator receives a chime request for Chime_33 or Chime_34 then the Chime Generator shall use the Click/Clack or Waveform Chime Generator to produce the sound. See AHU hardware specification for details.

Any chime that uses the Click / Clack generator shall only support Directionality "Front". Therefore Chime_33 and Chime_34 shall only be set to Directionality = Front by the Cluster. If the Chime Generator receives Directionality = All or Rear for Chime_33 or Chime_34 the Chime Generator shall respond back with Chime_Not_Recognized and the chime shall not be played.

If while playing Chime_33 or Chime_34 the chime generator receives a "IPC_Chime/IPC_Chime2 (Chime = No_Chime; Chime_Time_Criticality = Criticality_High)" from the Cluster to end Chime_33 or Chime_34, and then gets an IPC_Chime request play a new Chime_X, the chime generator shall:

- End the Chime_33 / Chime_34 chime without creating distortions or pops and follow the chime strategy to play the new Chime_X. Example if could end Chime_33/Chime_34 within 15 msec without producing distortions or pops like other chime sounds.
- If cannot end Chime_33/Chime_34 sound within 15 msec without creating noticeable distortions or pops:
    - Continue to play the Chime_33/Chime_34 sound until can end without creating distortions or pops but end as soon as possible. Playing Chime_33 / Chime_34 should not take more than 70 msec worst case since could end during the silent portion of the Chime_33/Chime_34 sound.
        - For example if there is a pause between the "Click" and "Clack", the Chime Generator shall end the chime during the pause if can't end the Click or Clack sound playing without noticeable distortions or pops.
        - This could be an exception for "ALERT-SR-REQ-014747-Chime_Time_Criticality = Criticality_High" in which the chime sound is usually immediately ended (within 15 msec).
    - Respond with AHU_Alert.St : AHU_Chime_Active/AHU_Chime_Active2 = No_Chime even if the Chime_33 and Chime_34 sound have not ended and start the process of playing new Chime_X.
    - Mix the new Chime_X with Chime_33 or Chime_34 either as output to the speakers or line level signals to the chime audio source (ex DSP AMP) if the Chime Generator hasn't yet ended the Chime_33/Chime_34 sound.

3.1.1.19 ALERT-SR-REQ-014750/C-Chime Audio Attenuation (TcSE ROIN-40370-1)

While chime(s) are active the Cluster shall tell the Chime Audio Source if the infotainment audio will be attenuated, muted, or if there will be no effect on non-chime infotainment audio via the 'IPC_Infotainment.St() : Attn_Info_Audio' signal.

3.1.1.20 ALERT-SR-REQ-014751/D-Chimes in Single and Dual Play (TcSE ROIN-40410-2)

The chimes shall be played regardless if the infotainment system is in Single Play or Dual Play.

Requirement to be updated when/if dual play is supported. For now a place holder for dual play.

~~If in Dual Play with the rear speakers muted and if the rear speakers are needed for the chime (as indicated in the Chime_Directionality signal then:~~

~~1. The AHU shall mute the line level signal to the RSE module for the headphones within 30 msec and then~~
~~2. unmute the rear speaker audio for chimes within 50 msec~~

~~If in Dual Play with a DSP AMP present then the DSP AMP shall unmute the rear speakers for chimes if the Chime_Directionality signal indicates that the rear speakers are needed. The rear speakers should not unmute until after 30 msec have passed from receiving the Chime CAN command signal but before 70 msec have passed from receiving the chime signal.~~

~~Note: If the RSE audio source is internal to the FES / RSEM (ex. rear DVD) then this will not affect the audio to the rear headphones. Only the line level audio from the AHU would be muted to the headphones.~~

~~After the Chime event has ended the AHU / RSE audio source line level signal would return to the FES / RSEM headphones if in dual play.~~

3.1.1.21 ALERT-SR-REQ-014752/C-_Chime_Active signal from Chime Generator (TcSE ROIN-40394-3)

The Chime Generator shall indicate what chime it is playing to the chime components (ex. Cluster, Chime Audio Source) via the '_Chime_Active = Chime_X' signal. This event-periodic signal will be updated on event when the Chime Generator starts or stops playing a chime.

When there is no chime being played then the '_Chime_Active' signal shall equal 'No_Chime'. Note: this does not mean that in between chime sounds (Off_Time_Btwn_Chime) that 'No_Chime' is set.

When the Chime_Occurance signal is set to a fixed repetition rate the Chime Generator shall not set the _Chime_Active signal equal to "No_Chime" until the last repetition and chime sound is finished playing. Until the last chime sound is played the _Chime_Active shall be set to the current chime.

3.1.1.22 ALERT-SR-REQ-014753/D-Chime Occurance signal (TcSE ROIN-40395-1)

The Cluster shall tell the Chime Generator the Occurrence of the chime to be played using the Chime_Occurance signal.

-- If Chime_Occurence is set to 1, 2, 3… repetitions then the chime shall be played 1, 2, 3… times respectively and then the chime shall end (unless repetition ended early by the Cluster with IPC_Chime : Chime = No_Chime). The Cluster shall know that the chime has ended by looking at what the Chime Generator signal 'XXX_Chime_Active' is set equal to. If it's set to 'No_Chime' then the chime has ended.

-- If Chime_Occurence is set to 'Continuous' then the Chime shall play as long as the Chime_X signal in 'IPC_Chime : Chime = Chime_X' doesn't change.

- When the chime is turned off (IPC_Chime : Chime = No Chime') then the currently playing chime will end. It shall either finish playing the chime or immediately end depending on the Chime_Time_Criticality signal state.

3.1.1.23 ALERT-SR-REQ-014754/C-Chime / Prompt / Beep Prioritization (TcSE ROIN-40432-5)

The Chime Audio Source shall be capable of mixing a chime and prompt together at the same time. If a beep event occurs while both a chime and prompt are active then the chime audio source shall mix in the beep if it is capable otherwise the beep shall not be heard. A chime has higher priority than a beep.

The Prompt Generator can monitor the IPC_Infotianment : Attn_Info_Audio / New_Attn_Event signal to see if the prompt is muted or attenuated. This could be used by the prompt generator to avoid prompts seeming to be starting mid-sentence to the user because of a muting event caused by a chime.

Alert Channel 1 between the Chime Generator and Chime Audio Source is used for Chime1 as indicated in the IPC_Chime.St message

Alert Channel 2 between the Chime Generator and Chime Audio Source is used for Chime2 as indicated in the IPC_Chime2.St message.

3.1.1.24 ALERT-SR-REQ-014755/E-Chime ID Assignments (TcSE ROIN-167427-3)

CAN	Chime_X	Chime Sound ID
0x1	Chime_0	No Chime
0x2	Chime_1	Turn Signal (Tic)
0x3	Chime_2	Turn Signal (Toc)
0x4	Chime_3	1.0 Second Chime
0x5	Chime_4	0.5 Second Chime
0x6	Chime_5	0.25 Sec Chime

0x7	Chime_6	1 Sec Tone (1KHz Alert)
0x8	Chime_7	0.1 Sec Chime
0x9	Chime_8	Ford DNA Chime B (Soft Warning)
0xA	Chime_9	Ford DNA Chime C (Hard Warning)
0xB	Chime_10	Ford DNA Chime D (Non-Critical Alert) - Info
0xC	Chime_11	Ford DNA "B" shortened to 0.5 sec
0xD	Chime_12	Perimeter Warn. Chime A
0xE	Chime_13	Perimeter Warn. Chime B
0xF	Chime_14	Perimeter Warn. Chime C
0x10	Chime_15	Cross-Traffic Alert (CTA)
0x11	Chime_16	Forward Park Aid
0x12	Chime_17	Reverse Park Aid
0x13	Chime_18	Lincoln DNA Chime B (Soft Warning)
0x14	Chime_19	Lincoln DNA Chime C (Hard Warning)
0x15	Chime_20	Lincoln DNA Inf Chime D (Non-Critical Alert)- Info
0x16	Chime_21	Lincoln DNA "B" shortened to 0.5 sec
0x17	Chime_22	ACC-High, and FCW
0x18	Chime_23	Lane Departure Warning (LDW)
0x19	Chime_24	Push Button
0x1A	Chime_25	Beltminder A
0x1B	Chime_26	Beltminder B
0x1C	Chime_27	RPA Continuous
0x1D	Chime_28	FPA Continuous
0x1E	Chime_29	Power Liftgate (POT) / Power Sliding Door
0x1F	Chime_30	Chime_30
0x20	Chime_31	Chime_31
0x21	Chime_32	Chime_32
0x22	Chime_33	Chime_33
0x23	Chime_34	Chime_34
0x24	Chime_35	Digital Audio Chime file (stereo chime)
0x25	Chime_36	Digital Audio Chime file (stereo chime)
0x26	Chime_37	Digital Audio Chime file (stereo chime)
0x27	Chime_38	Digital Audio Chime file (stereo chime)
0x28	Chime_39	Digital Audio Chime file (stereo chime)
0x29	Chime_40	Digital Audio Chime file (stereo chime)
0x2A	Chime_41	Digital Audio Chime file (stereo chime)
0x2B	Chime_42	Digital Audio Chime file (stereo chime)
0x2C	Chime_43	Digital Audio Chime file (stereo chime)
0x2D	Chime_44	Digital Audio Chime file (stereo chime)

3.1.1.25 ALERT-SR-REQ-014756/D-ANC Network Activation (TcSE ROIN-198071-2)

The ANC module shall vote to keep the network bus awake as long as Power_Up_Chimes_Modules = Active.

Note:

- this is so the ANC module can send its heartbeat signal to the Chime Generator.
- This requirement is for when the ANC module is not integrated in the AHU and is a separate module from the AHU.

3.1.1.26 ALERT-SR-REQ-237862/D-Chime_ID signal

Note throughout this Chime_ID signal requirement when the SPSS specifies what to do for the ChimeID_No_Rq / ChimeID_No_Stat signals the same requirements apply to Chime2ID_No_Rq / Chime2ID_No_Stat signals.

- IPC_Chime(ChimeID_No_Rq) corresponds to AHU_Alert(ChimeID_No_Stat)
- IPC_Chime2(Chime2ID_No_Rq) corresponds to AHU_Alert(Chime2ID_No_Stat)

Note: The Chime_ID signals were added per the Cluster Ford team since they are needed to identify chime active responses back from the AHU to make sure the Cluster Chime Request and AHU chime active responses (ie AHU_Chime_Active) were always talking about the same chime (chime = all the signals in IPC_Chime/IPC_Chime2). This was identified as a potential Cluster issue for multiple chime requests where Chime = Chime_X for a sound which could be used for multiple chimes.

- This Chime ID requirement needs to be supported when Adjustable Chimes is supported. Once this requirement is supported in the AHU software then the Chime ID signal shall continue to be supported by the AHU regardless whether adjustable chimes is supported or not.

Cluster Chime Client:
The Cluster / Chime Client shall set the signal ChimeID_No_Rq equal to an ID value to uniquely identify all chime requests to the infotainment system (see chime arbitrator specs for details on implementing this in the Cluster).

Once the Cluster sets ChimeID_No_Rq equal to an ID value for a chime request it shall hold this value for the entire time this chime is active in the IPC_Chime chime request message.

- Note: signal OFF_Time_Btwn_Chime is allowed to change and still be considered the same chime

The Cluster shall be backwards compatible with AHU modules that don't support the Chime_ID signals (sourced to earlier versions of the Alerts SPSS). If not supported the ChimeID_No_Stat from the AHU should always be set to 0x0 Inactive.

Some chime sequence diagrams where updated to show the ChimeID_No_Rq and ChimeID_No_Stat signals. Reference those sequence diagrams for examples of those signals being used.

AHU Chime Generator:
The AHU Chime Generator shall set the signal ChimeID_No_Stat equal to the value in the Clusters ChimeID_No_Rq signal when playing that particular chime (IPC_Chime(Chime = Chime_X; ChimeID_No_Rq = Y…)). The AHU shall continue to send the same ChimeID_No_Stat value from the Cluster ChimeID_No_Rq chime request signal until the AHU is done playing the chime (either AHU finishes playing or the Cluster ends the chime). The AHU shall never change the ChimeID_No_Stat signal while playing a chime regardless what the Cluster is sending in its ChimeID_No_Rq signal.

When the AHU sets AHU_Chime_Active = No_Chime the ChimeID_No_Stat signal shall be set to 0x1 (ID used for No_Chime).

Some chime sequence diagrams where updated to show the ChimeID_No_Rq and ChimeID_No_Stat signals. Reference those sequence diagrams for examples of those signals being used.

In the case where Cluster doesn't support Chime ID signal but the AHU does then the AHU shall just repeat whatever is in the ChimeID_No_Rq signal. The ChimeID_No_Rq signal does not have any effect on the AHU chime audio itself so the AHU is backwards compatible with Clusters that don't support Chime ID signals..

- If the Cluster keeps ChimeID_No_Rq = 0x0 Inactive while chimes is active (because it doesn't support chimes) then the AHU shall set ChimeID_No_Stat = 0x0 Inactive.
  - Exception: If simpler on the AHU software when there is no chime the AHU could still set ChimeID_No_Stat = 0x01 ID for No Chime.

Example1 (AHU ends chime when finished playing it):

1. Cluster sends IPC_Chime (Chime = Chime_X; ChimeID_No_Rq = Z; Chime_Occurence = 5 repetitions;…)
2. AHU plays the chime and sends AHU_Alert(AHU_Chime_Active = Chime_X; ChimeID_No_Stat = Z) while playing the chime
3. AHU finishes the 5th repetition and sends AHU_Alert(AHU_Chime_Active = No_Chime; ChimeID_No_Stat = 0x01 ID for AHU No Chime).

Example 2 (Cluster ends a chime before the AHU is finished playing it):

1. Cluster sends IPC_Chime (Chime = Chime_X; ChimeID_No_Rq = Z; Chime_Occurence = 5 repetitions;…)
2. AHU starts playing the chime and sends AHU_Alert(AHU_Chime_Active = Chime_X; ChimeID_No_Stat = Z)
3. Cluster ends the chime before the AHU finishes playing the 2nd repetition chime sound and sends IPC_Chime(Chime = No_Chime; ChimeID_No_Rq = don't care for AHU; Chime_Time_Criticality = Criticality_Low)
4. AHU sends AHU_Alert(AHU_Chime_Active = Chime_X; ChimeID_No_Stat = Z) until the second repetition Chime_X sound is complete

5. When AHU finishes the 2nd repetition it sends AHU_Alert(AHU_Chime_Active = No_Chime; ChimeID_No_Stat = 0x01 ID for AHU No Chime)

DSP AMP chime audio source:
No impact to the DSP AMP

3.1.2 Chimes Error Management Requirements

3.1.2.1 ALERT-SR-REQ-014757/C-Default Chime Source at Start-Up (TcSE ROIN-40440-2)

Upon bus wake-up the default is for the Cluster to set the Infotainment System as the Chime Generator & Chime Audio Source unless an Error state had been entered previously. This is assuming the Cluster was configured to have the Infotainment System as the Chime Source.

3.1.2.2 ALERT-SR-REQ-014758/C-Loss of communication with Chime module (TcSE ROIN-40441-5)

The Cluster shall monitor the AHU_Alert heartbeat periodic message for determining if the Chime Generator fell off the bus. If the Cluster loses communication with the Chime Generators AHU_Alert message for more then 5 seconds then the Cluster shall become the Chime Generator and Chime Audio Source and shall set the signal 'IPC_Infotainment.St() : Chime_Source = Cluster' and 'Power_Up_Chime_Modules = Inactive'.

If Chimes are supported through the infotainment system then the Chime Generator has to determine if a vehicle has the DSP AMP, AAM or ANC module present on a vehicle. If the Chime Generator loses communication with the DSP AMP, AMM, Cluster or ANC module for more then 5 seconds then the Chime Generator shall set AHU_Chime_Supported = Not Supported so the Cluster becomes the Chime Generator and Chime Audio Source.

3.1.2.3 ALERT-SR-REQ-014759/G-Chime Error States / Fault handling (TcSE ROIN-40443-11)

If the Chime Generator sets its signal 'XXX_Chimes_Supported' equal to 'Not_Supported' for a particular configuration then the Cluster shall become the Chime Generator and Chime Audio Source and sets the 'IPC_Infotainment.St() : Chime_Source = Cluster' and Power_Up_Chime_Modules = Inactive.

