Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – AM/FM/HD Tuner v2

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

Version 1.0

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Version Date: August 17, 2021

FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
August 17, 2021	1.0	Initial Release	

Table of Contents

1 Architectural Design

1.1 AMFMv2-CLD-REQ-420948/A-AMFM Client

Responsibility: The AMFM Client is the interface of the AMFM function. It acts with other system parts that control the AMFM or need data from it.
It also requests audio resources if they are needed.

1.1.1 AMFMv2-FUR-REQ-434291/A-Autocompare

The PDC must compare the actual tuned station / frequency with the preset memory.
The following is the indication if there is accordance;

1. In FM mode
   - RDS station: The PI code is identical
   - Non-RDS station: The frequency is identical

2. In AM mode
   - The frequency is identical

The following paragraph only applies for RDS.

The tuner shall take the AF list out from the preset memory, but it shall be ensured that the best AF applies every time.

1.1.2 AMFMv2-FUR-REQ-420950/A-Preset Indication Update

The preset indication after a preset recall shall only be removed or corrected after 5 seconds. Value will be confirmed by jury evaluation.

1.2 AMFMv2-CLD-REQ-420949/A-AMFM Server

Responsibility: The AMFM Tuner Server (Slave is the legacy term and will be replaced by Server in the future) is responsible for controlling the radio receiver when incoming service requests are received. The Server also transmits radio related status information to other interested parts over the Client. It will also handle traffic and PTY announcements for RDS markets.

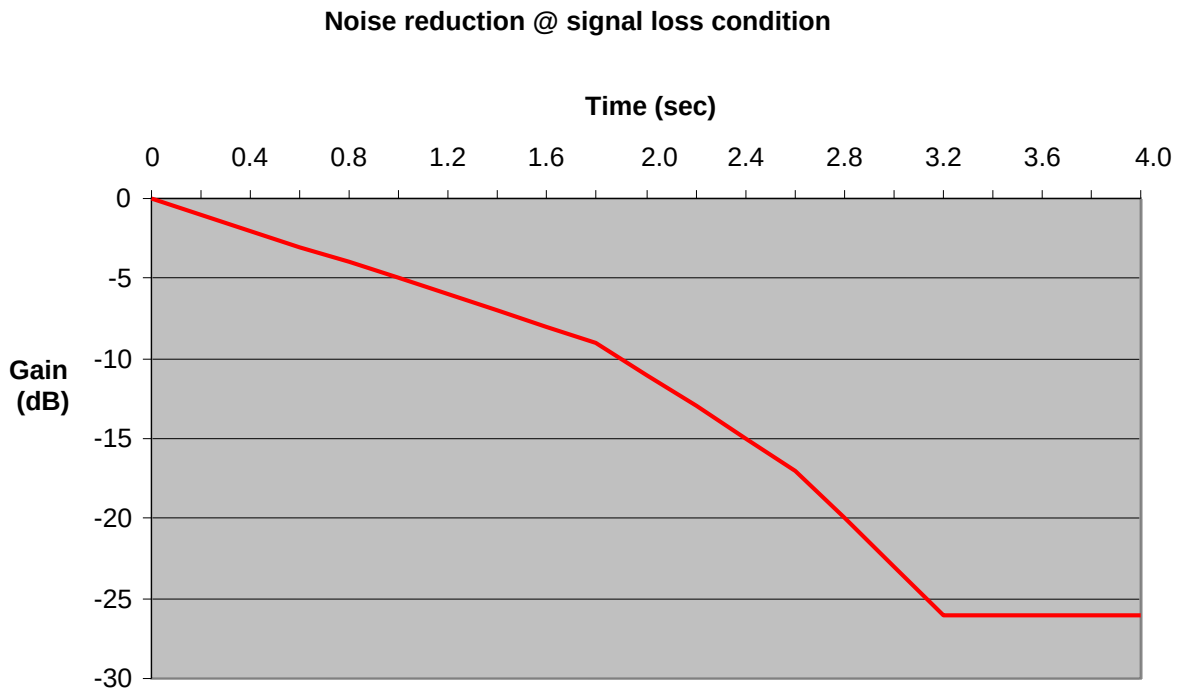
1.2.1 Functional Requirements

1.2.1.1 AMFM-FUR-REQ-024124/A-Mute for no signal (TcSE ROIN-27893-1)

Noise reduction strategy for signal loss condition

The radio shall reduce the off-station noise according to the chart below in the case that the tuner enters a signal loss condition.

Fine tuning will be done during development via jury evaluation.



Data Ponts	
Time (sec)	**Gain (dB)**
0.0	0.0
1.7	-9.0
2.5	-17.0
3.2 -->	-26.0

1.2.1.2 HDR-FUR-REQ-024125/B-HD tuner tune steps (TcSE ROIN-27907-2)

This requirement only applies for tuning step information while the AHU is currently tuned into an HD decoded station.

Description

AM and FM Tune-Up and Tune-Down Functions with HD present

When multiple HD streams are available on the current frequency, the Tune-Up and Tune-Down functions shall allow the selection of HD streams as well as analog frequencies. When the user activates the tune up/down function the tuner shall select the next available digital multicast in the direction the user tuned. If the current HD stream is the highest numbered stream, the next tune-up shall tune to the next highest analog frequency in the steps specified in the analog tuner methodology. If the current HD stream is the lowest numbered stream, the next tune-down shall tune to the next lower analog frequency in the steps specified in the analog tuner methodology.

AM and FM Seek-Up and Seek Down Functions with HD present

When multiple HD streams are available on the current frequency the Seek-Up and Seek-Down functions shall allow the selection of HD streams as well as analog frequencies. When the user activates the Seek-Up or Seek-Down function the tuner shall select the next available digital multicast in the direction the user indicated. If the current HD stream is the highest numbered stream, the next Seek-Up shall seek to the next highest analog frequency in the steps specified in the analog tuner methodology. If the current HD stream is the lowest numbered stream, the next Seek-Down shall seek to the next lower analog frequency in the steps specified in the analog tuner methodology.

1.2.1.3 TU-TMR-REQ-024126/A-T_AF (TcSE ROIN-119068-2)

Name	Description	Units	Range	Resolution	Default
T_AF	Time duration the HMI indicates "AF OFF"	sec	1-30	1	20

1.2.1.4 TU-TMR-REQ-024127/A-T_PI (TcSE ROIN-119069-3)

Name	Description	Units	Range	Resolution	Default
T_PI	Maximum time duration for the best AF to be from a verified PI code	sec	1-30	0.01	0.4

1.2.1.5 TU-TMR-REQ-024128/A-T_AF_JUMP (TcSE ROIN-119071-2)

Name	Description	Units	Range	Resolution	Default
T_AF_JUMP	Time delay before the tuner shall jump to another AF until after a manual tune.	sec	1-30	1	8

1.3 TU-CLD-REQ-194344/A-Tuner Client

Responsibility: The Tuner Client is responsible for requesting and displaying Tuner (AMFM, SDARS, DAB) based functions like preset or station lists and for selecting items out of those lists.