The Chime Generator shall monitor the Infotainment System Chime components (ie ANC, AAM, DSP AMP) XXX_Chimes_Supported signals. If the ANC, AAM or DSP AMP XXX_Chimes_Supported signals equal Not_Supported then the AHU shall set its AHU_Chimes_Supported signal = Not Supported. Note: The AHU shall not monitor the ANC Chime_Supported signal when ANC is integrated in the AHU or when a DSP AMP module is present.

The Chime components are responsible for setting "_Chimes_Supported = Not_Supported" whenever they are no longer able to produce chimes because of a fault condition, otherwise their signal shall be set to 'Supported' if able to produce chimes with no fault conditions (see IDS for details). A normal crank event is not considered a fault condition. A normal crank event would not cause the _Chime_Supported signal to change. For example if Chime_Supported = Supported and a normal crank event occurs the _Chime_Supported value would remain equal to Supported and would not change because of the crank event (ie would never change to Inactive or Not_Supported). A chime FMEA shall be performed on all the chime components to verify that fault conditions are detected and _Chimes_Supported is set to Not_Supported when necessary.

Any infotainment component that could prevent chimes from being played through the infotainment system needs to have a "XXX_Chimes_Supported" signal so chimes can be transferred to the Cluster for an error condition.

Some fault conditions (while not limited to these) that would result in the _Chimes_Supported signal being set to Not_Supported: 1) Short/open circuit to any of the chime speakers 2) short/open circuit on the line level signals to the chime components 3) low voltage preventing the chime components from producing audio (not applicable to crank but if AHU stuck at a low voltage)…

When the Audio Enable line is keeping the Audio Muted for more then 5 seconds then the chime source being muted shall set its chime signal 'XXX_Chime_Supported' equal to 'Not_Supported' (example DSP AMP, ANC, AAM).

The Chime Audio Components (ex.AHU, DSP AMP, AAM, ANC…) shall set their _Chime_Supported signal to Supported or Not_Supported within 2000 msec of the start of Chime Diagnostics. Reference the IDS for entering chime diagnostics.

If _Chime_Supported = Supported and then Power_Up_Chime_Modules = transitions from Active to Inactive and the module powers down and is no longer capable of producing chimes then the _Chime_Supported signal shall equal "inactive".

- Note: the start of chime diagnostics requires _Chime_Supported signal to equal Inactive (see IDS for details)

If the Chime Generator doesn't receive the ANC, AAM or DSP AMP Chimes_Supported signal equal to Supported within 3000 msec after the start of chime diagnostics it shall treat 'Inactive' the same as 'Not Supported' and set AHU_Chimes_Supported = Not Supported. During the 3000 msec since chime diagnostics started if the ANC, AAM or DSP AMP has their chime supported signal set to "Inactive" then the Chime Generator shall also have its _Chime_Supported signal set as "Inactive".
If the Chime Client (Cluster) receives 'AHU_Chimes_Supported = Inactive' 5000 msec after Power_Up_Chime_Modules transitions from Inactive to Active (or at network bus start-up might just go directly to active) then it shall treat 'Inactive' the same as 'Not_Supported'.

Note: The IPC_Infotainment : Chime_Source signal has no effect on the _Chime_Supported signal.

A periodic IPC_Chime/IPC_Chime2 network message is not considered a new chime event for the Chime Audio Components (ex Chime Generator, Chime Audio Source).

The user adjusted Bass, Treble, Balance, Mid-Range, Fade settings shall not effect chimes. For example if the BTMBF setting did effect chimes the user could fade to front speakers and a chime that is supposed to be played out of the rear speakers only would not be heard.

If the Chime Generator / Chime Audio Source is NOT configured to support the chime strategy as defined in this Chime SPSS feature/section than the Chime Generator/Chime Audio Source shall always be set to _Chime_Supported = Not_Supported.

- Ex. AHU_Chime_Supported would always be set to Not_Supported if the C1MCA chime strategy was configured ON since C1MCA chime strategy does not support this chime strategy as defined in this feature/section.
- Reference the Infotainment Diagnostic Spec for configuration used for this chime feature/section.

3.1.2.4 ALERT-SR-REQ-014760/C- Chime_Supported signal changes to Supported from Not_Supported (TcSE ROIN-40444-2)

If the Chime Generator set its signal 'XXX_Chimes_Supported' equal to 'Supported' after previously being set to 'Not_Supported' in the same ignition state then the Cluster shall not set the infotainment system as the chime source until the next ignition cycle. The 'IPC_Infotainment.St() : Chime_Source' shall remain equal to 'Cluster' for that ignition state.

3.1.2.5 ALERT-SR-REQ-014761/D-Load Shed (TcSE ROIN-40447-3)

During an infotainment Load Shed event (HMIAudioMode = Load Shed) the Cluster shall set the 'IPC_Infotainment.St() : Chime_Source' signal equal to 'Cluster' AND Power_Up_Chimes_Modules = Inactive for that ignition cycle and the Cluster shall become the Chime Generator and Chime Audio Source.

Note: see "PWRMAN-GREQ-014509-Infotainment Components Load Shed State requirements" for when an infotainment load shed event is active

3.1.2.6 PWRMAN-SR-REQ-014509/D-Infotainment Components Load Shed State requirements (TcSE ROIN-66172-3)

Unless otherwise noted the infotainment components shall transition to their Standby or Sleep Load Shed low power state when the signal HMIAudioMode == Load Shed.

The infotainment components that support chimes (ex. AHU, DSP AMP, AAM, ANC…) during a transition to load shed from state where chimes are through the infotainment system shall wait until the Cluster transfers control of the chimes back to the Cluster (as defined in ALERT-REQ-014761-Load Shed) before entering their low power states.

- Since the infotainment components that support chimes have to wait for Cluster to transfer chime control back to the Cluster during a load shed event before they no longer support chimes the infotainment components would have

Chime_Supported = Supported while supporting chimes. After chime control is transferred to the Cluster the infotainment components can change Chime_Supported = Not_Supported while the load shed is active.

In the Standby Load Shed low power state non-essential component functions shall be turned OFF (ex. active pre-fetch). Basic standby operations will still be followed such as supporting the Network bus and any regulatory requirements (ex. illumination).

Note: There may also be applicable Climate Control load shed requirements for modules the support Climate Control functionality.

3.1.2.7 ALERT-SR-REQ-014762/C-Response when chime signals from Chime Client set to inactive (TcSE ROIN-193435-1)

If any of the signals Chime, Chime_Directionality, Chime_Time_Criticality, OFF_Time_Btwn_Chime, or Chime_Occurance in the IPC_Chime (1 or 2) messages are set to 'inactive' then the Chime Generator won't create a new chime sound and the AHU_Alert : AHU_Chime_Active signal will be set to No_Chime to tell the Cluster that it is not playing the chime.

3.1.2.8 ALERT-SR-REQ-052682/I-Chime Requests while the infotainment system is muted during a cold crank

During a cold crank event infotainment chimes are muted by the infotainment system. If the Cluster needs to have a chime played during a cold crank while the infotainment system is muted then the Cluster would have to play the chime through the Cluster.

After a crank event ends the Chime Generator shall unmute and be capable of playing the chimes no later than 1000 msec after the crank event ends.

- The Crank event ending for both the AHU and DSP AMP is defined in requirements "STMGNTv2-GFUN-202153-1-Crank, Front System ON" for CGEA 1.3 and "STMGNT-FUN-014666-Crank, Front System ON" for CGEA 1.2 / C1MCA.
- Reference the EMC specification(s) for the worst case cold crank voltage profile that needs to be supported (ex EMC requirement CI-230).

After a crank event ends but before the Chime Generator has unmuted if the chime generator receives a chime request then:

- the Chime Generator shall still respond to IPC_Chime/IPC_Chime2 chime request messages and behave as if it is playing the chime (ex chime generator responds with AHU_Alert : AHU_Chime_Active = Chime_X)
- as soon as the Chime Generator is unmuted the chime will be playing as if the chime began playing with the initial chime request (exception seat belt chime). For example if the chime had 3 repetitions then by the time the Chime Generator is unmuted it may be on the 2nd or 3rd repetition.

Exception to Chime Generator requirement above - Seat Belt Chime:
After a crank event ends and the Chime Generator has not yet unmuted if the chime generator had received a Seat Belt Chime request from the Cluster while the network signal said crank (if message was not lost with crank voltage dip) or after crank ends but before the AHU / DSP AMP unmuted then (ie IPC_Chime /IPC_Chime2 = "Seat Belt Chime") then:

1. the chime generator shall update the AHU_Chime_Active/AHU_Chime_Active2 signal to Seatbelt Chime when it received the IPC_Chime request (follow sequence diagram for when DSP AMP present), and
   - AHU Only (No DSP AMP):
     - then the chime generator delays playing the seat belt chime until after the chime generator is unmuted as long as:
       i. when the unmute first occurs the Cluster is still sending the seat belt chime request message (IPC_Chime = "Seat Belt Chime")
       ii. and the Cluster has not already ended the chime (ie IPC_Chime : Chime = No_Chime).

       The Chime Generator shall start playing the seat belt chime no later than 20 msec after the unmute occurs.
   - AHU with DSP AMP combination:
     - then the chime generator delays playing the seat belt chime until 950 msec +/- 10 msec after the crank event ends as defined in Station Management SPSS crank requirements (STMGNT-FUN-014666, STMGNT-FUN-202153) as long as:

- when the unmute first occurs the Cluster is still sending the seat belt chime request message (IPC_Chime = "Seat Belt Chime")
- and the Cluster has not already ended the chime (ie IPC_Chime : Chime = No_Chime).

The IPC_Chime / IPC_Chime2 seat belt chime is active when the following signals are set:

Ford Seat Belt Chime:
IPC_Chime/IPC_Chime2 (Chime = 0x0B Chime_10, Chime_Vol_Levl = 0x0 100% stored volume; Chime_Directionality = 0x2 Front; Chime_Time_Criticality = 0x1 Criticality_High; OFF_Time_Btwn_Chime = 0x1 Continuously; Chime_Occurance = 0x4 4 repetitions)

Lincoln Seat Belt Chime:
IPC_Chime/IPC_Chime2 (Chime = 0x15 Chime_20, Chime_Vol_Levl = 0x0 100% stored volume; Chime_Directionality = 0x2 Front; Chime_Time_Criticality = 0x1 Criticality_High; OFF_Time_Btwn_Chime = 0x1 Continuously; Chime_Occurance = 0x4 4 repetitions)

Example – Seat belt chime request after a crank event ended but before the AHU is unmuted (No DSP AMP present):
1. Crank event ends
2. The Cluster sends IPC_Chime (Chime = 0x0B Chime_10, Chime_Vol_Levl = 0x0 100% stored volume; Chime_Directionality = 0x2 Front; Chime_Time_Criticality = 0x1 Criticality_High; OFF_Time_Btwn_Chime = 0x1 Continuously; Chime_Occurance = 0x4 4 repetitions)
3. The AHU responds within 75 msec with AHU_Alert.st (AHU_Chime_Active = 0xA Chime_10)
4. 600 msec (could be any value under 1000 msec) after the crank event ended the AHU unmutes and starts playing the first seat belt chime sound and plays all 4 repetitions (unless Cluster ends the chime before finished).

3.1.2.9 PWRMAN-SR-REQ-014520/F-Transport Mode and CGEA Chimes (TcSE ROIN-40663-3)

Audio Chimes shall NOT be enabled through the Infotainment System during Transport Mode. The Cluster shall support Chimes during Transport Mode.

During a transition to Transport Mode from another CarMode state where the chimes are through the infotainment system the Cluster shall set the 'Chime_Source' signal equal to 'Cluster' and Power_Up_Chime_Modules = Inactive.

- The infotainment components that support chimes shall wait until the Cluster transfers control of the chimes back to the Cluster with the 'Chime_Source = Cluster' AND 'Power_Up_Chime_Module = Inactive' before entering their transport mode low power states.
  - Since the infotainment components that support chimes have to wait for Cluster to transfer chime control back to the Cluster during a transport mode event before they no longer support chimes the infotainment components would have Chime_Supported = Supported while supporting chimes. After chime control is transferred to the Cluster the infotainment components can change Chime_Supported = Not_Supported while transport mode is active.

3.1.3 Sequence Diagrams

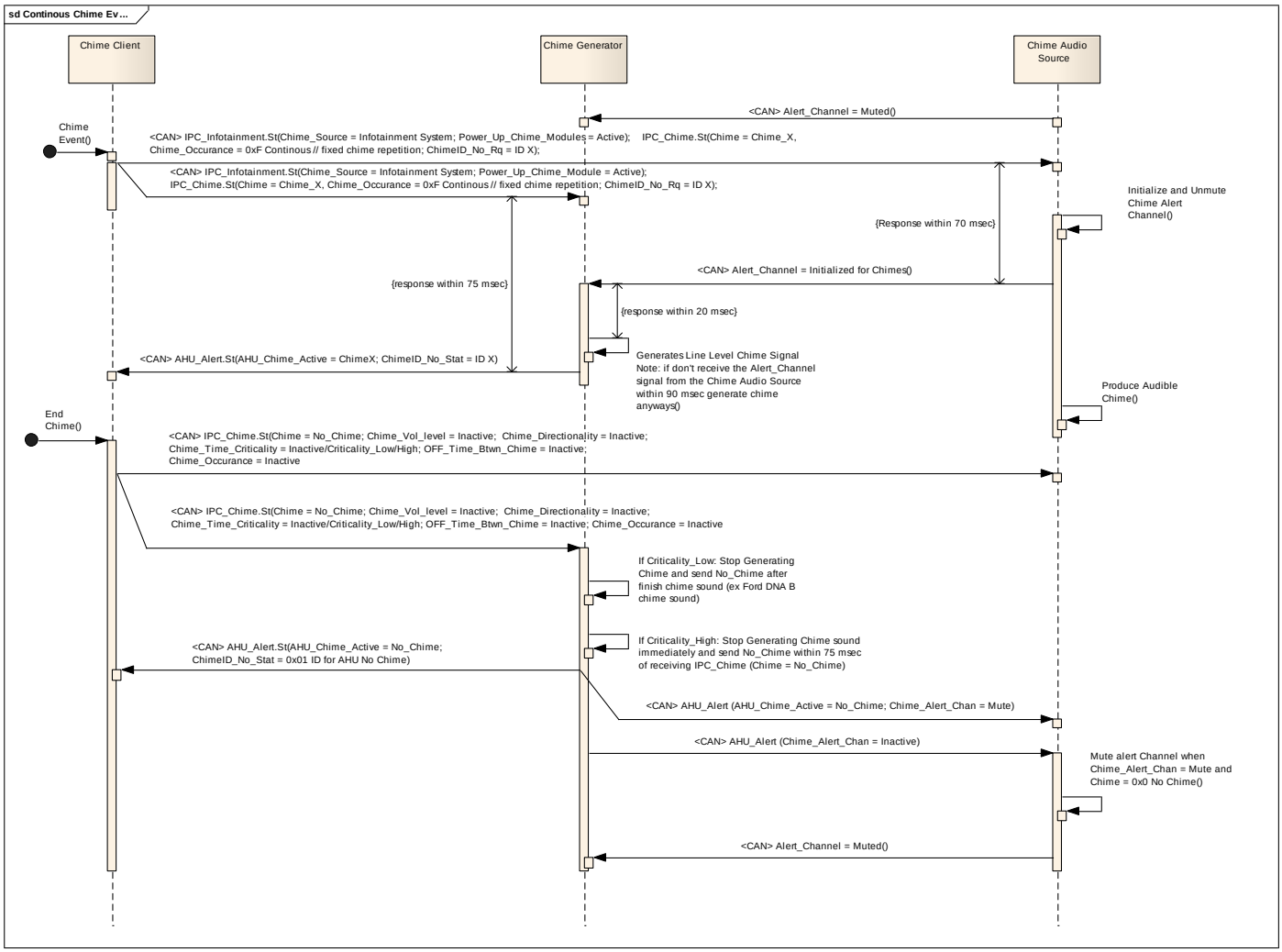
3.1.3.1 ALERT-SD-REQ-014763/D-Cluster ending Continuous Chime event, or Fixed Repetition Chime event where Cluster ends chime before repetitions finished (TcSE ROIN-40403-4)