1.4 TU-CLD-REQ-194345/A-Tuner Settings Client

Responsibility: The Tuner Settings Client is responsible for indicating to the system the user selected options.

1.5 TU-CLD-REQ-194346/B-Tuner Server

Responsibility: The Tuner Server is responsible for providing the requested Tuner (AMFM, SDARS, DAB) based functions like preset or station lists and transitioning to the selected items. They are responsible for storing the lists requested.

1.6 Interface Requirements

1.6.1 AMFM-IIR-REQ-421192/A-AMFM Client_Tx

1.6.1.1 MD-REQ-105690/A-AFJump_Rq

Message Type: Request

Name	Literals	Value	Description
Request	-		This interface is used to request the AF jump function to be disable/enable.
	Inactive	0x0	
	Inhibit	0x1	The AF jump functionality will be requested to be disabled if “Inhibit” is set. A disabled AF jump function stops selecting alternative frequencies to not annoy the customer with flickering information in the presented view.
	Enable	0x2	The AF jump functionality will be requested to be enabled if “Enable” is set. An enabled AF jump function allows selecting alternative frequencies to provide improved reception for the customer.

Init value: “Inactive”

Default value: “Enable”

1.6.1.2 MD-REQ-114861/A-FreezeStationList.Rq

Message Type: Request

This method is used to tell the ACU to keep or release the Station List Snapshot.

Name	Literals	Value	Description
int *Mode*	-	-	
	False	0x1	The parameter FALSE is used to release the list when the Station List is closed or a station in the list is selected.
	True	0x2	The parameter TRUE is used to keep the Station List alive.

1.6.1.3 MD-REQ-114862/A-GetStationList.Rq

Message Type: Request

This Method is used to request Station List information. The request tells the radio what Tuner Band to pull the information from, size of list to gather, and where to start the transfer. The requested number of stations are sent back in a response message.

Name	Literals	Value	Description
int *StationList*	-	-	
	Analog AM List	0x1	
	Analog FM List	0x2	
	Digital FM List	0x3	
	Analog and Digital FM List	0x4	Used in Non-RDS market and HD is configured on
	Analog FM PTY List	0x5	Not Used
	DAB Ensemble Service List	0x6	Not Used
	DAB Service List	0x7	Delivers list of all stations (X-Ensemble List)
int *RefreshFlag*	-	-	The Refresh Flag will indicate to the AHU that a refreshed list or the current list is being requested
	False	0x0	
	True	0x1	
int *ListSize*	Inactive	0x00	
	List Size 1	0x01	
	List Size 2	0x02	
	…	…	
	List Size 30	0x1E	
	No Entry	0x1F	
int *StartingIndex*	-	-	
	Centered around currently playing	0x00	Request the station that is currently playing and the other stations centered around it. If no station is playing, the list shall start at IndexNumber 1.
		0x01	
		0x02	
		…	
	Ensemble Name	0xFE	Not Used
	No Entry	0xFF	
int *PTY Code*	-	-	If Station List = 0x1, 0x5 - 0x7

			Then PTY Code = 0x0
		0x0	
		…	
		0x1F	

1.6.1.4 MD-REQ-114863/A-GetTagInfo.Rq

Message Type: Request

This method is used to request Song Tagging information.

Name	Literals	Value	Description
int *Info*	-	-	
	Tag information	0x1	

1.6.1.5 MD-REQ-114866/A-SetAFMode.Rq

Message Type: Request

This method is used to toggle automatic frequency following on/off.

Name	Literals	Value	Description
int *Mode*	-	-	
	AF On (not used)	0x1	
	AF Off	0x1	
	AUTO	0x3	

1.6.1.6 MD-REQ-114868/A-SetCurrentSLStation.Rq

Message Type: Request

This method is used to set a station in the currently browsed Station List.

Name	Literals	Value	Description
int *Index*	-	-	
	Index 1	0x01	
	Index 2	0x02	
	Index 3	0x03	
	…	…	
	Index 254	0xFE	

1.6.1.7 MD-REQ-114869/A-SetCurrentStat.Rq

Message Type: Request

This method sets the current frequency, PI Code or station (frequency and PI Code) of the AM/FM Radio.

If direct tuning to an HD Channel then operation shall be set to 0x1 Set Current Frequency and MCChannel shall be set to the HD number indicated by the user. If direct tuning to an analog station then MCChannel shall be set to 0x0 Inactive.

Name	Literals	Value	Description
int *Operation*	-	-	

	Set Current Frequency	0x1	
	Set Current PI Code (may initiate PI Seek)	0x2	
	Set Current Station (frequency and PI Code)	0x3	
int *Frequency*	-	Number. Size: 11 bits	Offset from lowest possible. Depending on the currently tuned band, the offset will be in KHz or MHz. Formulas to apply for frequency calculation: AM - Frequency = 153 + Offset kHz. Offset range = 0..1557 FM - Frequency = 76 + 0.05*Offset MHz. Offset range = 0..640
int *PICode*	-	16 bit hex coded PI Code	
int *MCChannel*	-	-	
	Inactive	0x0	
	MCChannel1	0x1	
	MCChannel2	0x2	
	MCChannel3	0x3	
	MCChannel4	0x4	
	MCChannel5	0x5	
	MCChannel6	0x6	
	MCChannel7	0x7	

1.6.1.8 MD-REQ-114871/B-SetCurrentTUPreset.Rq

Message Type: Request

This method is used to set the radio station preset.

Name	Literals	Value	Description
int *Preset*	-	-	
	Preset 1	0x01	
	Preset 2	0x02	
	Preset 3	0x03	
	…	…	
	Preset 30	0x1E	

1.6.1.9 MD-REQ-114872/A-SetHDMode.Rq

Message Type: Request

This method is used to toggle HD radio on/off.

Name	Literals	Value	Description
int *Request*	-	-	
	Off	0x1	
	On	0x2	

1.6.1.10 MD-REQ-114873/A-SetNEWSMode.Rq

Message Type: Request

This method is used to toggle NEWS (PTY code 01) background scan on/off. If NEWS is on a detection of PTY 1 shall interrupt the current audio source.

Name	Literals	Value	Description
int *Mode*	-	-	
	News On	0x1	
	News Off	0x2	

1.6.1.11 MD-REQ-114874/A-SetRadioSeekMode.Rq

Message Type: Request

This method is used to perform different operations of frequency/SAT channel seek.

Note: All seek functionality can be interrupted by sending a "seek off" request to the AHU. If an automatic seek or a scan is interrupted while seeking frequencies, the radio goes back to the previously tuned station. If a scan is interrupted while tuned and waiting to continue scan, the radio stays tuned to the current frequency/station.