Pre-condition
No Chimes are active

Scenario
Chime Client initiates a chime

Post-condition
Chime is ended by the Chime Client

Sequence Diagram



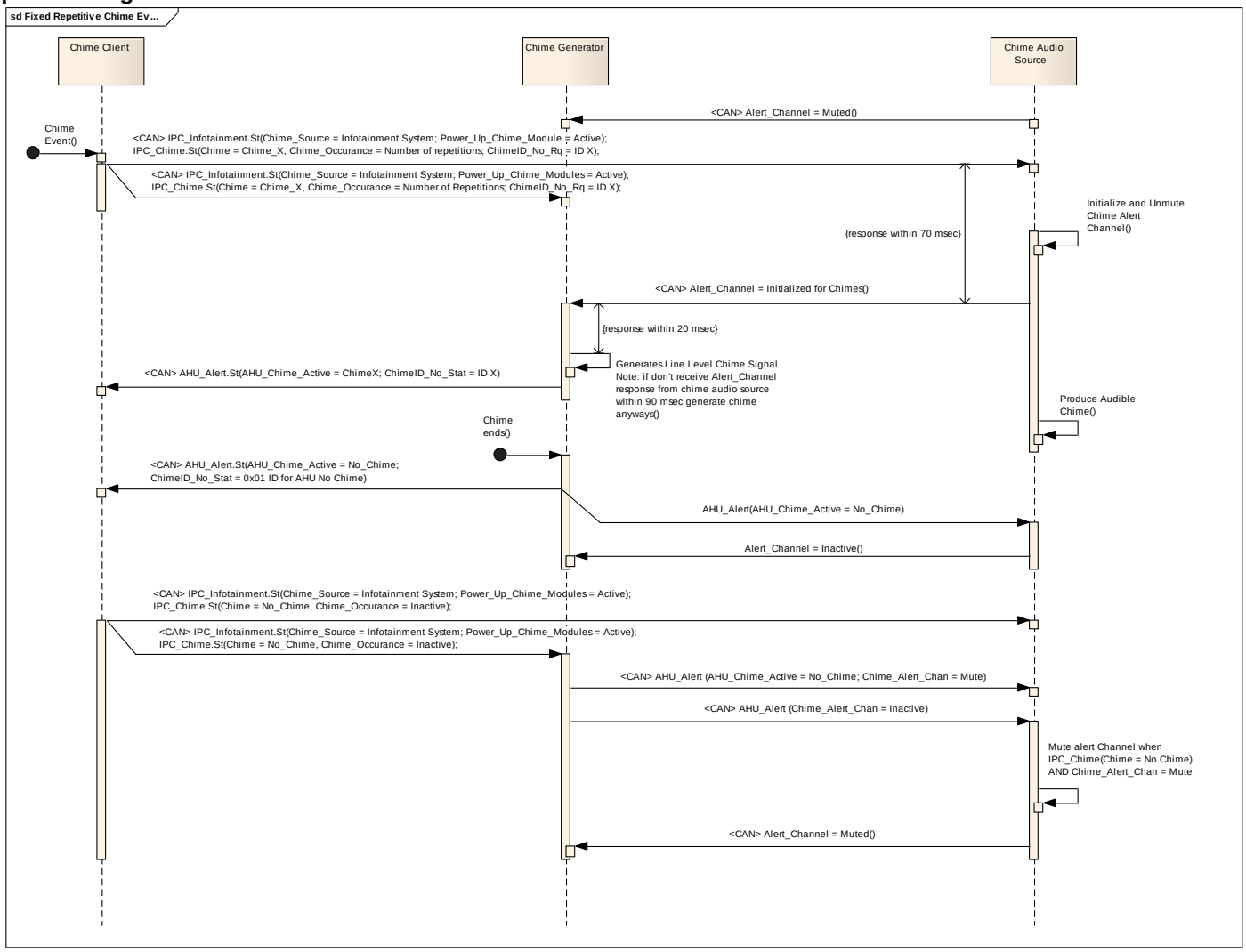
3.1.3.2 ALERT-SD-REQ-014764/B-Fixed Repetitive Chime Event (TcSE ROIN-167429-2)

Pre-condition
No Chimes are active

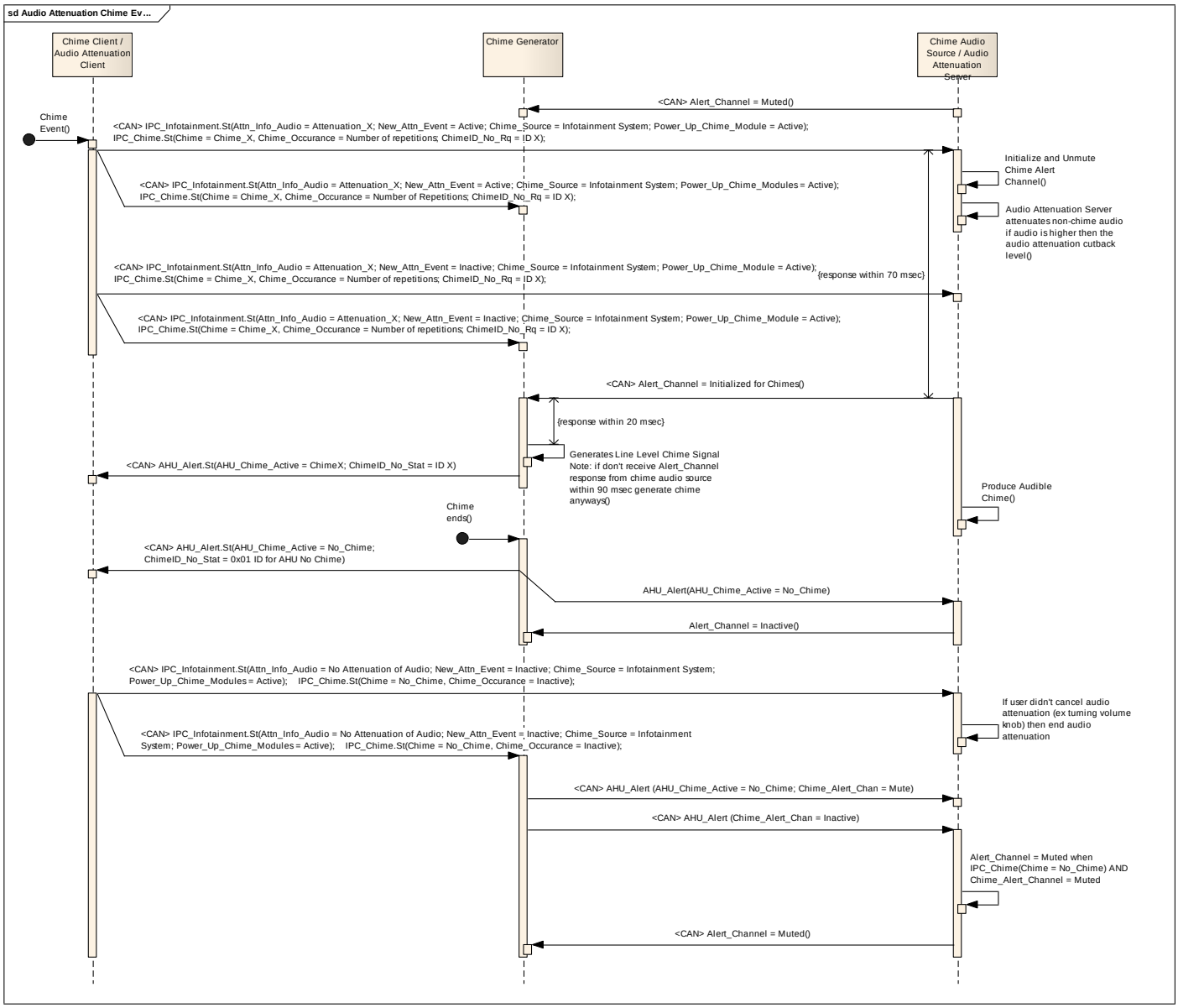
Scenario
Chime Client initiates a Fixed Chime Event

Post-condition
Chime is completed

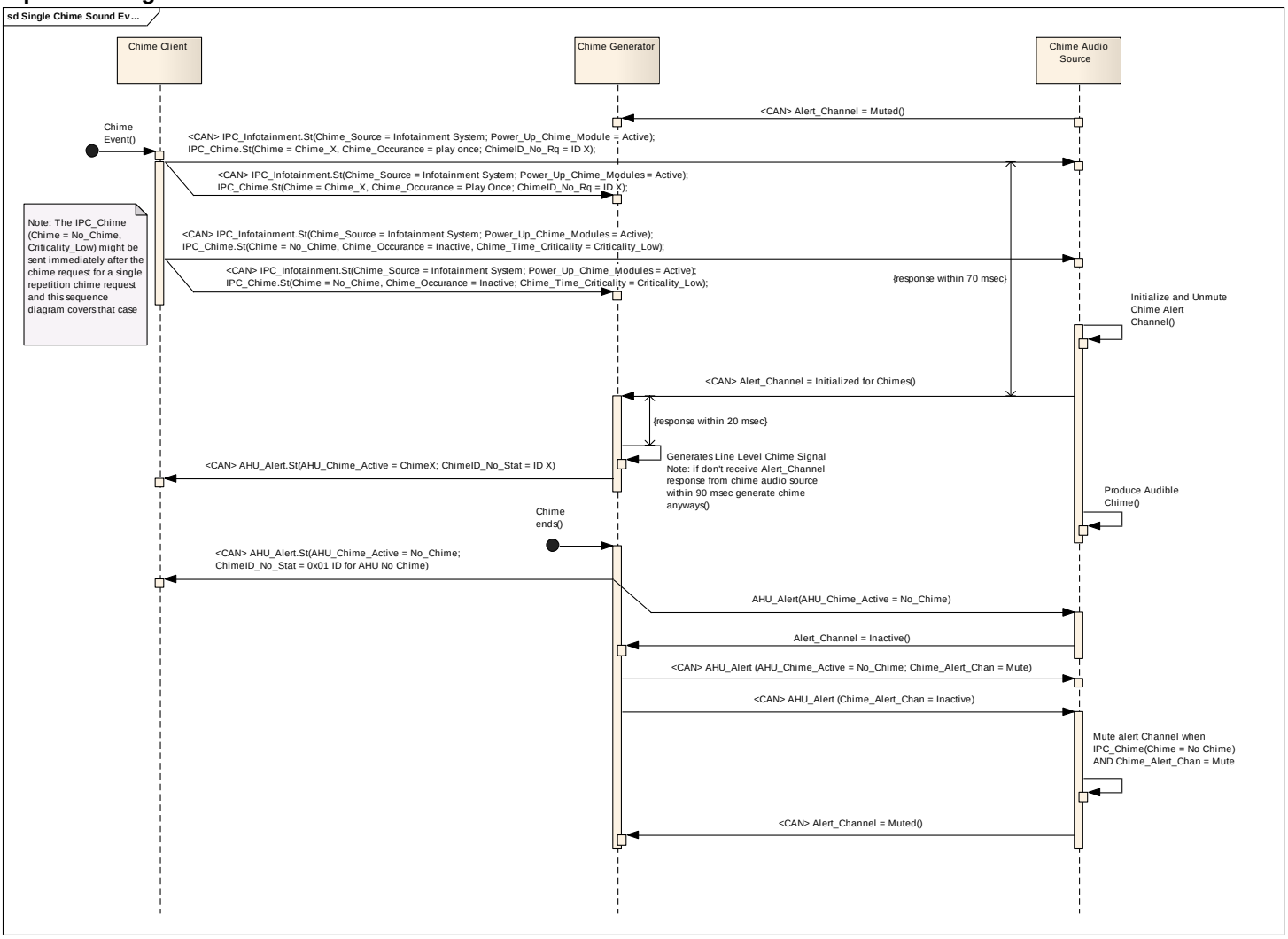
Sequence Diagram



Sequence Diagram


sd Audio Attenuation Chime Ev...
Chime Client / Audio Attenuation Client
Chime Generator
Chime Audio Source / Audio Attenuation Server
<CAN> Alert_Channel = Muted()
Chime Event()
<CAN> IPC_Infotainment.St(Attn_Info_Audio = Attenuation_X; New_Attn_Event = Active; Chime_Source = Infotainment System; Power_Up_Chime_Module = Active); IPC_Chime.St(Chime = Chime_X, Chime_Occurance = Number of repetitions; ChimeID_No_Rq = ID X);
Initialize and Unmute Chime Alert Channel()
<CAN> IPC_Infotainment.St(Attn_Info_Audio = Attenuation_X; New_Attn_Event = Active; Chime_Source = Infotainment System; Power_Up_Chime_Modules = Active); IPC_Chime.St(Chime = Chime_X, Chime_Occurance = Number of Repetitions; ChimeID_No_Rq = ID X);
Audio Attenuation Server attenuates non-chime audio if audio is higher then the audio attenuation cutback level()
<CAN> IPC_Infotainment.St(Attn_Info_Audio = Attenuation_X; New_Attn_Event = Inactive; Chime_Source = Infotainment System; Power_Up_Chime_Module = Active); IPC_Chime.St(Chime = Chime_X, Chime_Occurance = Number of repetitions; ChimeID_No_Rq = ID X);
{response within 70 msec}
<CAN> IPC_Infotainment.St(Attn_Info_Audio = Attenuation_X; New_Attn_Event = Inactive; Chime_Source = Infotainment System; Power_Up_Chime_Module = Active); IPC_Chime.St(Chime = Chime_X, Chime_Occurance = Number of repetitions; ChimeID_No_Rq = ID X);
<CAN> Alert_Channel = Initialized for Chimes()
{response within 20 msec}
Generates Line Level Chime Signal Note: if don't receive Alert_Channel response from chime audio source within 90 msec generate chime anyways()
<CAN> AHU_Alert.St(AHU_Chime_Active = ChimeX; ChimeID_No_Stat = ID X)
Produce Audible Chime()
Chime ends()
<CAN> AHU_Alert.St(AHU_Chime_Active = No_Chime; ChimeID_No_Stat = 0x01 ID for AHU No Chime)
AHU_Alert(AHU_Chime_Active = No_Chime)
Alert_Channel = Inactive()
<CAN> IPC_Infotainment.St(Attn_Info_Audio = No Attenuation of Audio; New_Attn_Event = Inactive; Chime_Source = Infotainment System; Power_Up_Chime_Modules = Active); IPC_Chime.St(Chime = No_Chime, Chime_Occurance = Inactive);
If user didn't cancel audio attenuation (ex turning volume knob) then end audio attenuation
<CAN> IPC_Infotainment.St(Attn_Info_Audio = No Attenuation of Audio; New_Attn_Event = Inactive; Chime_Source = Infotainment System; Power_Up_Chime_Modules = Active); IPC_Chime.St(Chime = No_Chime, Chime_Occurance = Inactive);
<CAN> AHU_Alert (AHU_Chime_Active = No_Chime; Chime_Alert_Chan = Mute)
<CAN> AHU_Alert (Chime_Alert_Chan = Inactive)
Alert_Channel = Muted when IPC_Chime(Chime = No_Chime) AND Chime_Alert_Channel = Muted
<CAN> Alert_Channel = Muted()

Sequence Diagram



3.1.3.3 ALERT-SD-REQ-014765/A-Low Priority Chime overwriting another Chime on the same Alert Channel (TcSE ROIN-200749-2)