Name	Literals	Value	Description
int *Mode*	-	-	
	Seek Off	0x1	
	Automatic Up	0x2	Automatic up/down will: (AM/FM) -- search the frequency band until a station is found and then stay tuned to that station. (SDARS) -- tune to the next available channel.
	Automatic Down	0x3	
	Manual Single Step Up	0x4	Manual single step up/down will: (AM/FM) -- increment the frequency by one unit (size of frequency change depends on the band). (SDARS) -- tune to the next available channel. (DAB) -- increment the Block number by one unit. If StationList is frozen then use this as ensemble Seek (Single Tuner); use this to change the browsing pointer to next or prev available ensemble (Dual Tuner)
	Manual Single Step Down	0x5	
	Continuous Manual Up	0x6	Continuous manual up/down will: (AM/FM) -- be used for scanning the frequency band manually. (SDARS) -- indicate a "Fast Tune" operation where-by the SDARS Remote Server will only send the Channel and
	Continuous Manual Down	0x7	

			Number information until the "Fast Tune" is over.
	Scan Up	0x8	Scan will: (AM/FM/SDARS) -- "Automatic seek" for a station, stay tuned for a few seconds and then "Automatic seek" to the next station etc.
	Scan Down	0x9	
	PTY Seek Up	0xA	
	PTY Seek Down	0xB	
	Autostore	0xC	
	Continuous Automatic Up	0xD	Continuous Automatic up/down will: (AM/FM) -- Not Used (DAB) uses Continuous Automatic Up/Down reference Sequence Diagram (SDARS) -- indicate a "Fast Seek" operation where-by the SDARS Remote Server will only send the Channel and Number information until the "Fast Seek" is over
	Continuous Automatic Down	0xE	
	Reserved	0xF	

1.6.1.12 MD-REQ-114875/A-SetRBDSMode.Rq

Message Type: Request

This method is used to toggle RBDS on/off.

Name	Literals	Value	Description
int *Request*	-	-	
	Off	0x1	
	On	0x2	

1.6.1.13 MD-REQ-114876/A-SetREG.Rq

Message Type: Request

This method is used to toggle regional follow on/off.

Name	Literals	Value	Description
int *Mode*	-	-	
	Off	0x1	
	On	0x2	

1.6.1.14 MD-REQ-114877/A-SetTagMode.Rq

Message Type: Request

This method is used to toggle Tag Mode on/off.

Name	Literals	Value	Description
int *Mode*	-	-	
	Off	0x1	
	On	0x2	

1.6.1.15 MD-REQ-114878/A-SetTAMode.Rq

Message Type: Request

This method is used to activate/deactivate the traffic announcement function.

Name	Literals	Value	Description
int *Mode*	-	-	
	TA Local On (not used)	0x1	
	TA Distant On = TA On	0x2	
	TA Off	0x3	

1.6.1.16 MD-REQ-114879/A-StationListScan.Rq

Message Type: Request

This method is used to request the Radio to cancel scanning for a station list.

Name	Literals	Value	Description
int *Status*	-	-	
	Cancel Scan	0x1	

1.6.1.17 MD-REQ-421823/A-StorePreset2.Rq

Message Type: Request

This method is used for mixed mode presets to store the currently tuned station in the preset memory of choice. After storing the station as a preset, the preset automatically becomes active.

Name	Literals	Value	Description
int *Preset*	-	-	
	Preset 1	0x1	
	Preset 2	0x2	
	...	…	
	Preset 29	0x1D	
	Preset 30	0x1E	

1.6.2 AMFM-IIR-REQ-421193/A-AMFM Client_Rx

1.6.2.1 MD-REQ-114881/A-GetStationList.Rsp

Message Type: Response

This method is used to supply the Station List information (Index Number, Frequency, HD Multicast Number, Station Name, Program Type).

Note:
If the PSName is shorter than 8 characters, it must be terminated with an end of string character.
If the SSN is shorter than 4 characters, it must be terminated with an end of string character.
If DAB Service Name is less than 8 characters, it must be terminated with an end of string character.
If DAB Ensemble Name is less than 16 characters, it must be terminated with an end of string character.
(UTF16 will need 16 bytes for 8 characters while Latin only needs 8 bytes).

For FM Analog Dynamic Station List with Dual Tuner the following Parameters are set to these standard values for RDS Markets:
StationList is always set to 0x2 Analog FM List
Requested PTY is always set to 0x0
HD Multicast is always set to 0x0 Analog
Program Type is always set to 0x0

For FM Analog Dynamic Station List with Dual Tuner the following Parameters are set to these standard values for Non-RDS Markets:
StationList is set to 0x2 Analog FM List if HD configured Off
StationList is set to 0x4 Analog and Digital FM List if HD configured On
Requested PTY is always set to 0x0
HD Multicast is set based on availability of HD and configuration
Program Type is always set to 0x0

If the radio is not in an RDS Market then TP and TMC Status shall be set to 0x0

The data is transferred as a complex data type. The message is transferred using the ISO 15765-2 transport protocol.

Name	Literals	Value	Description
int *StationList*	-	-	
	Analog AM List	0x1	
	Analog FM List	0x2	
	Digital FM List	0x3	
	Analog and Digital FM List	0x4	Used in Non-RDS market and HD is configured on
	Analog FM PTY List	0x5	If Station List is 0x5 then Parameter frequency will contain the total number of stations available in a particular PTY.
	DAB Ensemble Service List	0x6	
	DAB Service List	0x7	
int *List Size*	-	-	Parameter List Size defines how many list items are transmitted in the response.
	Invalid	0x0	
	List Size 1	0x1	
	List Size 2	0x2	
	…	…	
	List Size 30	0x30	
	…	…	
	Reserved	0xFE	
	No Entry	0xFF	
int *TotalNumOfStatAval*	-	-	If Station List = 0x5 Then TotalNumOfStatAval = Total Number of PTY's Available If Station List = 0x6 AND requested StartingIndex = 0xFE

			Then TotalNumOfStatAval = 0x0 0 stations aval = no reception 0x1 1 station aval ... 0xFD 253 stations aval 0xFE reserved 0xFF reserved
	Invalid	0x0	
	1 Station Aval	0x1	
	…	…	
	253 Station Aval	0xFD	
	Reserved	0xFE	
	No Entry	0xFF	
int *Requested PTY*	-	-	If StationList = 0x1 or 0x5 - 0x7 then Requested PTY = 0x0 Otherwise Requested PTY = 0x00 ... 0x1F
int *Refresh Flag*	-	-	
	False	0x0	
	True	0x1	
vector *ItemVector*	-	-	Array (1...N) of record (IndexNumber, Frequency,HDMulticast,TPStatus, TMCStatus, ProgramType, StationName) with NbrOfItem defined in the ListSize parameter.
Index Number	-	-	
	Index Number 0	0x00	
	…	…	
	Index Number 253	0xFD	
	EnsembleName	0xFE	
	Reserved	0xFF	
Frequency	-	-	To calculate the value of the Parameter Frequency the following formula shall be used: AM: frequency = 153 + Offset kHz. Offset range 0...1557. FM: frequency = 76 + 0.05*Offset MHz. Offset range = 0...640. DAB: frequency/BlockNumber = Bitfield: Bit 0 .. 4: L-Band Canada: Numeric value (1 .. 23); L-Band Europe: Numeric value (A=1 .. W=23); Band III: Numeric value (A=1 .. W=23); hex coded Bit 5 .. 8: Band III: Numeric value (not used for L-Band; default value: 0h), hex coded Bit 9: 0: Band III 1: L-Band If Station List = Analog FM PTY List

			Frequency = Number of Stations available in the PTY Category 0x00 ... 0xFE If Station List = DAB Ensemble Service List Frequency = BlockNumber
	0	0x0	
	1	0x1	
	…	...	
	1557	0x615	
	Reserved	0x616	
	…	…	
	Reserved	0xFFFF	
HD Multicast	-	-	If HD Multicast is 0x0 Not Applicable/Analog then Station Name will contain the PSName or the DAB Service Name for DAB lists. If the HD Multicast is 0x1...0x7 then Station Name will send SSN and Program Type data will be sent.
	Not Applicable/Analog	0x0	
	MC 1	0x1	
	MC 2	0x2	
	MC 3	0x3	
	MC 4	0x4	
	MC 5	0x5	
	MC 6	0x6	
	MC 7	0x7	
	PTY List	0x8	
Station Name	-	-	If HD Multicast = PTY List Station Name = 0x0 If HD Multicast = Not Applicable/Analog Station Name = PSName PSName = 8 Characters Max If HD Multicast = 0x1 .... 0x7 Station Name = SSN SSN = 4 Characters Max If HD Multicast = Not Applicable/Analog StationList = DAB Station Name = DAB Service Name DAB Service Name is 16 Characters Max
Program Type	-	-	If HD Multicast = PTY List Program Type = PTY Code Number If HD Multicast = Analog Program Type = PTY Code Number If HD Multicast = 0x1....0x7 Program Type = PTY Code Number
TP Status	-	-	
	not available	0x0	
	available	0x1	
TMC Status	-	-	

	not available	0x0	
	available	0x1	

1.6.2.2 MD-REQ-114883/A-GetTagInfo.Rsp

Message Type: Response

The data is transferred as a complex data type. The message is transferred using the ISO 15765-2 transport protocol.

Name	Literals	Value	Description
byte *Title*	-	Title = 64 Characters Max	Terminate with 0x00 If Invalid or Empty set to 0x00
byte *Artist*	-	Artist = 64 Characters Max	Terminate with 0x00 If Invalid or Empty set to 0x00
byte *Album*	-	Album = 64 Characters Max	Terminate with 0x00 If Invalid or Empty set to 0x00
byte *UFID Owner Identifier*	-	UFID Owner Identifier = 128 Characters Max	Terminate with 0x00 If Invalid or Empty set to 0x00
byte *UFID Identifier*	-	UFID Identifier = 64 Characters Max	Terminate with 0x00
byte *Station Call Sign*	-	Call Letters = 16 Characters Max	Terminate with 0x00 If Invalid or Empty set to 0x00
byte *Time Stamp*	-	ALFN(Time Stamp) = 4 bytes	
int *Time Lock Status*	-	-	
	Time Lock not Set	0x0	
	Time Lock Set	0x1	
	(ALFN invalid)	0xFF	
byte *Station Frequency*	-	Station Frequency = 9 Characters Max	Terminate with 0x00 If Invalid or Empty set to 0x00
int *Program Number*	-	-	
	Multicast 1	0x1	
	Multicast 2	0x2	
	Multicast 3	0x3	
	Multicast 4	0x4	
	Mutlicast 5	0x5	
	Multicast 6	0x6	
	Multicast 7	0x7	
	Invalid or Empty	0xFF	
byte *Genre*	-	Genre = 128 Characters Max	Terminate with 0x00 If Invalid or Empty set to 0x00
int *Ambiguous Data Flag*	-	-	
	Not Ambiguous	0x00	
	Ambiguous	0x01	
	Invalid or Empty	0xFF	
int *Button Press Flag*	-	-	

	No	0x00	
	Yes	0x01	
	Invalid or Empty	0xFF	

1.6.2.3 MD-REQ-107185/B-CurrentItemsInFMSL_St

Message Type: Status

Name	Literals	Value	Description
Status	-		This interface communicates the current available number of stations in the station list.
	Invalid	0x00	
	NumberOfItemsInFMSL	0x01 – 0xFE	This parameter indicates the number of items in the FM station list.
	NoValidPreset	0xFF	If it is confirmed that the station list is empty (no items) the value “NoValidPreset” is communicated.

Init value: “Invalid”
Default value: “NoValidPreset”

1.6.2.4 MD-REQ-114884/A-ArtistName.St()

Message Type: Status

This message is used to deliver the HD Artist Name.

Note:
If the Artist Name is less than 64 Characters, it must be terminated with an end of string character.

The data is transferred as a complex data type. The message is transferred using the ISO 15765-2 transport protocol.

Name	Literals	Value	Description
byte *ArtistName*	-	Artist Name = 65 characters Max	64 characters plus 1 end of string character.

1.6.2.5 MD-REQ-114885/A-CurrentStationName.St()

Message Type: Status

This status message delivers the program station name of the currently tuned station. The attribute should be transmitted directly when a station is changed, but when a station is tuned, it should not be transmitted more often then every 1000ms. If it is not possible to decode a Station Name, due to bad reception, 'EOS 0x00' character shall be transmitted.

For DAB Tuners this Method is used to transmit the 16 Character Service Name. For AMFM Tuner this Method is used to transmit the PSName.

Note: If the Station Name changes for an already tuned station, the attribute shall transmit the new Station Name.

CurrentStationName.St and CurrentPSName.St shall always be sent together for legacy compatability. If the Character Coding Flag is set to Coding Table I then CurrentPSName shall be filled with an EOS character. The Sequence Diagrams show CurrentPSName.St when this is seen both methods shall be sent.

See TP-GREQ-138093 Character Coding Flag for details about Character Coding.

Name	Literals	Value	Description
byte *Station Name*	-	Station Name = 17 characters Max	Up to 16 Characters + 1 End of String Character

1.6.2.6 MD-REQ-114886/A-RadioText.St()

Message Type: Status

This method is used to transmit Radio Text Data across the bus.

Name	Literals	Value	Description
byte *Radio Text*	-	Radio text = 65 characters Max	Up to 64 characters plus 1 end of string character.

1.6.2.7 MD-REQ-114887/A-SongTitle.St()

Message Type: Status

This message is used to deliver the HD Song Title.

Note:
If the Song Title is less than 64 Characters, it must be terminated with an end of string character.

The data is transferred as a complex data type. The message is transferred using the ISO 15765-2 transport protocol.

Name	Literals	Value	Description
byte *SongTitle*	-	SongTitle = 65 characters Max	Up to 64 characters plus 1 end of string character.