Pre-condition

Chime event 1 is active on Alert Channel 1

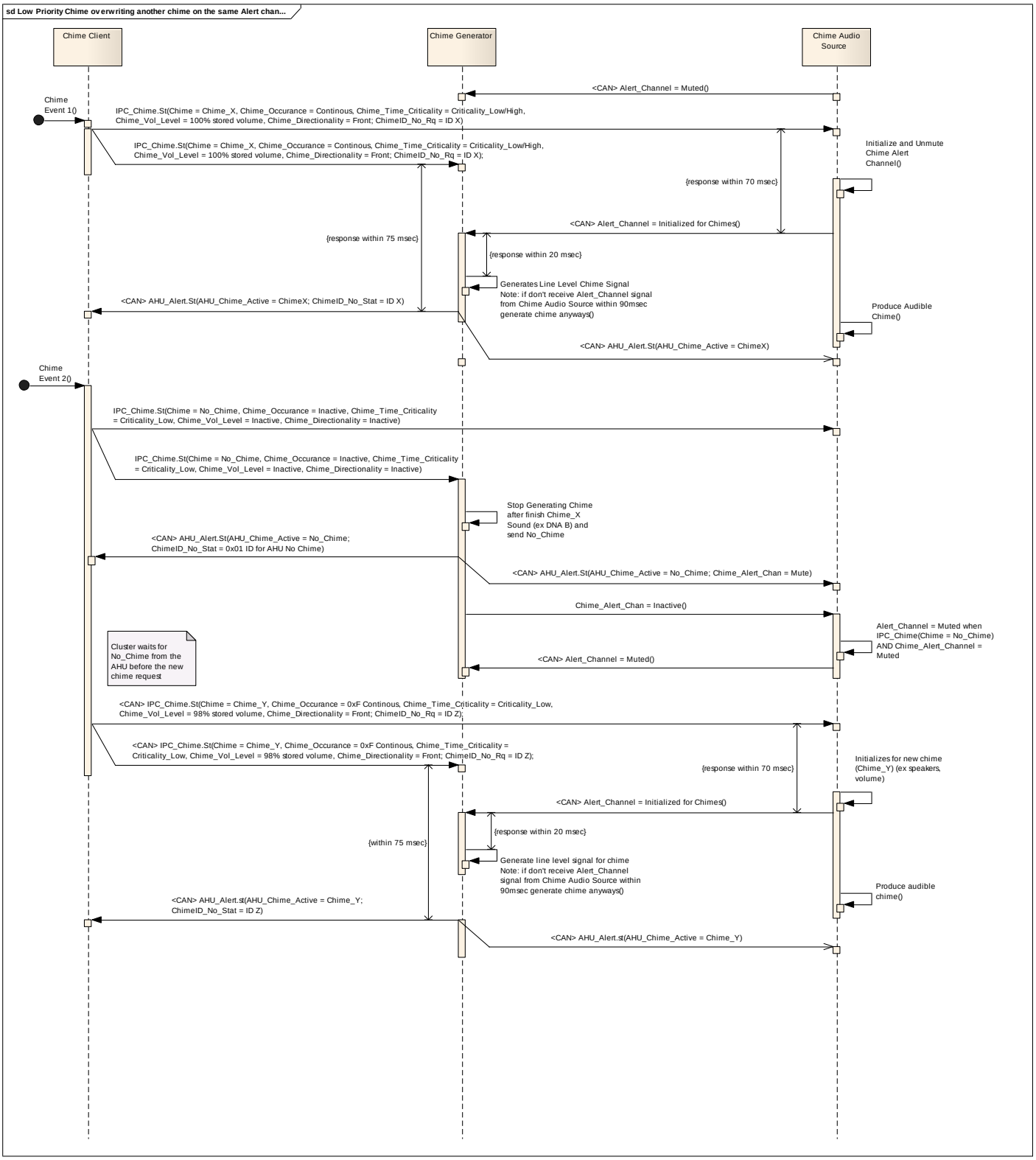
Scenario

Chime Client initiates a low criticality Chime event 2 on Alert Channel 1

Post-condition

Chime event 2 is playing through the infotainment system on Alert Channel 1

Sequence Diagram



3.1.3.4 ALERT-SD-REQ-014766/A-High Priority Chime overwriting another Chime on the same Alert Channel (TcSE ROIN-200760-3)

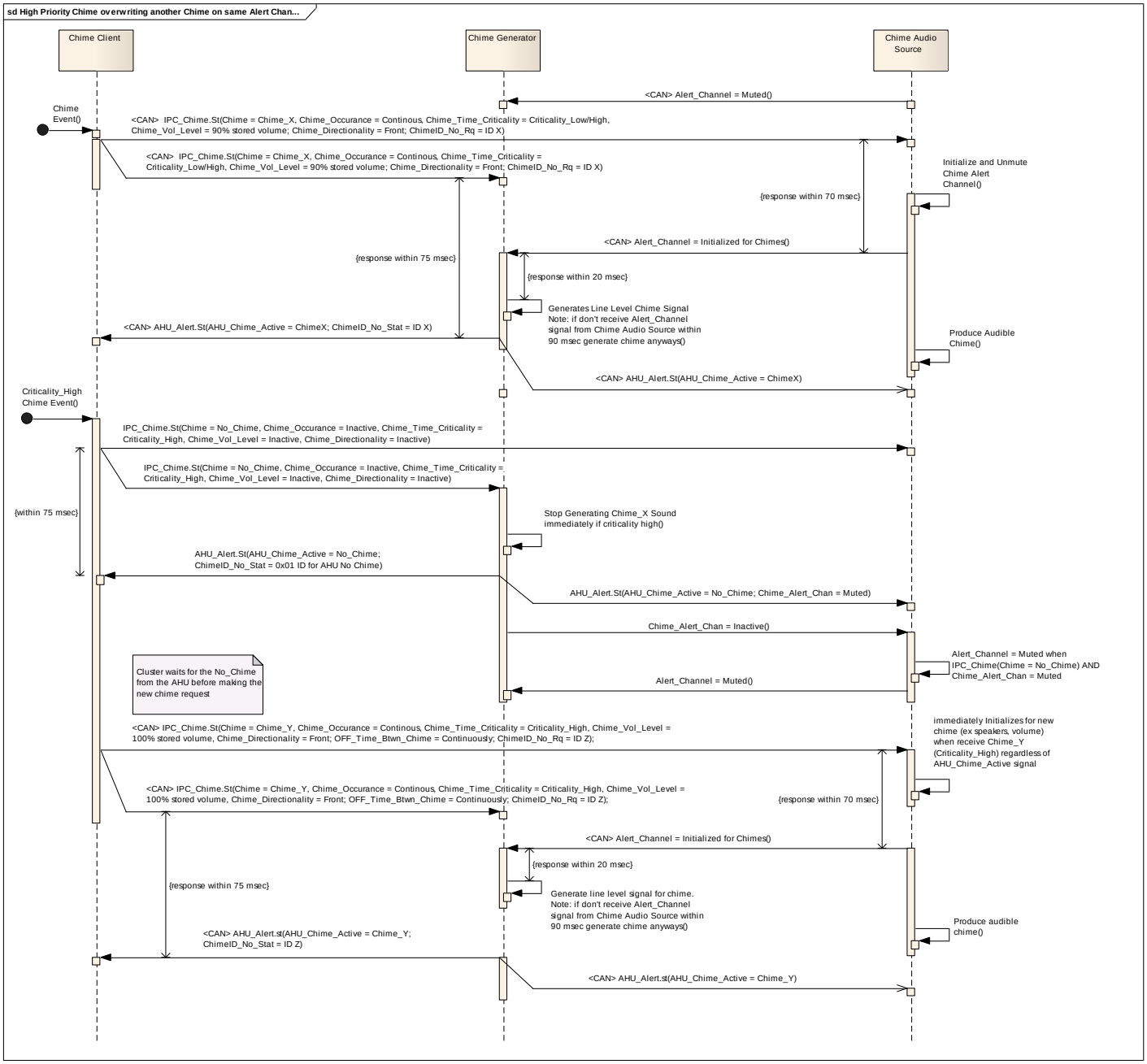
Pre-condition

There is a chime active on Alert Channel 1

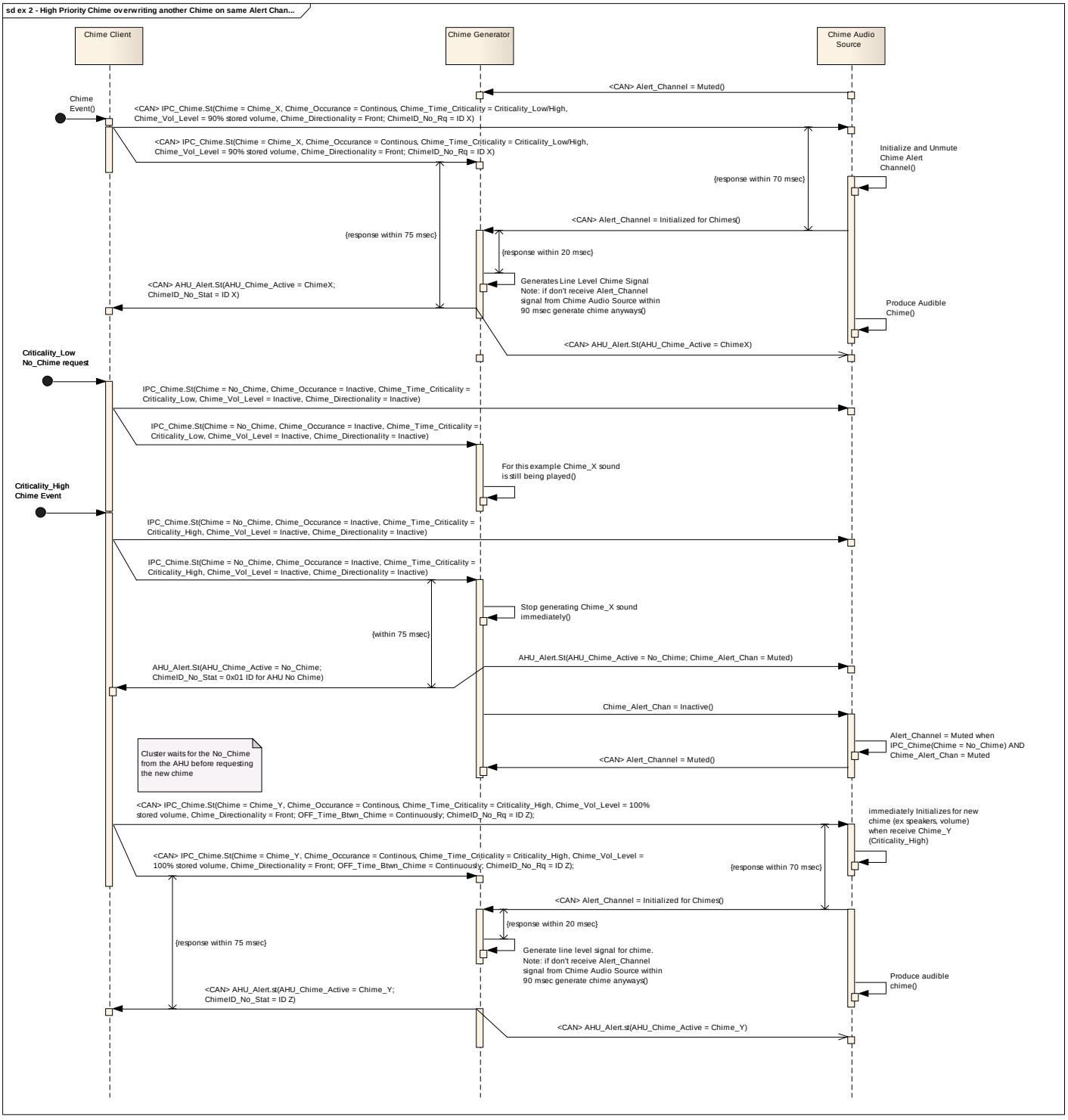
Scenario
Chime Client initiates a High Criticality Chime on Alert Channel 1

Post-condition
The new high priority chime is playing through the infotainment system on Alert Channel 1

Sequence Diagram



Sequence Diagram



3.1.3.5 ALERT-SD-REQ-014767/A-Low Priority Chime - requesting a new chime on a different Alert channel with the same directionality (TcSE ROIN-285762-1)

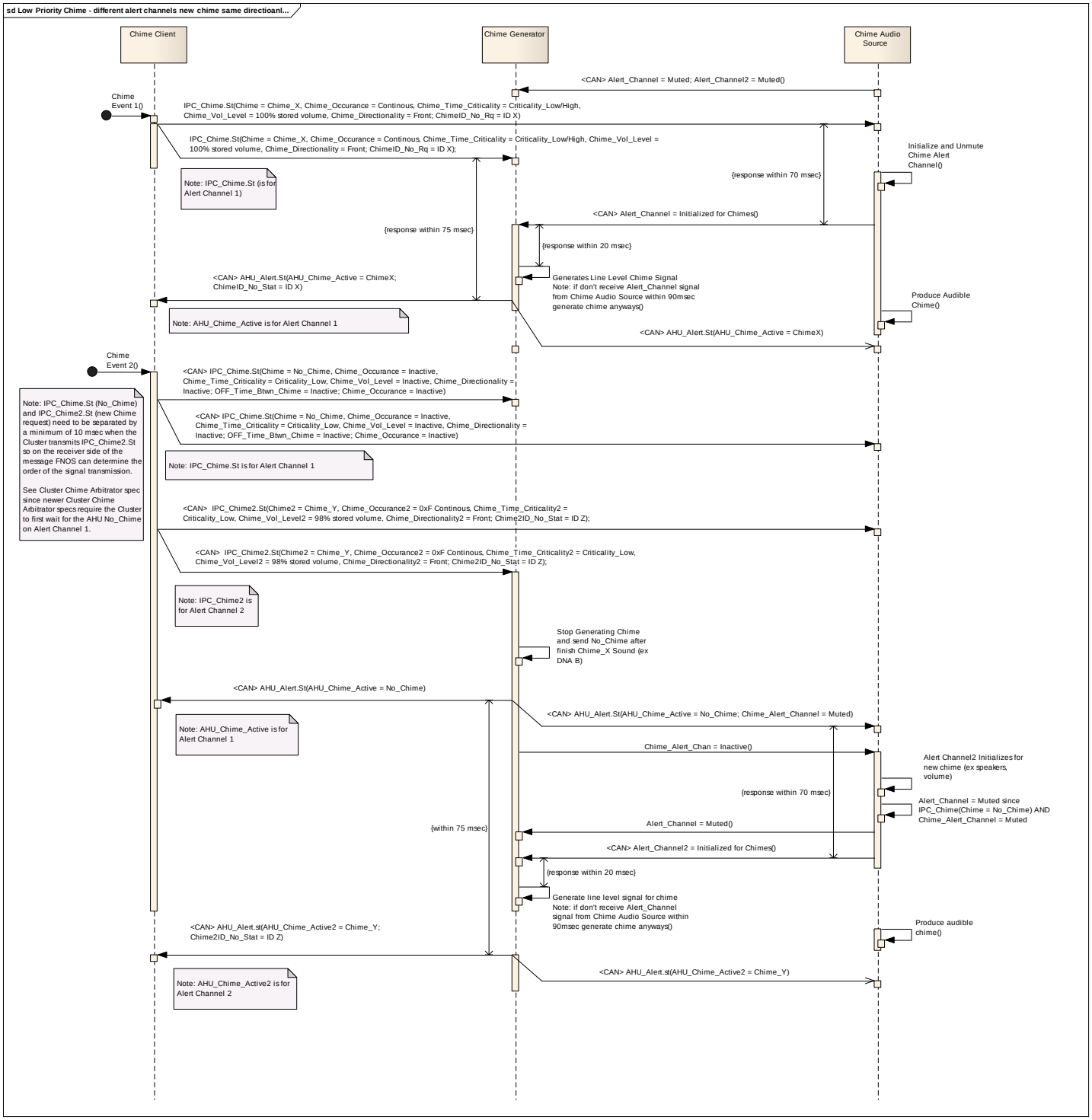
Pre-condition

Chime event 1 is active on Alert Channel 1

Scenario
Chime Client initiates a new low criticality Chime event 2 on Alert Channel 2

Post-condition
Chime event 2 is playing through the infotainment system on Alert Channel 2

Sequence Diagram



3.1.3.6 ALERT-SD-REQ-014768/D-High Priority Chime - requesting a new chime on a different Alert channel with the same directionality (TcSE ROIN-285767-1)