1.6.2.8 MD-REQ-107184/A-AFJump_St

Message Type: Status

Name	Literals	Value	Description
Status	-		This interface is used to communicate the status of the related AF jump function.
	NoDataExists	0x0	
	Inhibited	0x1	If the AF jump function is disabled the value “Inhibited” is communicated. A disabled AF jump function stops selecting alternative frequencies to not annoy the customer with flickering information in the presented view.
	Enabled	0x2	If the AF jump function is enabled the value “Enabled” is communicated. An enabled AF jump function allows selecting alternative frequencies to provide improved reception for the customer.

Init value: “NoDataExists”
Default value: “Enabled”

1.6.2.9 MD-REQ-114888/A-AFMode.St()

Message Type: Status

This status message shows if the Automatic Frequency following function is activated.

Name	Literals	Value	Description
int *Mode*	-	-	
	AF On (not used)	0x1	
	AF Off	0x2	
	AUTO	0x3	

1.6.2.10 MD-REQ-421824/A-AvailableHDChannel.St()

Message Type: Status

This method is used to indicate the availability of HD channels for the current frequency.

Name	Literals	Value	Description
int Validation	-	-	
	Invalid	0x0	
	Valid	0x1	
int HD1	-	-	
	NotAvailable	0x0	
	Available	0x1	
int HD2	-	-	
	NotAvailable	0x0	
	Available	0x1	
int HD3	-	-	
	NotAvailable	0x0	
	Available	0x1	
int HD4	-	-	
	NotAvailable	0x0	
	Available	0x1	
int HD5	-	-	
	NotAvailable	0x0	
	Available	0x1	
int HD6	-	-	
	NotAvailable	0x0	
	Available	0x1	
int HD7	-	-	
	NotAvailable	0x0	
	Available	0x1	

1.6.2.11 MD-REQ-114890/A-CurrentFreq.St()

Message Type: Status

This status message delivers the frequency of the currently tuned station.

Name	Literals	Value	Description
int *Number*	-	Size:11 bits	Formulas to apply: AM - Frequency = 153 + Offset kHz. Offset range = 0..1557

			FM - Frequency = 76 + Offset*0.05 MHz. Offset range = 0..640 Offset from lowest possible. Depending on the currently tuned band, the offset will be in KHz or MHz.

1.6.2.12 MD-REQ-114891/A-CurrentHDMulticast.St()

Message Type: Status

This method is used to report the HD multicast number for the currently playing station.

Name	Literals	Value	Description
int *Status*	-	-	
	0	0x0	
	1	0x1	
	2	0x2	
	3	0x3	
	4	0x4	
	5	0x5	
	6	0x6	
	7	0x7	

1.6.2.13 MD-REQ-114892/A-CurrentPICode.St()

Message Type: Status

This status message delivers the PI code for the currently tuned station.

Name	Literals	Value	Description
int *Availability*	-	Size: 1 bit	
	PI Code not available	0x0	
	PI Code available	0x1	
int *PICode*	-	Size: 16 bits	Size - 16 bits Valid range = Full

1.6.2.14 MD-REQ-114894/A-CurrentPSName.St()

Message Type: Status

This status message delivers the program station name (PS Name) of the currently tuned station. The attribute should be transmitted directly when the frequency/station is changed, but when a station is tuned, it should not be transmitted more often than every 1000ms. If it is not possible to decode a PS Name, due to a non-RDS station or bad reception, 'EOS 0x00' characters shall be transmitted.

For DAB Tuners this Method is used to transmit the 8 Character Service Name.

Note:

If the PS Name changes for an already tuned station, the attribute shall transmit the new PS Name.
CurrentStationName.St and CurrentPSName.St shall always be sent together for legacy compatability.
If the Character Coding Flag is set to Coding Table I then CurrentPSName shall be filled with an EOS character. The Sequence Diagrams show CurrentPSName.St when this is seen both methods shall be sent.

See TP-GREQ-138093 Character Coding Flag for details about Character Coding.

Name	Literals	Value	Description
byte *PSName*	-	PSName = 8 Characters	8 characters (8 bytes) Character Coding: RDS LATIN

1.6.2.15 MD-REQ-114895/A-CurrentPTYCode.St()

Message Type: Status

This status message delivers the program type (PTY) code for the currently tuned station.

Name	Literals	Value	Description
int *Code*	-	-	
	PTY 1 (NEWS)	0x01	
	PTY 2	0x02	
	...		
	PTY 31 (Alarm)	0x1F	

1.6.2.16 MD-REQ-114896/A-CurrentSLIndex.St()

Message Type: Status

This status message delivers the currently tuned station in the Station List.

Name	Literals	Value	Description
int *CurrFMSLPreSt Preset*	-	-	
	Invalid	0x00	When the Station list is not used, the status shall be set to 0x00 invalid.
	Index 1	0x01	
	Index 2	0x02	
	....	…	
	Index 254	0xFE	
	No valid station	0xFF	When the Station list is used but the currently played station doesn't exist in the Station list, 0xFF shall be sent.

1.6.2.17 MD-REQ-114897/A-CurrentSSName.St()

Message Type: Status

This method is used to transmit the Short Station Name when a station is broadcasting in HD.

Name	Literals	Value	Description
byte *SSName*	-	SSName = 4 characters	4 characters (4bytes) Character Coding: RDS LATIN

1.6.2.18 MD-REQ-114898/A-CurrentStatFlags.St()

Message Type: Status

This status signal shows the RDS information for the currently tuned frequency.

Name	Literals	Value	Description
int *Status*	-	Bitfield (5 bits)	The RDS information shall be set as supported when PS Name has been verified for the current frequency. If DAB is active source only Bit 3 holds DAB Service information about Mono or Stereo reception all other station flags are based on the currently tuned FM frequency.
	Invalid	Bit 0: 0	
	Valid	Bit 0: 1	Bit 0 shall be set to valid throughout the powermode cycle whenever the slave is ready to write the signal values.
	EON not supported not used	Bit 1: 0	
	EON supported not used	Bit 1: 1	
	TP not supported	Bit 2: 0	
	TP supported	Bit 2: 1	
	Mono	Bit 3: 0	
	Stereo	Bit 3: 1	

1.6.2.19 MD-REQ-114899/A-CurrentTUBand.St()

Message Type: Status

This signal delivers the Band of the actual selected radio station.

Name	Literals	Value	Description
Int *Mode*	-	Size: 4bit	
	Invalid	0x0	
	FM1	0x1	
	FM2	0x2	
	FM AST	0x3	
	AM	0x4	
	AM AST	0x5	
	FM3	0x6	
	DAB1	0x7	
	DAB2	0x8	
	SAT1	0x9	
	SAT2	0xA	
	SAT3	0xB	
	DAB3	0xC	
	Reserved	0xD – 0xF	

1.6.2.20 MD-REQ-421825/A-CurrentMixPreset2.St()

Message Type: Status

This status signal tells the clients what preset is currently active (if any) when configured as Mixed Mode Presets.

Name	Literals	Value	Description
int *Presets*	-	-	
	Invalid	0x00	
	Preset 1	0x01	
	Preset 2	0x02	
	Preset 3	0x03	
	Preset 4	0x04	
	…	…	
	Preset 30	0x1E	
	No active preset	0x1F	

1.6.2.21 MD-REQ-114900/A-DirectTune.St()

Message Type: Status

This method is used to report whether it received a Valid or Invalid station.

Name	Literals	Value	Description
int *Status*	-	-	-
	Invalid/Not Active	0x0	If not responding to a direct tune request this signal shall be set to Invalid/Active
	Invalid Station	0x1	
	Valid Station	0x2	

1.6.2.22 MD-REQ-114901/A-HDChanStatus.St()

Message Type: Status

This method is used to report whether an HD station is being acquired, is acquired, has no multicast (no HD Channel), or multicast is not found.

Name	Literals	Value	Description
byte *Status*	-	-	
	Acquiring	0x1	
	Acquired	0x2	
	No Multicast	0x3	If the station is not an HD station or HD is turned off this signal shall be set to 0x3 No Multicast (No HD Channel).
	Not Found	0x4	If multicast of 2+ is selected by either a Direct Tune or Preset Selection and cannot be acquired then signal shall be set to 0x4 Not Found.

1.6.2.23 MD-REQ-114902/A-HDMode.St()

Message Type: Status

This method is used to report whether HD Mode is on or off.

Name	Literals	Value	Description
int *Status*	-	-	
	Off	0x1	
	On	0x2	

1.6.2.24 MD-REQ-114903/A-NEWSMode.St

Message Type: Status

This status message shows if the NEWS function is activated.

Name	Literals	Value	Description
int *Mode*	-	-	
	NEWS On	0x1	
	NEWS Off	0x2	

1.6.2.25 MD-REQ-114904/A-NumofHDMulticastChans.St()

Message Type: Status

This method is used to report how many multicasts are available on a given station.

Name	Literals	Value	Description
int *Channel*	-	-	
	0	0x0	
	1 Multicast Available	0x1	
	2 Multicast Available	0x2	
	3 Multicast Available	0x3	
	4 Multicast Available	0x4	
	5 Multicast Available	0x5	
	6 Multicast Available	0x6	
	7 Multicast Available	0x7	

1.6.2.26 MD-REQ-114906/A-RadioSeekMode2.St()

Message Type: Status

This status message tells the clients in which seek mode the radio is. The PTY Search mode may be entered automatically by the radio when the user selects PTY codes.

Note: Added parameters Continuous Automatic Up and Continuous Automatic Down for SDARS functionality. If RadioSeekMode2.St is sent then the radio needs to send RadioSeekMode.St.

Name	Literals	Value	Description
int *Mode*	-	-	
	Seek Off	0x01	
	Automatic Up	0x02	
	Automatic Down	0x03	
	Manual Single Step Up	0x04	
	Manual Single Step Down	0x05	
	Continuous Manual Up	0x06	
	Continuous Manual Down	0x07	
	Scan Up	0x08	

	Scan Down	0x09	
	PTY Seek Up	0x0A	
	PTY Seek Down	0x0B	
	Autostore	0x0C	
	TP Seek	0x0D	
	PI Seek	0x0E	
	Continuous Automatic Up	0x0F	
	Continuous Automatic Down	0x10	

1.6.2.27 MD-REQ-114907/A-RadioSeekModeResult.St()

Message Type: Status

This method is used to indicate to the other modules if no station was found after an Autostore or PTY Seek/Scan was performed. This signal shall be set to 0x1 Inactive unless required to indicate No Station Found.

Name	Literals	Value	Description
int *Status*	-	-	
	Invalid	0x01	
	Inactive	0x02	
	No Station Found	0x03	

1.6.2.28 MD-REQ-114908/A-RBDSMode.St()

Message Type: Status

This method is used to report whether RBDS Mode is on or off. This signal shall be defaulted to On 0x2.

Name	Literals	Value	Description
int *Status*	-	-	
	Off	0x1	
	On	0x2	

1.6.2.29 MD-REQ-114909/A-REG.St()

Message Type: Status

This status message shows if the regional following function is activated.

Name	Literals	Value	Description
int *Mode*	-	-	
	Off	0x1	
	On	0x2	

1.6.2.30 MD-REQ-114910/A-SelectedPTYCodes.St()

Message Type: Status

This status message delivers an array with selected (desired) program type (PTY) codes.

Note:

PTY code 0 omitted due to that it is a non-valid PTY code.

If you are requested for a PTY that currently does not exist then bit 0 should be set to 0 invalid. Otherwise if a PTY Code is selected or all PTY codes are not selected then bit 0 should be set to 1valid.

Name	Literals	Value	Description
int *Code*	-	Size: 28 bits	
	For RDS Markets		
	invalid	Bit 0: 0	
	valid	Bit 0: 1	
	PTY Code 2 selected	Bit 1: 1	
	PTY Code 2 not selected	Bit 1: 0	
	…	…	
	PTY Code 29 selected	Bit 28: 1	
	PTY Code 29 not selected	Bit 28: 0	
	For RBDS Markets		
	invalid	Bit 0: 0	
	valid	Bit 0: 1	
	PTY Code 2 selected	Bit 1: 1	
	PTY Code 2 not selected	Bit 1: 0	
	PTY Code 3	Bit 2	
	PTY Code 4	Bit 3	
	PTY Code 5	Bit 4	
	PTY Code 6	Bit 5	
	PTY Code 7	Bit 6	
	PTY Code 8	Bit 7	
	PTY Code 9	Bit 8	
	PTY Code 10	Bit 9	
	PTY Code 11	Bit 10	
	PTY Code 12	Bit 11	
	PTY Code 13	Bit 12	
	PTY Code 14	Bit 13	
	PTY Code 15	Bit 14	
	PTY Code 16	Bit 15	
	PTY Code 17	Bit 16	
	PTY Code 18	Bit 17	
	PTY Code 19	Bit 18	
	PTY Code 20	Bit 19	
	PTY Code 21	Bit 20	
	PTY Code 22	Bit 21	
	PTY Code 23	Bit 22	
	PTY Code 24 unassigned	Bit 23	
	PTY Code 25 unassigned	Bit 24	
	PTY Code 26 unassigned	Bit 25	
	PTY Code 27 unassigned	Bit 26	
	PTY Code 01 unassigned	Bit 27	
	PTY Code 29	Bit 28	

1.6.2.31 MD-REQ-114911/A-StationListScan.St()

Message Type: Status

This message shows the status of the Station List Scan function. If not responding to a request this signal shall be set to 0x0 Invalid/Not Active.

Name	Literals	Value	Description
int *Status*	-	-	
	Scan Cancelled	0x1	

1.6.2.32 MD-REQ-114912/A-StorePreset.St()

Message Type: Status

This status signal tells the clients what preset has been stored.

Name	Literals	Value	Description
int *Preset*	-	-	
	Invalid	0x00	
	Preset 1		
	Preset 2		
	…		
	Preset 30	0x1E	
	NotStoring	0x1F	Set back to Not Storing after sending the stored preset value.

1.6.2.33 MD-REQ-114913/A-TagMode.St()

Message Type: Status

This method is used to report whether Tag Mode is on or off.