Pre-condition

Chime event 1 is active on Alert Channel 1

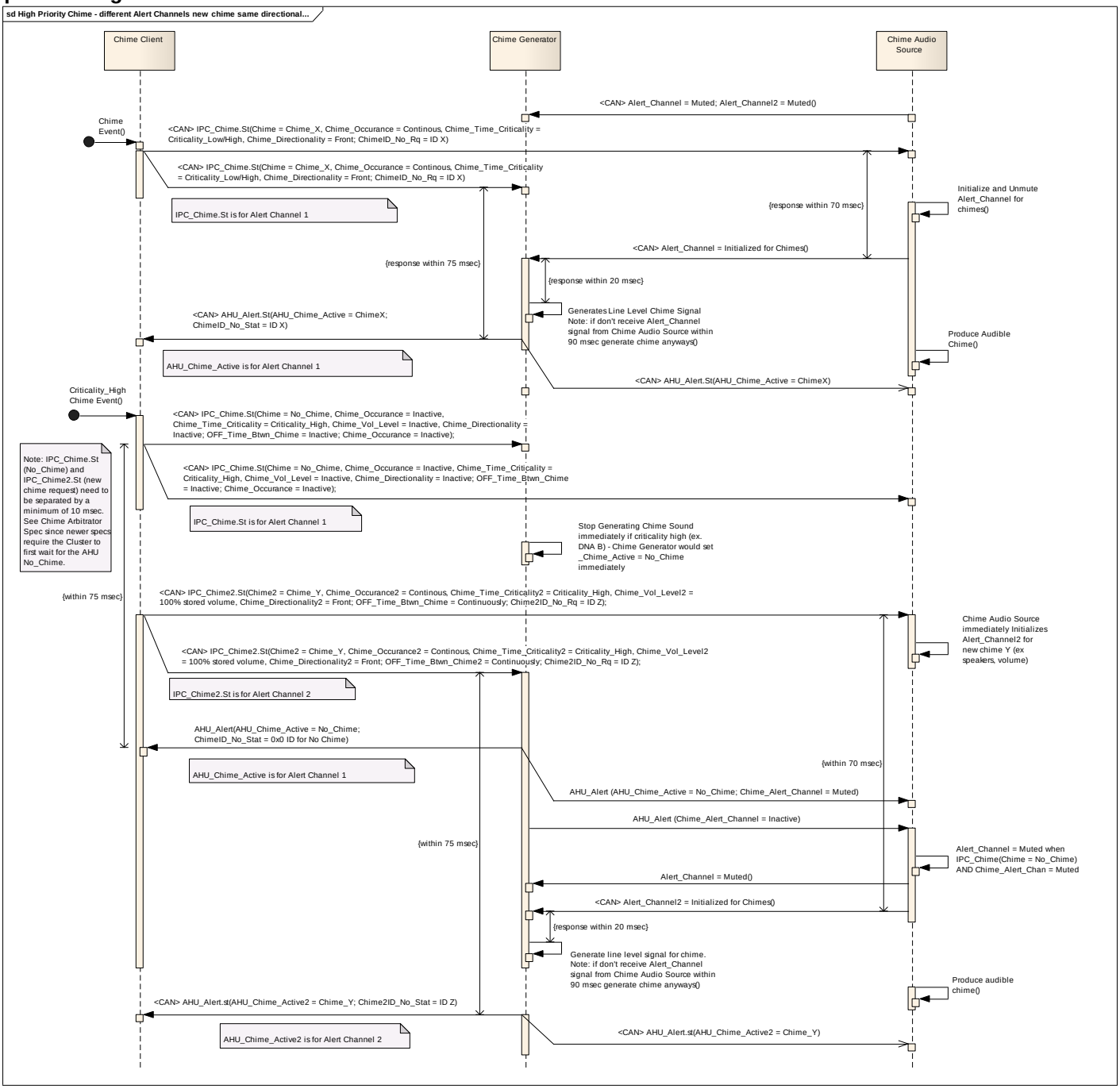
Scenario

Chime Client initiates a new high criticality Chime event 2 on Alert Channel 2

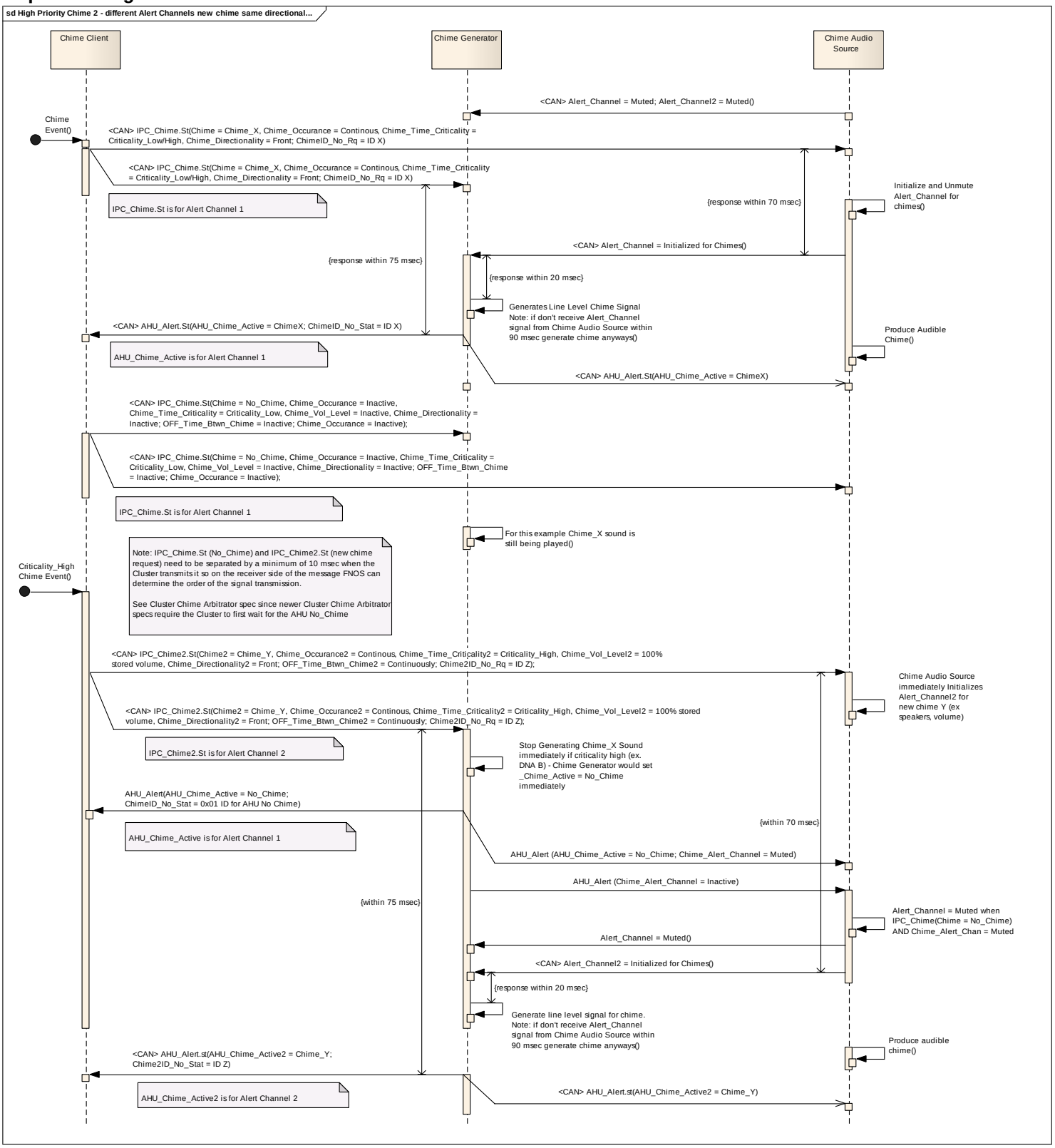
Post-condition

Chime event 2 is playing through the infotainment system on Alert Channel 2

Sequence Diagram



Sequence Diagram



3.2 ALERT-FUN-REQ-014780/B-Mixable Prompts (TcSE ROIN-119787-1)

3.2.1 Prompt Activation Requirements

3.2.1.1 ALERT-SR-REQ-014781/C-Prompt Generator requests for prompts from Prompt Audio Source (TcSE ROIN-41487-3)

When the Prompt Generator (prompt client) requests from the Prompt Audio Source to play the prompts the Prompt Generator shall:

1. Tell the Prompt Audio Source to initialize for prompts within $T_{prompt\_initializaiton}$ using the signal 'Alert_ChanX = Initialize for Prompts'. The Prompt Generator shall keep Alert_ChanX = Initialize for Prompts for the duration of the prompts.
2. Tell the Prompt Audio Source if there is attenuation of the Active Audio Source using the Attn_Info_Audio and New_Attn_Event signals.
3. Tell the Prompt Audio Source what speakers to play the prompts through using the PromptX_Directionality signal. The Prompt Generator shall keep Prompt_Directionality = Directionality_X for the duration of the prompt.

3.2.1.2 ALERT-TMR-REQ-014782/C-Tprompt_initialization (TcSE ROIN-41488-2)

Name	Description	Units	Range	Resolution	Default
Tprompt_initialization	Maximum time allowed from when the Prompt Generator requests the Prompt Audio Source to initialize for prompts until the Prompt Audio Source responds to the Prompt Generator that it is initialized for prompts and capable of receiving the Prompt Generated signal.	msec	0-1000	10	50

3.2.1.3 ALERT-SR-REQ-014783/E-Prompt Audio Source response to prompt request (TcSE ROIN-41512-5)

The volume settings sources are Media, Phone, Prompts, VR and TA. Once the Prompt Audio Source is initialized for prompts (Alert_Chan = Initialized for prompts) then prompts are the current active volume setting source. This means if there are user volume adjustments that prompts will be updated by the adjustment since it is the active volume settings source and the other volume settings sources will not be updated unless noted otherwise.

When prompts are the active volume setting source with the other audio sources attenuated (audio sources that can be attenuated during prompts are defined in requirement "VOL-FUR-REQ-014819-Volume Attenuation/Restoration (TcSE ROIN-27919-9)") then since volume user adjustments only adjust the non-attenuated prompt volume the partial attenuation of the attenuated sources would not be cancelled by volume adjustments (ex. Media attenuation wouldn't be cancelled during prompts).

Once the Prompt Audio Source is no longer initialized for prompts then the active volume settings source will not be prompts but the active volume source indicated in the ResourceUpdate.St message. See volume section for further details. Note: this means when SYNC_Alerts : Alert_Chan = "Inactive" or "Mute" the ResourceUpdate signal is used for the volume settings source.

Note: when using this method for mixable prompts (ie SYNC_Alerts in this function) then this method for the Prompt Generator would be used for mixable prompts in place of the prompt strategy in the audio management feature. Unless noted otherwise this method should be used for the prompt generator.

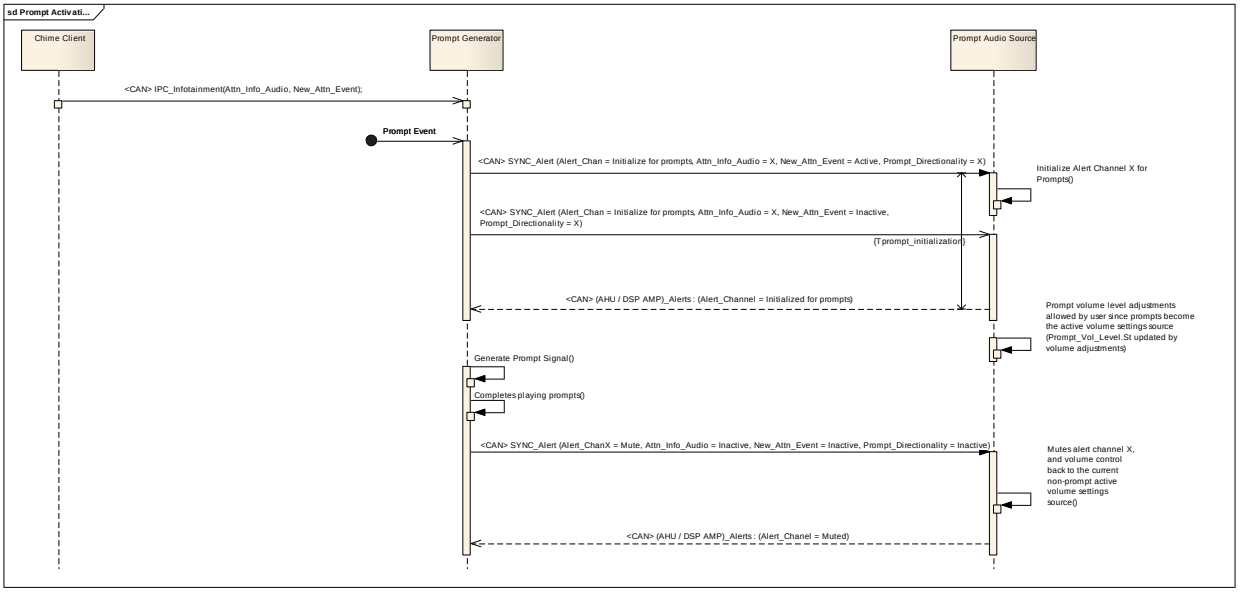
3.2.2 Sequence Diagrams

3.2.2.1 ALERT-SD-REQ-014784/B-Prompt Activation (TcSE ROIN-41489-4)

Pre-condition
No prompts are active

Post-condition
Prompt is completed

Sequence Diagram



3.3 ALERT-FUN-REQ-014785/B-Beep (TcSE ROIN-119788-1)

For enabling / disabling touch panel beeps and for touch panel beeps configuration reference vehicle settings functions (only have one in a SPSS):
"VS-GFUN-129114-Touch Panel Beeps Settings"
or
"VS-FUN-REQ-025233-Touch Panel Beeps Settings (TcSE ROIN-292335-1)".

3.3.1 Beep Activation Requirements

For certain events (ex. touch sense press event) the infotainment system may need to produce audible beeps.

3.3.1.1 ALERT-SR-REQ-014786/C-Beep Generator allowable times for producing Beeps (TcSE ROIN-273468-1)

The Beep Generator shall be able to produce beeps for the EFP (FCIM) and APIM (FCDIM) when HMIAudioMode = ON and shall not produce beeps when HMIAudioMode = OFF.

~~The Beep Generator shall be able to produce beeps for the OHCM when Demand_PwrModing = ON~~

3.3.1.2 ALERT-REQ-014787/B-EFP Beep Requests (TcSE ROIN-304907-1)

For EFP(FCIM) that support beeps the EFP(FCIM) shall NOT send the network signal to produce an audio beep for selection of climate control inputs unless climate functions are active in the current Vehicle State (Climate Indicators State = Enabled as defined within the Powering Moding section of the applicable Climate Control Functional Specification) i.e. climate functions may not be active when Ignition does not equal Run.
NOTE: The EFP(FCIM) shall continue to send the network signal to produce audio beeps for all infotainment inputs (ex seek touch sense button) regardless of climate control input status.

The EFP(FCIM) shall send infotainment beep requests whenever HMIAudioMode = ON / Multimedia_System = ON.

3.3.1.3 ALERT-SR-REQ-014788/B-Beep Directionality (TcSE ROIN-273469-1)

The Beep Generators / Beep Audio Source shall produce the infotainment beeps out of the front speakers

3.3.1.4 ALERT-SR-REQ-014789/B-Infotainment System Beep Set-up (TcSE ROIN-110897-4)

The Beep Generator and Beep Audio Source will vary depending on the infotainment system module availability. The Infotainment System Beep set-up will follow the table below.

Modules Present	Beep Client	Beep Generator	Beep Audio Source	Comments
AHU / DSP AMP / MFD or APIM / EFP / OHCM	APIM / EFP / OHCM	DSP AMP	DSP AMP	DSP AMP produce audible beep based on infotainment network message from Beep Client
AHU / MFD or APIM / EFP / OHCM	APIM / EFP / OHCM	AHU	AHU	AHU produce audible beep based on infotainment network message from Beep Client

Beep Configuration Table

3.3.1.5 ALERT-TMR-REQ-014790/C-T_Beep_Event (TcSE ROIN-110901-1)

Name	Description	Units	Range	Resolution	Default
T_Beep_Event	The maximum time allowed from when a beep event begins until the signal 'XXX_Audible_Beep = Active' is put on the infotainment bus by the beep client.	msec	0-1000	10	30

3.3.1.6 ALERT-SR-REQ-014791/D-Beep Activation (TcSE ROIN-39866-4)

When there is both an AHU and DSP AMP on the vehicle at the same time then the DSP AMP shall become the Beep Generator. The Beep Client(s) shall send the Beep Generator the infotainment network signal 'Audible_Beep = Active' to produce an audio beep (ex. touch sense button press beeps). The Beep Generator shall produce the audible beep within T_Audible_Beep of receiving the signal 'Audible_Beep = Active'.

After the Beep Generator produces the beep it shall wait for the signal 'Audible_Beep to equal 'Inactive' before it produces another beep based on the signal 'Audible_Beep ' set to 'Active'.

3.3.1.7 ALERT-TMR-REQ-014792/D-T_Audible_Beep (TcSE ROIN-56911-3)

Name	Description	Units	Range	Resolution	Default
T_Audible_Beep	The maximum time allowed from when the Beep Generator receives the 'Audible_Beep == Active' signal until an audible beep is produced.	msec	0-1000	10	50

3.3.2 Sequence Diagrams

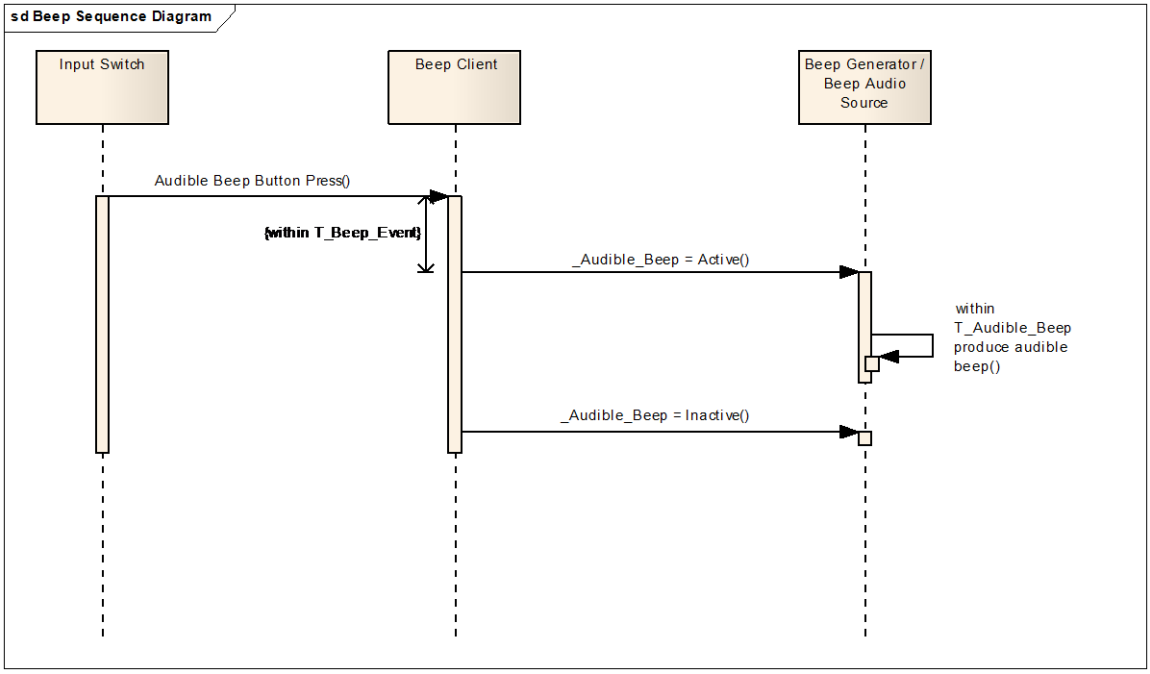
3.3.2.1 ALERT-SD-REQ-014793/B-Beep Activation (TcSE ROIN-262985-1)

Pre-condition
No beep active and beeps are supported

Scenario
Audible Beep event (ex touch sense button press event)

Post-condition
Audible Beep is produced

Sequence Diagram


sd Beep Sequence Diagram
Input Switch
Beep Client
Beep Generator / Beep Audio Source
Audible Beep Button Press()
{within T_Beep_Event}
_Audible_Beep = Active()
within T_Audible_Beep produce audible beep()
_Audible_Beep = Inactive()

3.4 ALERT-FUN-REQ-014794/B-Audio Attenuation/Muting Strategy (TcSE ROIN-119789-1)

There may be multiple audio attenuation / muting requests from outside of the Infotainment System (ex. FCW, RPA…) but the AHU / DSP AMP shall only support 1 audio attenuation / muting request signal from outside the Infotainment System. The 'IPC_Infotainment.St() : Attn_Info_Audio' signal shall be used to Attenuate / Mute the infotainment audio. The Cluster is the Audio Attenuation Request Prioritizer responsible for sending the audio attenuation requests from outside the Infotainment System to the AHU / DSP AMP.

There may also be muting requests internal to the infotainment system such as for prompts using the 'SYNC_Alerts : Attn_Info_Audio' signal.

3.4.1 Cluster Prioritizing Audio Attenuation Requests

3.4.1.1 ALERT-SR-REQ-014795/C-Cluster Prioritizing Audio Attenuation Requests (TcSE ROIN-39883-2)

The Cluster may receive multiple audio attenuation requests at the same time from outside the infotainment system. While multiple audio attenuation requests are active at the same time the Cluster shall use the request with the greatest attenuation of audio for the Attn_Info_Audio signal. The Cluster Attn_Info_Audio signal shall be broadcast on the Infotainment bus.

For example, while FCW (forward collision warning) is active with a full audio mute if a Reverse Park Aid signal is requesting the audio be partially attenuated then the audio will remain fully muted since FCW has the highest attenuation level.

Upon exiting the audio attenuation / muting request with the greatest attenuation, the next highest audio attenuation request shall be serviced until there are no longer any active audio attenuation requests.

3.4.2 AHU / DSP AMP Prioritizing Audio Attenuation Requests

3.4.2.1 ALERT-SR-REQ-014796/C-Multiple Attenuation Requests (TcSE ROIN-39884-2)

The AHU / DSP AMP may receive multiple audio attenuation requests at the same time whether from outside the infotainment system (ex. chime requests sent to the Cluster which sends attenuation requests to infotainment components) or internal to the infotainment system (ex. SYNC prompts attenuation requests). While multiple audio attenuation requests are active at the same time the AHU / DSP AMP shall use the request with the greatest attenuation of audio.

Upon exiting the audio attenuation / muting request with the greatest attenuation, the next highest audio attenuation request shall be serviced until there are no longer any active audio attenuation requests.

3.4.3 Infotainment System Audio Attenuation

3.4.3.1 ALERT-SR-REQ-014797/C-Audio Attenuation to Attenuation_X volume level (TcSE ROIN-39889-2)

When the AHU / DSP AMP receives the signal Attn_Info_Audio with New_Attn_Event = Active then the AHU / DSP AMP will lower their infotainment volume to Attenuation_X audio level as defined in the AHU / DSP AMP component requirements (see requirement VOL-GREQ-27919-6-Volume Attenuation/Restoration).

The Transmitter Audio Attenuation Client shall set Attn_Info_Audio to the desired attenuation level for the duration of the requested audio attenuation. See ALERT-GREQ-39896-3-Transmitters usage of New_Attn_Event signal for the usage of the New_Attn_Event signal.

Ex.
1. Audio Attenuation Client sends an attenuation request with Attn_Info_Audio = Attenuation_X / New_Attn_Event = Active
2. Audio Attenuation Client sends Attn_Info_Audio = Attenuation_X / New_Attn_Event = Inactive (See requirement 39896 Transmitters usage of New_Attn_Event for details).
3. Audio Attenuation Client keeps sending Attn_Info_Audio = Attenuation_X / New_Attn_Event = Inactive while the attenuation event is occuring (note: Audio Attenuation Client has no knowledge if a partial attenuation is cancelled).
4. When Audio Attenuation Client no longer needs the attenuation it shall send Attn_Info_Audio = 'No Attenuation of Audio" / New_Attn_Event = Inactive.

.

3.4.3.2 ALERT-SR-REQ-014798/C-Audio Attenuation Timing (TcSE ROIN-39890-2)

The AHU / DSP AMP shall lower their volume to the predefined audio level within 100 msec of receiving the Attn_Info_Audio signal with the New_Attn_Event = Active if the Attn_Info_Audio signal causes an attenuation event.

The AHU / DSP AMP shall lower their volume assuming that the present audio volume level is higher than the Attenuation_X level, otherwise the audio volume and XXX_Volume_Level signal shall not change.

3.4.3.3 VOL-SR-REQ-014799/C-Volume signal update for Audio Attenuation (TcSE ROIN-39891-2)

The AHU / DSP AMP shall update the XXX_Volume_Level signal after receiving the Attn_Info_Audio signal that results in a decrease in audio.

Note: the corresponding XXX_Volume_Updated signal with the XXX_Volume_Level signal shall be set to "No Update" for an Attn_Info_Audio attenuation event that changes the XXX_Volume_Level signal.

3.4.3.4 ALERT-SR-REQ-014800/C-User Volume adjustment lock-out period (TcSE ROIN-39892-3)

During an Attn_Info_Audio audio attenuation event volume user adjustments won't be able to lower or increase volume ~~shall be ignored~~ until 200 msec after the AHU / DSP AMP first receives the Attn_Info_Audio signal set to an attenuation level with the signal New_Attn_Event = Active.

Only after 200 msec from first receiving Attn_Info_Audio = Attenuation_X / New_Attn_Event = Active shall volume user adjustments cancel the partial attenuation.

3.4.3.5 ALERT-SR-REQ-014801/E-Volume user adjustments during a partial attenuation (TcSE ROIN-39893-4)

Volume user adjustments are allowed after 200 msec from first receiving the Attn_Info_Audio signal with the signal New_Attn_Event = Active. Volume user adjustments to any of the attenuated volume sources shall effectively cancel the active partial attenuation attenuating the affected volume sources.

Ex.
1. Pre-Condition: XXX_Volume_Level = 20
2. Audio Attenuation Clients sends a partial Attenuation request with Attenuation_X / New_Attn_Event = Active which sets the volume level to volume step 5
3. Then the Audio Attenuation Client sets Attn_Info_Audio = Attenuation_X / New_Attn_Event = Inactive
4. The Audio Attenuation Server volume goes to XXX_Volume_Level = 5 and XXX_Volume_Updated = No Update.
5. The user adjust the attenuated volume up with SetVolume = +1 step while the partial attenuation is active
6. The partial attenuation is then cancelled and volume is increased to volume step 6 (XXX_Volume_Level = 6)

Note: If two partial attenuations are active at once then cancelling the partial attenuation of one partial attenuation doesn't necessarily cancel the attenuation of another partial attenuation.

Ex.
Pre-Condition:
1. There is both a Chime (IPC_Infotainment) AND Prompt (SYNC_Alerts) partial attenuation event active at the same time.
2. A media source (ex AM/FM) is granted in the Resource Update message and Prompts are active. Since prompts are active they are the active volume source

Event:
User adjust the volume while prompts are active

Post-Condition:
The chimes partial attenuation (IPC_Infotainment) is cancelled so prompts are no longer attenuated but the media source still is attenuated from the Prompt partial attenuation (SYNC_Alerts). The prompt partial attenuation is active so media is still attenuated. The prompt partial attenuation is still active per requirements 41512 and 27919.

3.4.3.6 ALERT-SR-REQ-014802/C-Volume user adjustments during a full mute (TcSE ROIN-39894-2)

During an Attn_Info_Audio attenuation event volume user adjustments shall be ignored while a full mute Attenuation event is active unless otherwise noted in the AHU / DSP AMP component requirements. The AHU / DSP AMP shall update the XXX_Volume_Level signal accordingly.

3.4.3.7 ALERT-SR-REQ-014803/C-New Attenuation request at the same attenuation level that was cancelled because of a volume user adjustment (TcSE ROIN-39895-2)

To protect for the case were another Attn_Info_Audio attenuation event happens requesting a partial attenuation at the same Attn_Info_Audio attenuation level that the AHU / DSP AMP is ignoring (because of a previous user volume adjustment) then to make sure the attenuation is still acted on the AHU / DSP AMP shall monitor the "New_Attn_Event".

If the AHU / DSP AMP receive the "New_Attn_Event = Active" concurrently with "Attn_Info_Audio" signal set to an attenuation level then the audio shall be attenuated (if applicable per other attenuation requirements) even if "Attn_Info_Audio" signal attenuation level did not change.

3.4.3.8 ALERT-SR-REQ-014804/C-Transmitters usage of New_Attn_Event signal (TcSE ROIN-39896-3)

The Audio Attenuation Transmitting module shall set the "New_Attn_Event = Active' when it requests a new Attenuation event.

The "New_Attn_Event" signal shall be set equal to "Active" and then set to "Inactive" (within 30 msec) and then all subsequent periodic status updates shall set the signal "New_Attn_Event = Inactive" until a new Attenuation event occurs.

Ex. Audio Attenuation Client requesting the same audio attenuation at different times:
1. The Audio Attenuation Client (audio attenuation transmitting module) requests a new attenuation event when a Reverse Park Aid chime begins. The Audio Attenuation Client sends a partial attenuation request with Attn_Info_Audio = Attenuation_X and New_Attn_Event = Active.

2. Then the Audio Attenuation Client keeps Attn_Info_Audio equal to Attenuation_X and sets New_Attn_Event = Inactive

3. the Audio Attenuation Client keeps Attn_Info_Audio equal to Attenuation_X for as long as the Reverse Park Aid beeps are playing but keeps New_Attn_Event = Inactive

4. The Audio Attenuation Client requests the Seat Belt chime to play out of the front speakers while the Reverse Park Aid chime continues to play out of the rear speakers. The Audio Attenuation Clients sends a partial attenuation request with Attn_Info_Audio = Attenuation_X and New_Attn_Event = Active.

5. Then the Audio Attenuation Client keeps Attn_Info_Audio equal to Attenuation_X and sets New_Attn_Event = Inactive

6. the Audio Attenuation Client keeps Attn_Info_Audio equal to Attenuation_X for as long as the Seat Belt chime or Reverse Park Aid chime are playing but keeps New_Attn_Event = Inactive

7. After some time the Reverse Park Aid chime ends and the Audio Attenuation Client keeps Attn_Info_Audio = Attenuation_X and keeps New_Attn_Event = Inactive.

8. Some time after the Reverse Park Aid chime ends the Seat Belt chime ends and the Audio Attenuation Client sets Attn_Info_Audio = 'No Attenuation of Audio' and keeps New_Attn_Event = Inactive.

Note: The seat belt chime and RPA chime are used as examples and may or may not be the same attenuation level. Please reference the applicable function specifications for what attenuation to use

3.4.3.9 ALERT-SR-REQ-014805/G-Volume when changing to a lower attenuation / no attenuation from a higher attenuation (TcSE ROIN-39897-2)

When the 'Attn_Info_Audio = Attenuation_X' signals change to a lower attenuation level or to no attenuation resulting in an increase in volume then the AHU / DSP AMP shall gracefully increase the volume at a rate defined in Volume SPSS requirement “FUR-REQ-088208-Audio Attenuation / Mute Ramps”.

Upon exiting the audio attenuation / muting request with the greatest attenuation, the next highest audio attenuation request shall be serviced until there are no longer any active audio attenuation requests.

Example from two different modules sending different attenuation values in different network messages:
1. Pre-Condition: XXX_Volume_Level = 20

2. Audio Attenuation Client A sends a partial Attenuation request with Attenuation_X / New_Attn_Event = Active which sets the volume level to volume step 16 (see attenuation table for actual volume steps to use – ie VOL-REQ-014819-Volume Attenuation/Restoration)
3. Then the Audio Attenuation Client A sets Attn_Info_Audio (Module A) = Attenuation_X / New_Attn_Event = Inactive
4. The Audio Attenuation Server volume goes to XXX_Volume_Level = 16 and XXX_Volume_Updated = No Update.
5. Audio Attenuation Client B sends a partial Attenuation request with Attenuation_Y / New_Attn_Event = Active which sets the volume level to volume step 7
6. Then the Audio Attenuation Client B sets Attn_Info_Audio (Module B) = Attenuation_Y / New_Attn_Event = Inactive
7. The Audio Attenuation Server volume goes to XXX_Volume_Level = 7 and XXX_Volume_Updated = No Update.
8. Then the Audio Attenuation Client B sets Attn_Info_Audio (Module B) = No Attenuation of Audio / New_Attn_Event = Inactive
9. The Audio Attenuation Server volume goes to XXX_Volume_Level = 16 and XXX_Volume_Updated = No Update.
10. Then the Audio Attenuation Client A sets Attn_Info_Audio (Module A) = No Attenuation of Audio / New_Attn_Event = Inactive
11. The Audio Attenuation Server volume goes to XXX_Volume_Level = 20 and XXX_Volume_Updated = No Update.