Name	Literals	Value	Description
int *Status*	-	-	
	Off	0x1	
	On	0x2	

1.6.2.34 MD-REQ-114914/A-TAMode.St()

Message Type: Status

This status message shows if the Traffic Announcement function is activated.

Name	Literals	Value	Description
int *Mode*	-	-	
	TA Local On (not used)	0x1	
	TA Distant On = TA On	0x2	
	TA off	0x3	

1.6.2.35 MD-REQ-421378/A-RadioAnnouncement_St

Message Type: Status

This method is used to provide the source and the type of an active radio announcement.

Name	Literals	Value	Description
Int *RASource*	-	-	The parameter RASource shall be used to indicate which tuner band is the source of a Radio Announcement
	inactive	0x0	Shall be used when no Radio Announcement shall be broadcasted.
	FM	0x1	The value FM is set if the current source of the Radio Announcement is FM tuner
	DAB	0x2	The value FM is set if the current source of the Radio Announcement is DAB tuner
	Reserved	0x3	
Int *RAType*	-	-	The parameter RAType shall be used to indicate which Type does have the active Radio Announcement. Radio announcement types 1-16 are only applicable for DAB radio source.
	inactive	0x00	Shall be used when no Radio Announcement shall be broadcasted
	TA	0x01	
	NEWS	0x02	
	ALARM	0x03	
	type1	0x04	
	type2	0x05	
	type3	0x06	
	type4	0x07	
	type5	0x08	
	type6	0x09	
	type7	0x0A	
	type8	0x0B	
	type9	0x0C	
	type10	0x0D	
	type11	0x0E	
	type12	0x0F	
	type13	0x10	
	type14	0x11	
	type15	0x12	
	type16	0x13	

1.6.2.36 MD-REQ-434522/A-PresetTuneConfirmation.St

Message Type: Status

This status signal tells the client that the preset has been tuned to.

Name	Literals	Value	Description
int *Preset*	-	-	Set back to Null after indicating the Preset Tuned Confirmation. Not confirmed set if preset is unable

			to be tuned in RDS markets. This signal is in response to the SetCurrentTUPreset_Rq
	Null	0x00	
	Preset 1		
	Preset 2		
	…		
	Preset 30	0x1E	
	NotConfirmed	0x1F	

1.6.3 TU-IIR-REQ-205020/A-TunerSettingClient_Tx

1.6.3.1 MD-REQ-205017/B-SelectedNumber OfPresets.St()

Message Type: Status

This method is used to indicate the max number of presets the user would like to see in the HMI or preset list.

Name	Literals	Value	Description
int *Status*	-	-	
	Invalid	0x0	
	MaxPresets1	0x1	
	MaxPresets2	0x2	
	….	…	
	MaxPresets30	0x1E	

1.6.4 TU-IIR-REQ-299207/B-TunerClient-TunerServer

1.6.4.1 MD-REQ-297090/B-SelectStation_Rq

Message Type: Request

This method is used to select a station from the mixed station list.

Name	Literals	Value	Description
Int *RequestSelector*	-	-	The parameter RequestSelector shall be used to determine if a FM or DAB station is requested.
	Inactive	0x0	
	PI-Code	0x1	The value PI-Code shall be set if a FM station via PI-Code is requested.
	SCIDI_SID_ECC	0x2	The value SCIDI_SID_ECC shall be set if a DAB station via SCID, SID and ECC is requested.
	Reserved	0x3	

Int16 *PI-Code*	-	-	The parameter PI-Code is used to address the requested FM station.
	Inactive	0x0000	The Value Inactive shall be set if a non-FM station is requested.

	PI-Code	0x0001 – 0xFFFF	PI-Code in hex.

Int16 *SCID*	-	-	The parameter SCID is used to address the requested DAB station. The parameter SCID shall be combined with parameter SID and ECC.
	Inactive	0x0000	The Value Inactive shall be set if a non-DAB station is requested.
	SCID	0x0001 – 0xFFFF	SCID in hex.

Int16 *SID*	-	-	The parameter SID is used to address the requested DAB station. The parameter SID shall be combined with parameter SCID and ECC.
	Inactive	0x0000	The Value Inactive shall be set if a non-DAB station is requested.
	SID	0x0001 – 0xFFFF	SID in hex.

Int ECC	-	-	The parameter ECC is used to address the requested DAB station. The parameter ECC shall be combined with parameter SCID and SID.
	Inactive	0x00	The Value Inactive shall be set if a non-DAB station is requested.
	ECC	0x01 – 0xFF	ECC in hex.

1.6.5 TU-IIR-REQ-299209/B-TunerServer-TunerClient

1.6.5.1 MD-REQ-297091/B-SelectStation_Rsp

Message Type: Response

This method is used to respond to a select station request.

Name	Literals	Value	Description
Int *ResponseCode*	-	-	The parameter ResponseCode shall be used to state if a select station request can be executed successfully or not..
	NULL	0x0	
	NotAccepted	0x1	The value NotAccepted is set if the station which is requested cannot be tuned (Is currently NOT in the learn memory).

	Accepted	0x2	The value Accepted is set if the station which is requested can be tuned.
	Reserved	0x3	

2 General Requirements

2.1 HDR-SR-REQ-024053/C-Initial Display Data shown when selecting an HD Preset or Direct Tuning an HD channel (TcSE ROIN-128157-1)

Whenever the user selects a Preset with an HD channel stored in it or Direct Tunes to an HD channel, the MFD shall only display the frequency for 2 seconds before displaying the rest or the display data that the AHU sends over. This is done so that the user does not see the RBDS data flash on the display before the HD data is available.

The HD song, artist, and station information (ie: PAD information), shall be sent to the Sync for as long as the HD station is tuned to, regardless of what audio source is currently playing.

2.2 TU-TMR-REQ-024057/A-T_PRESET_STORE (TcSE ROIN-119072-3)

Name	Description	Units	Range	Resolution	Default
T_PRESET_STORE	Time delay before a preset is stored	sec	1-30	0.5	2

2.3 TU-TMR-REQ-024058/A-T_button_hold (TcSE ROIN-159172-3)

Name	Description	Units	Range	Resolution	Default
T_button_hold	Time delay before a button press and hold function is activated	sec	1-30	0.5	1.5

2.4 AMFM-SR-REQ-024059/A-Starting Index = 0x00 Usage for Preset List or Station List browsing (TcSE ROIN-174324-1)

If the AM/FM Slave receives a request for Preset List or Station List and the Starting Index parameter in the request is set to 0x00, then the AM/FM Slave shall respond by following the examples below.

Example 1: If the request is for a List Size of 5 and a Starting Index of 0x00 then the response would come back with two stations above the currently playing station and two stations below the currently playing station.

Example 2: If the request is for a List Size of 4 and a Starting Index of 0x00 then the response would come back with one station above and two stations below the currently playing station.

Example 3: If the request is for a List Size of 6 and a Starting Index of 0x00 then the response would come back with two stations above and three stations below the currently playing station.