3.4.3.10 ALERT-SR-REQ-014806/C-Timing to increase volume because of a lowering of the attenuation level (TcSE ROIN-39898-2)

When the 'Attn_Info_Audio = Attenuation_X' signals change to a lower attenuation level or to no attenuation resulting in an increase in volume then the ACM / DSP AMP shall start to increase the volume level no later then 200 msec after receiving the Attenuation update.

3.5 ALERT-FUN-REQ-195348/C-Adjustable Chime Strategy

3.5.1 Use Cases

3.5.1.1 ALERT-UC-REQ-195369/D-Set rear park aid chime volume level while no other chime is active

Actors	Vehicle Occupant
Pre-conditions	Infotainment System is Powered ON The HMI is configured to have Rear Park Aid chime volume adjustment HMI available when Rear Park Aid is on the vehicle. Park Aid chime adjustment HMI is the active HMI screen No chime is active.
Scenario Description	The user changes the chime volume level of the rear park aid chime via the HMI
Post-conditions	The rear park aid sound/feedback chime is played at the new volume level. If infotainment audio was playing (ex AM/FM/USB…) then the audio is attenuated to the attenuation level that is normally used when playing the rear park aid chime. The new volume level of the rear parking aid chime is changed and stored (stored between ignition cycles). The new rear park aid chime volume level is shown on the HMI.
Notes	This use case was for rear park aid chime but applies to any supported adjustable chime. The attenuation signal only applies to chimes that support chime attenuation. The HMI for adjustable chime settings should only be shown when ignition is in Run
Interfaces	Vehicle System, G-HMI

3.5.1.2 ALERT-UC-REQ-195370/D-Set front park aid chime volume level while no other chime is active

Actors	Vehicle Occupant
Pre-conditions	Infotainment System is Powered ON. The HMI is configured to have Front Park Aid chime volume adjustment HMI available when Front Park Aid is on the vehicle Park Aid chime adjustment HMI is the active HMI screen. No chime is active.
Scenario Description	The user changes the chime volume level of the front park aid chime via the HMI
Post-conditions	The front park aid sound/feedback chime is played with the new volume level. If infotainment audio was playing (ex AM/FM/USB…) then the audio is attenuated to the attenuation level that is normally used when playing the front park aid chime.

	The new volume level of the front parking aid chime is changed and stored (stored between ignition cycles). The new front park aid chime volume level is shown on the HMI.
Notes	This use case was for front park aid chime but applies to any supported adjustable chime. The attenuation signal only applies to chimes that support chime attenuation. The HMI for adjustable chime settings should only be shown when ignition is in Run
Interfaces	Vehicle System, G-HMI

3.5.1.3 ALERT-UC-REQ-195371/E-Set front/rear park aid chime volume level while another chime is playing through the same speakers (Front or Rear speakers)

Actors	Vehicle Occupant
Pre-conditions	Infotainment System is Powered ON. The HMI is configured to have Front Park Aid chime volume adjustment HMI available when Front Park Aid is on the vehicle Park Aid chime adjustment HMI is the active HMI screen. A non front park aid chime is currently playing out of the front speakers (ex low fuel warning chime, seat belt chime…) through the infotainment system
Scenario Description	The user changes the chime volume level of the front park aid chime via the HMI
Post-conditions	If there is a currently active chime (ex seat belt chime) playing out of the same speakers as the front park aid chime (ie directionality equals front speakers) then the front park aid sound/feedback chime is not played. If there is a currently active chime (ex seat belt chime) playing out of the same speakers as the front park aid chime (ie directionality equals front speakers) then the audio attenuation associated with the front park aid chime is not sent (audio attenuation could be sent for the active chime though if that chime has audio attenuation associated with it). The new volume level of the front parking aid chime is changed and stored (stored between ignition cycles). This happens whether or not the front park aid feedback chime was played. The new front park aid chime volume level is shown on the HMI.
Notes	This use case applies to any supported adjustable chime and not just front park aid chime The HMI for adjustable chime settings should only be shown when ignition is in Run
Interfaces	Vehicle System, G-HMI

3.5.1.4 ALERT-UC-REQ-195372/F-Set front/rear park aid chime volume level while the front/rear park aid chime is already playing

Actors	Vehicle Occupant
Pre-conditions	Infotainment System is Powered ON. The HMI is configured to have Front Park Aid chime volume adjustment HMI available when Front Park Aid is on the vehicle.

	Park Aid chime adjustment HMI is the active HMI screen. The Front Park Aid chime is currently playing out of the front speakers through the infotainment system
Scenario Description	The user changes the chime volume level of the front park aid chime via the HMI while the front park aid chime is already playing
Post-conditions	The front park aid chime that is already playing is played with the new volume level. This does not change the chime itself other than the volume. The front park aid duration and pause between chimes is not changed with the front park aid volume adjustment. The new volume level of the front parking aid chime is changed and stored. The new front park aid chime volume level is shown on the HMI.
Notes	This use case applies to any supported adjustable chime and not just front park aid chime The HMI for adjustable chime settings should only be shown when ignition is in Run
Interfaces	Vehicle System, G-HMI

3.5.1.5 ALERT-UC-REQ-209067/E-Adjust chime volume while adjustable chime is playing feedback chimes

Actors	Vehicle Occupant
Pre-conditions	Infotainment System is Powered ON. The HMI is configured to have Front Park Aid chime volume adjustment HMI available when Front Park Aid is on the vehicle Park Aid chime adjustment HMI is the active HMI screen. No Chimes are playing through the infotainment system
Scenario Description	1. The user changes (this case increases) the chime volume level of the front park aid chime via the HMI to +1 2. While the feedback chime is playing the user increases the chime volume level again to +2
Post-conditions	The current Chime_16 Forward Park Aid feedback chime sound completes it sound at +1 adjustable chime volume (doesn't play other Chime_16 repetitions for feedback chime at +1) The Chime_16 Forward Park Aid feedback chime is played at the desired number of repetitions at the +2 adjustable chime volume
Notes	This use case applies to reverse park aid also and not just front park aid chime See the Cluster Chime Arbitrator spec for this use case and in case of any conflict the chime arbitrator spec shall take precedent The HMI for adjustable chime settings should only be shown when ignition is in Run
Interfaces	Vehicle System, G-HMI

3.5.1.6 ALERT-UC-REQ-233120/C-Chime event using an Adjustable Chime setting

Actors	Vehicle Occupant
Pre-conditions	Infotainment System is Powered ON. Front Park Aid adjustable chime volume is already set to + 1 adjustable chime value (user previously adjusted the settings in earlier ignition cycles) No Chimes are playing through the infotainment system
Scenario Description	Front Park Aid chime event happens • The Cluster request Front Park Aid chime at the +1 adjustable chime value
Post-conditions	Infotainment System plays the Front Park Aid chime at the +1 adjustable chime loudness level
Notes	This use case applies to any supported adjustable chime and not just front park aid chime The HMI for adjustable chime settings should only be shown when ignition is in Run
Interfaces	Vehicle System

3.5.2 Requirements

For adjustable chimes the Chime ID signal requirement "Alert-SR-REQ-237862-Chime ID signal" has to be supported. Once supported in the AHU software then the Chime ID signal shall be supported by the AHU regardless whether adjustable chimes is supported or not.

3.5.2.1 ALERT-SR-REQ-232946/D-Feature Based Message Protocol usage for adjustable chimes HMI Settings

The definition of how to use Feature Based Message Protocol for Set and Query operations is defined in the Feature Based Message Protocol SPSS and shall be followed to support this SPSS.

To support this SPSS for Adjustable Chimes the supplier will need an August 2016 or later version of the FBMP SPSS to accompany this spec.

~~For Adjustable Chimes the Adjustable Chime Client (ex SYNC) shall use the infotainment start-up method (ie when HMIAudioMode goes from OFF to ON) to query the adjustable chimes setting values from the Chime Client/Adjustable Chime Server (ex Cluster). This is described in the FBMP SPSS.~~

For Adjustable Chimes the Adjustable Chime Client (ex SYNC) shall use the start-up method where the Adjustable Chime Client queries the adjustable chimes setting values from the Chime Client/Adjustable Chime Server (ex Cluster) after ignition goes to Run. This is described in the FBMP SPSS.

3.5.2.2 ALERT-SR-REQ-209035/E-Saving Adjustable Chime Settings between power modes

The Cluster Chime Client / Cluster Adjustable Chime Server shall remember the adjustable chime volume selection values (ex frontParkAidChimveVolSelection.St, rearParkAidChimeVolSelection.St) between power modes. This includes but is not limited to ignition cycles and between network bus wake-up and sleep cycles.

3.5.2.3 ALERT-REQ-208870/E-Adjustable chimes when the Cluster is the chime audio source when chimes are not supported by the infotainment system

When chimes are not through the infotainment system and the cluster back up chime generator is the Chime Audio Source (ex AHU_Chime_Supported = Not_Supported) then the chimes wil be played by the Cluster at the Cluster default chime volume and will not support adjustable chime volume levels.

3.5.2.4 ALERT-HMI-REQ-208871/F-HMI for adjustable chimes when chimes is not through the infotainment system

When AHU_Chime_Supported = Not Supported the Adjustable Chime HMI (ex APIM) shall:

- not allow the user to adjust the chime volume from the HMI adjustable chime menu.
  - HMI may want to indicate to the user that the adjustable chime feature is not supported (such as greying out the menu pick). HMI team to determine
- Show the adjustable chime volume at the 0 / default volume

The Adjustable Chime HMI Client (ex APIM) shall monitor the AHU_Chime_Supported signal to support this requirement.

Note: Chimes are not through the infotainment system whenever the signal AHU_Chime_Supported = Not Supported. When chimes are not supported by the infotainment system (ex speaker open circuit) then the Cluster back-up chime generator is the Chime Audio Source for that ignition cycle (or until the issue is fixed).

3.5.2.5 ALERT-SR-REQ-208872/G-HMI when adjusting the chime volume

When the Adjustable Chime HMI Client sends a request to change the chime volume to the Cluster Chime Client / Adjustable Chime Server, the HMI shall not show the updated chime volume until the Adjustable Chime HMI Client receives the response from the cluster chime client / Adjustable Chime Server that it is at the new chime level.

Example:

Pre-Condition:
The Adjustable HMI client has displayed the Front Park Aid adjustable chime volume as 0 / default volume.

Event:
The user increases the Front Park Aid adjustable chime volume to +1 from the HMI and the Adjustable Chime HMI Client sends Feature.Rq(Operation = Set; FeatureID = FrontParkAidChimeVolSelection; Configuration = +1 Adjustable Chime Volume Level; PersonalityIndex = Active Personality) to the Cluster Chime Client / Adjustable Chime Server.

The Adjustable HMI Clients HMI still shows the Front Park Aid adjustable chime volume as 0 / default volume.

Post-Condition:
The Adjustable Chime HMI Client (ex SYNC) receives Feature.St(FeatureID = FrontParkAidChimeVolSelection; Configuration = +1 Adjustable Chime Volume Level; PersonalityIndex = Active Personality) and updates the HMI to show Front Park Aid is at +1 adjustable chime volume level.

3.5.2.6 ALERT-REQ-208983/E-Adjustable Chime Client HMI configuration

The Adjustable Chime Client (ex APIM) shall have a configuration for what adjustable chimes are supported or not on the HMI. When adjustable chimes are not supported the HMI for adjustable chimes shall not be shown.

3.5.2.7 ALERT-SR-REQ-209036/L-Mapping Adjustable Chime HMI selection to an Adjustable Chime Sound

The infotainment system chime audio source (ex AHU and DSP AMP) shall use the AdjustableChimeVol.St and AdjustableChimeVol2.St signals in the IPC_Chime / IPC_Chime2 message to map the adjustable chime value to their volume loudness value specified in the module hardware specification / interior harmony specification for a chime sound.

The chime audio source (ex AHU / DSP AMP) shall support adjustable chimes for the following chime sounds in the IPC_Chime / IPC_Chime2 message when Chime / Chime2 equals:

- Chime_16 Forward Park Chime
- Chime_17 Reverse Park Chime
- Chime_27 RPA Continuous
- Chime_28 FPA Continuous

Note: for a complete list of chime sounds see the Chime_X ID assignment list see "Alert-REQ-014755-Chime ID Assignments" in the Chime SPSS.

Selected adjustable chime volume level on the HMI sent to the Cluster adjustable chime server	AdjustableChimeVol.St / AdjustableChimeVol2.St signals value in the IPC_Chime and IPC_Chime2 messages	Mapping loudness value for the Chime Audio Source
-3	-3	See Module Hardware Spec / interior harmony specification for loudness target
-2	-2	See Module Hardware Spec / interior harmony specification for loudness target
-1	-1	See Module Hardware Spec / interior harmony specification for loudness target
0 / default volume	0 / default volume	See Module Hardware Spec / interior harmony specification for loudness target
+1	+1	See Module Hardware Spec / interior harmony specification for loudness target
+2	+2	See Module Hardware Spec / interior harmony specification for loudness target
+3	+3	See Module Hardware Spec / interior harmony specification for loudness target

Note: the AHU and DSP AMP shall have stored the Chime_X adjustable chime loudness values (ie -3, -2, -1, +1, +2, +3) above and below the 100% max loudness value (0 / default volume) for an adjustable Chime_X sound.

The Chime_Vol_Level signal in the IPC_Chime message shall adjust the Chime_X volume levels for both the default level (0) and for the adjustable chime values (ie -3, -2, -1, +1, +2, +3) by the percentage indicated in the Chime_Vol_Level signal.

Note: for the Adjustable HMI Chime Client (ex APIM) and Adjustable Chime Server (ie Cluster) see the Feature Based Message Protocol "AdjustableChimeVolumeSelection – FBMP" signal interface descriptions in the beginning of this SPSS for what adjustable chime HMI interfaces are supported.

3.5.2.8 ALERT-SR-REQ-209680/G-Setting Adjustable Chime signal in the IPC_Chime and IPC_Chime2 chime request messages

When the Cluster Chime Arbitrator Client sends IPC_Chime / IPC_Chime2 infotainment chime requests to the infotainment system to play chimes at an adjustable chime volume loudness level then the "IPC_Chime : AdjustableChimeVol" signal value shall be set and held at the adjustable chime value for the duration of the Chime Request with the other IPC_Chime signal parameters (ie held until No_Chime is sent by the Chime Client).

When the Cluster Chime Client sends a No_Chime the Cluster AdjustableChimeVol signal shall be set to "Inactive".

- In other words the Cluster will send "IPC_Chime (Chime = No_Chime, AdjustableChimeVol = Inactive").

Note: this could be for the Cluster requesting a standard chime at an adjustable chime level or requesting a feedback chime when the user adjusts the chime volume level.

3.5.2.9 ALERT-SR-REQ-209686/E-Setting Adjustable Chime signal in the AHU_Alert and DSP_AMP_Alert messages

If the AHU or DSP AMP Chime Audio Source gets an IPC_Chime / IPC_Chime2 request to play an adjustable chime for a Chime_X sound that the chime audio source does not support adjustable chimes for then the chime audio source shall set AdjustableChimeVolSupported = Not Supported.

When the AHU or DSP AMP chime audio source plays a chime at an adjustable chime volume loudness level the AdjustableChimeVolSupported signal shall be set for the duration of playing the requested IPC_Chime / IPC_Chime2 chime.

When a DSP AMP is present the AHU shall monitor the DSP_AMP_Alert message and when the DSP AMP responds with "Alert_Chan = Initialized for chimes" the AHU shall:

- set "AHU_Alert : AdjustableChimeVolSupported = Supported" if the DSP AMP sets "AdjustableChimeVolSupported = Supported", else
- set "AHU_Alert : AdjustableChimeVolSupported = Not Supported" if the DSP AMP sets "AdjustableChimeVolSupported = Not Supported"
- continue to keep "AHU_Alert : AdjustableChimeVolSupported = Inactive" if the DSP AMP incorrectly keeps set "AdjustableChimeVolSupported = Inactive"

When the adjustable chime is no longer being played the AdjustableChimeVolSupported signal shall be set back to Inactive

- AHU: (AHU_Alert : AHU_Chime_Active = No_Chime; AdjustableChimeVolSupported = Inactive).
- DSP AMP: (DSP_AMP_Alert : Alert_Channel = Inactive; AdjustableChimeVolSupported = Inactive)

The Cluster only monitors the AHU AdjustableChimeVolSupported signal and does not look at the DSP AMP signal.

See sequence diagrams for examples

3.5.2.10 ALERT-SR-REQ-209764/G-Error Handling when infotainment system doesn't support adjustable chimes for a particular chime sound

If the Chime/Chime2 chime_x sound signals in the IPC_Chime/IPC_Chime2 messages has the AdjustableChimeVol signal set to a value other than "0 adjustable chime volume / default volume" for a chime_X sound that the Chime Audio Source (AHU/DSP AMP) does not support adjustable chimes for then:

1. The Chime Audio Source shall ignore the "IPC_Chime / IPC_Chime2 : AdjustableChimeVol.St / AdjustableChimeVol2.St" signal for the adjustable chime sound it does not support and play the chime through the infotainment system as it normally would as indicated in the other parameters in the IPC_Chime / IPC_Chime2 messages (play the default volume).
    a. The Chime Audio Source would play the chime_x sounds as though AdjustableChimeVol = 0 adjustable chime volume / default volume.
    b. The Chime Audio Source shall not set Chime_Not_Recognized which would cause the Cluster to play the chime. As long as the Infotainment Chime Audio Source supports the chime sound it shall be played by the infotainment system.
2. The Chime Audio Source (ex AHU, DSP AMP) shall set AdjustableChimeSupported or AdjustableChimeSupported2 = Not Supported for the chime sound (ex Chime_X in "Alert-014755_Chime ID Assignments" table) that it does not support adjustable chimes for while it is playing the requested chime.
3. If the DSP AMP is the Chime Audio Source and if the DSP AMP AdjustableChimeVol / AdjustableChimeVol2 signal equals "Not Supported" while "DSP_AMP_Alert : Alert_Chan = Initialized for Chimes" then the AHU shall set:
    a. AHU_Alert (AHU_Chime_Active / AHU_Chime_Active2 = Chime_X) for the chime it is playing through the infotainment system for the chime sound the DSP AMP doesn't support, and
    b. At the same time set AHU_Alert (AdjustableChimeVolSupported / AjustableChimeVolSupported2) to Not_Supported.
4. When the Cluster Chime Client receives AHU_Alert : AdjustableChimeSupported / AdjustableChimeSupported2 = Not_Supported then the Cluster Chime Client shall:
    a. set 0 / Default Chime in the Feature.St message so the HMI is updated to show that the chime volume is not staying at the adjustable chime volume level selected by the user but at the default chime volume.
        i. Note: Cluster would have to update the FBMP Feature.St(FeatureID = Applicable Adjustable Chime; Configuration = 0 / default adjustable chime volume) to update the Adjustable Chime Client HMI to show that still at the default chime volume.

Note: See sequence diagram
"Alert-SD-209691-User tries to change adjustable chime value for a chime sound the infotainment system doesn't support adjustable chimes for" for details of the order the signals are sent.

3.5.3 Sequence Diagrams

3.5.3.1 ALERT-SD-REQ-209690/G-User sets an adjustable chime loudness value for a chime

Pre-condition:

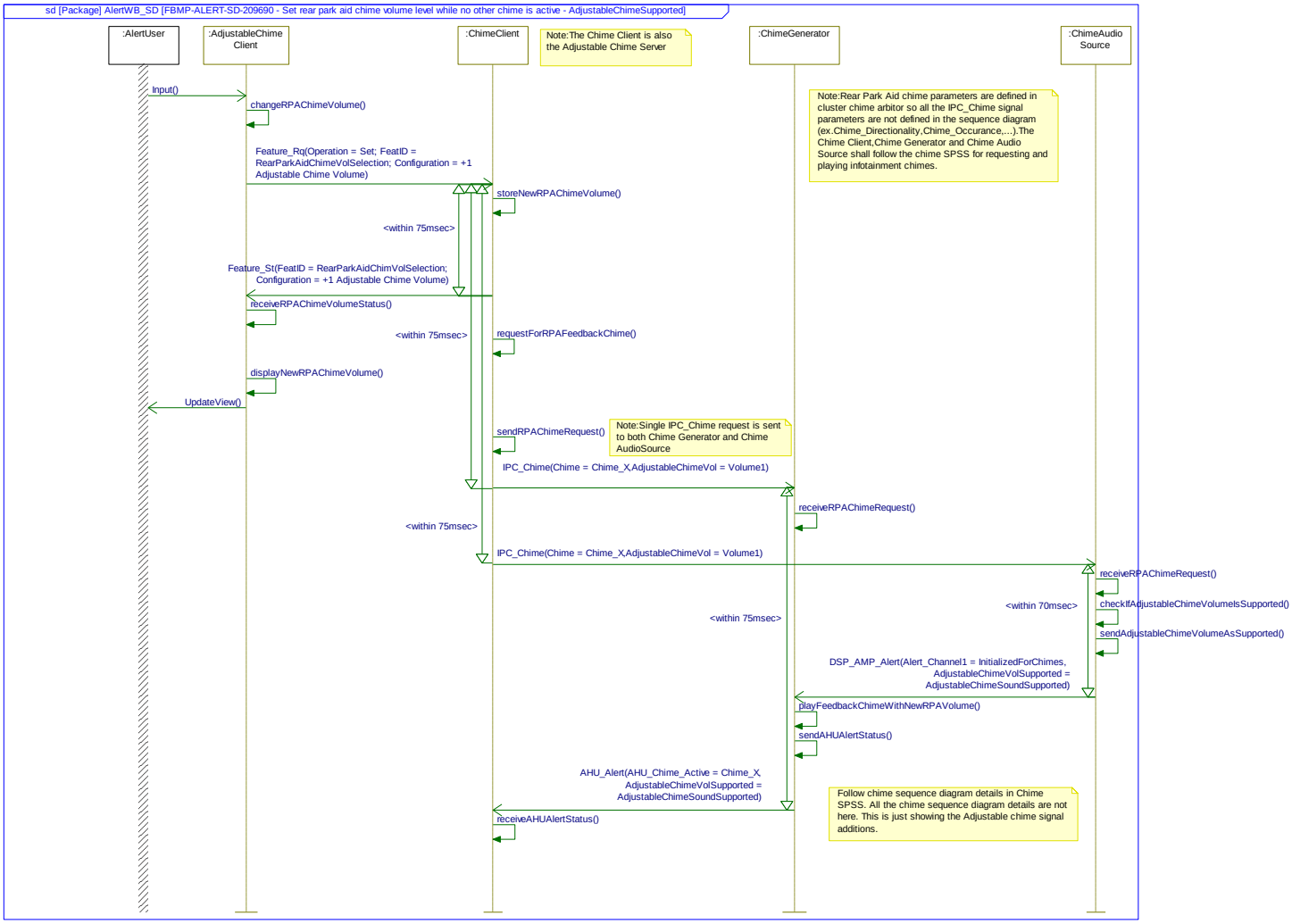
Adjustable chimes HMI screen is shown
Adjustable chimes is set to 0 / default volume loudness value for Reverse Park Aid (note: says RPA as an example but applies for any adjustable chime)
No chime is active

Event:

The user changes the reverse park aid chime loudness value from 0 / default to +1

Post-Condition:

The RPA feedback Chime is played at the +1 adjustable chime value
The HMI shows RPA chime at the +1 adjustable chime value



3.5.3.2 ALERT-SD-REQ-209691/F-User tries to change adjustable chime value for a chime sound the infotainment system doesn't support

Pre-condition:

Adjustable Chimes HMI screen is shown

Adjustable chimes is set to 0 / default volume loudness value for Reverse Park Aid (note: says RPA as an example but applies for any adjustable chime).

No Chime is active

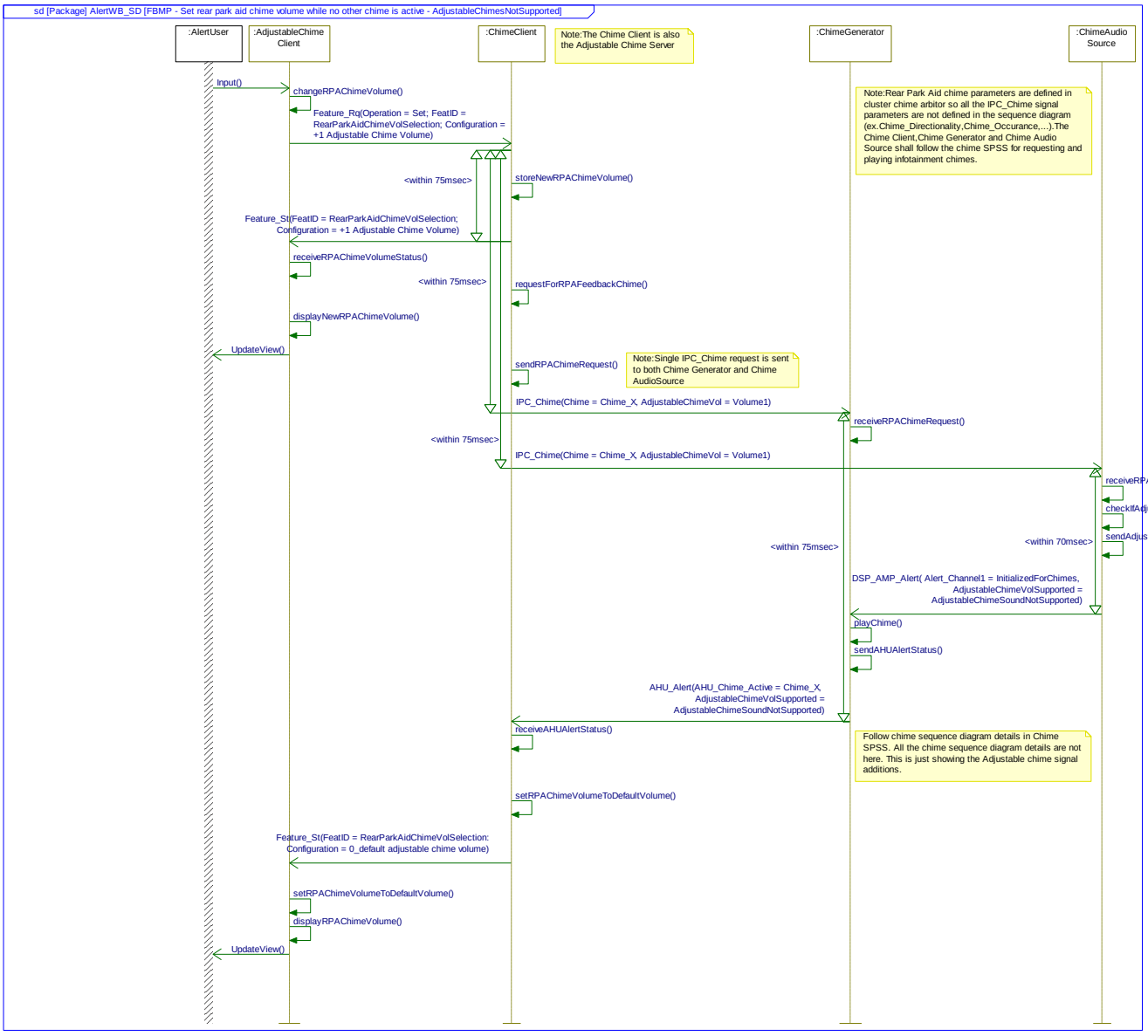
Event:

The user changes the reverse park aid chime loudness value from 0 / default to +1

Post-Condition:

RPA feedback chime is played at the default volume

HMI is shown at the RPA default volume



3.5.3.3 ALERT-SD-REQ-233176/B-Normal Chime Event using the adjustable chime signal

Pre-condition:

No Chime is active

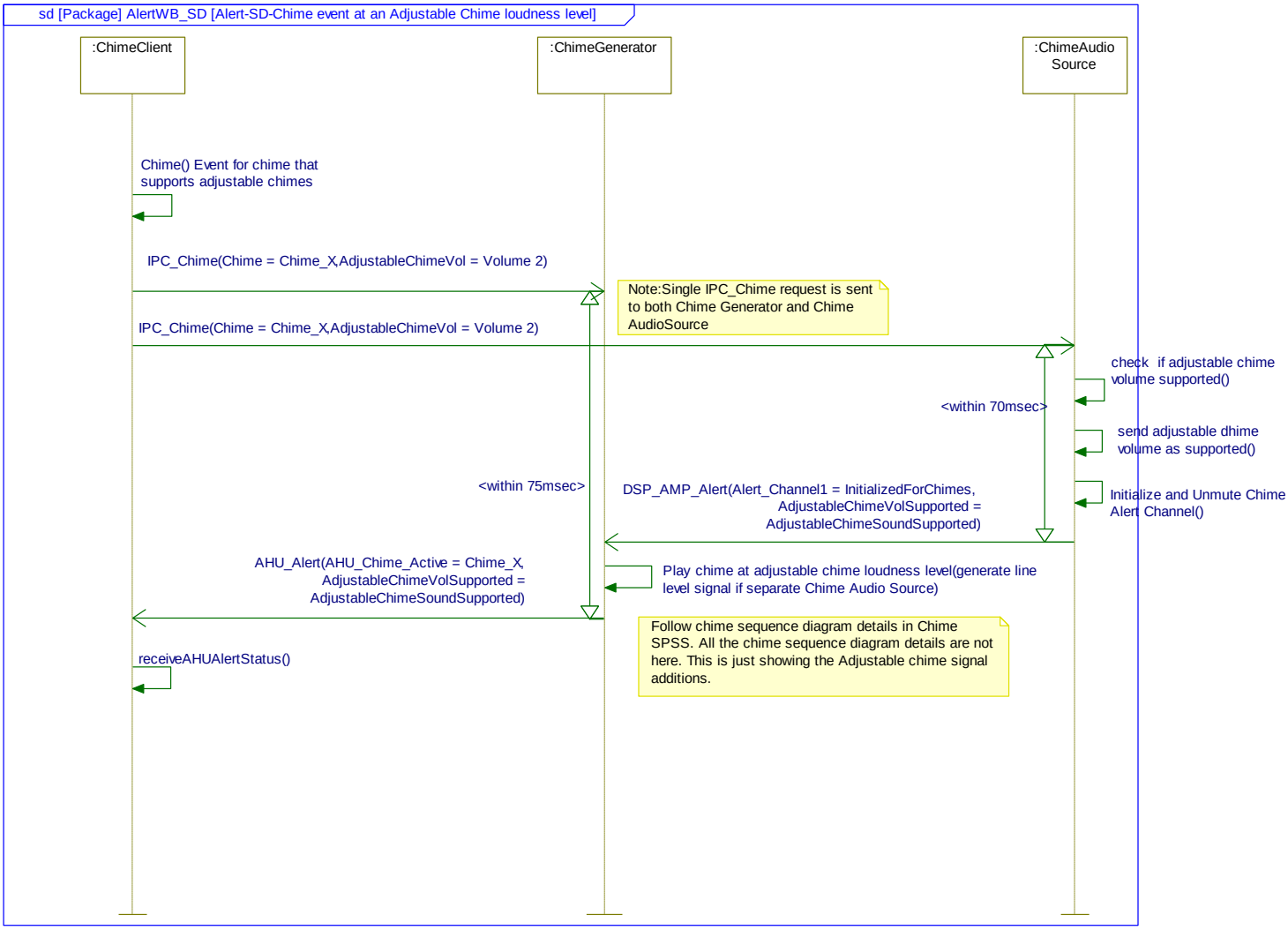
On a previous ignition cycle adjustable Chime_X was set to +2 adjustable chime volume

Event:

A chime event occurs on the vehicle in which Chime_X is sent from the Cluster to the infotainment system with the Chime_X adjustable chime volume set to +2

Post-Condition:

The chime is played by the infotainment system at the +2 level indicated in the Adjustable Chime signal from the Cluster



4 Appendix: Reference Documents

Reference #	Document Title
1	
2	
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