2.5 HDR-SR-REQ-024060/B-The meaning of HD Multicast when used in the AM/FM/HD signals (TcSE ROIN-185467-1)

In the signals and messages for AM/FM/HD the use of the term Multicast is defined in the following way:

HD Multicast 1 = HD1 = MPS
HD Multicast 2 = HD2 = SPS
HD Multicast 3 = HD3 = SPS
HD Multicast 4 = HD4 = SPS
HD Multicast 5 = HD5 = SPS
HD Multicast 6 = HD6 = SPS
HD Multicast 7 = HD7 = SPS

Example:
If you are on 94.7 -1 (HD1) and it has 3 HD channels then:

NumofHDMulticastChans.St = 0x3 3 Multicast Available
CurrentHDMulticast.St = 0x1

2.6 HDR-TMR-REQ-024063/A-T_HD Decode (TcSE ROIN-195283-1)

Name	Description	Units	Range	Resolution	Default
T_HD Decode	Time until the digital audio stream is blended from an HD decoded station.	msec	500-1000	100	800

2.7 HDR-HMI-REQ-024064/A-When to use AvailableHDChannel.St vs NumofHDMulticastChans.St (TcSE ROIN-200119-1)

If the method AvailableHDChannel.St is being reported as invalid or is not received then the Client shall use the method NumofHDMulticastChans.St for HMI purposes. If both methods are valid then either one can be used based on how the HMI wants to show the HD information to the user.

2.8 AMFM-SR-REQ-024065/A-CurrentStationName usage (TcSE ROIN-159173-1)

For AMFM Tuner CurrentStationName.St and CurrentPSName.St shall always be sent together by the AHU to handle legacy compatibility. If the AHU is sending Unicode then CurrentStationName.St signal shall contain valid data and CurrentPSName.St signal shall be filled with EOS characters. If non Unicode text is being sent then both CurrentStationName.St and CurrentPSName.St signals shall be filled with data.

When CurrentPSName.St is contained in a sequence diagram it represents the sending of both the CurrentStationName.St and CurrentPSName.St.

2.9 AM/FM Tuning Ranges

For more information on the AM/FM tuning ranges and tunable parameters required, please see AMFM-HW/SWR-REQ-407353/A-AM FM Tuning Ranges and AMFM-HW/SWR-REQ-407354/A-Tuner Variants per Countries of the world within the Global Phoenix Audio Controller HW Spec_rev 1.2_2021-07-30 or latest revision available. Requirements in this section are only those in addition.

2.10 HD Acquiring and Display Data Sequence Diagrams

2.10.1 HDR-SD-REQ-024066/A-HD Acquiring Process (TcSE ROIN-119537-1)

Scenario

Normal Usage

The user has selected a station and the system is searching for HD broadcast information for that station.

Constraints

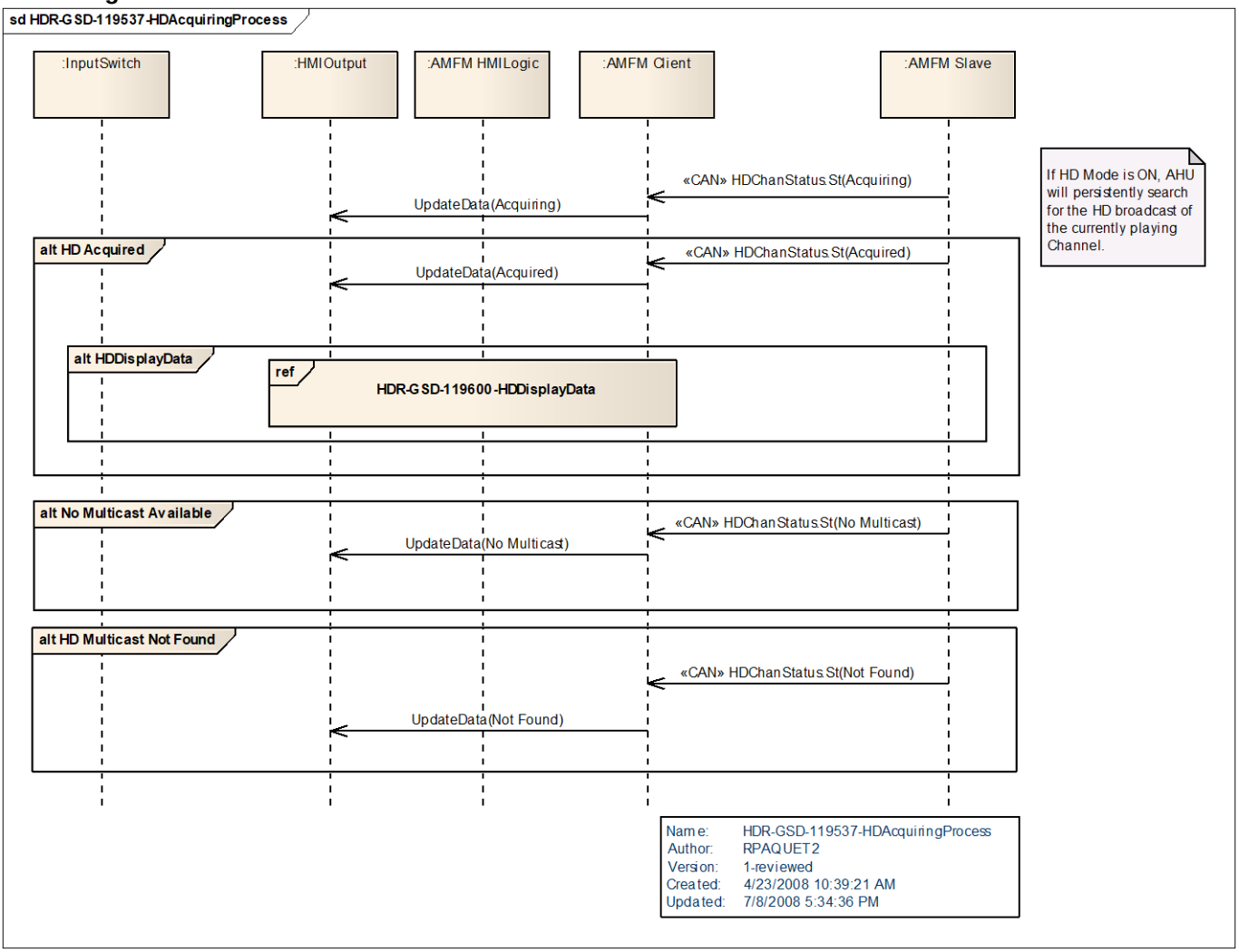
Pre-condition

HD radio is turned On.

Post-condition

If HD broadcast is available and found for the tuned station then the station will broadcast in Digital. See Sequence Diagram HDR-GSD-119600-HD Display Data.

Sequence Diagram



2.10.2 HDR-SD-REQ-024067/A-HD Display Data (TcSE ROIN-119600-3)

Scenario

Normal Usage

HD Acquiring Process found an HD broadcast for the tuned station.

Constraints

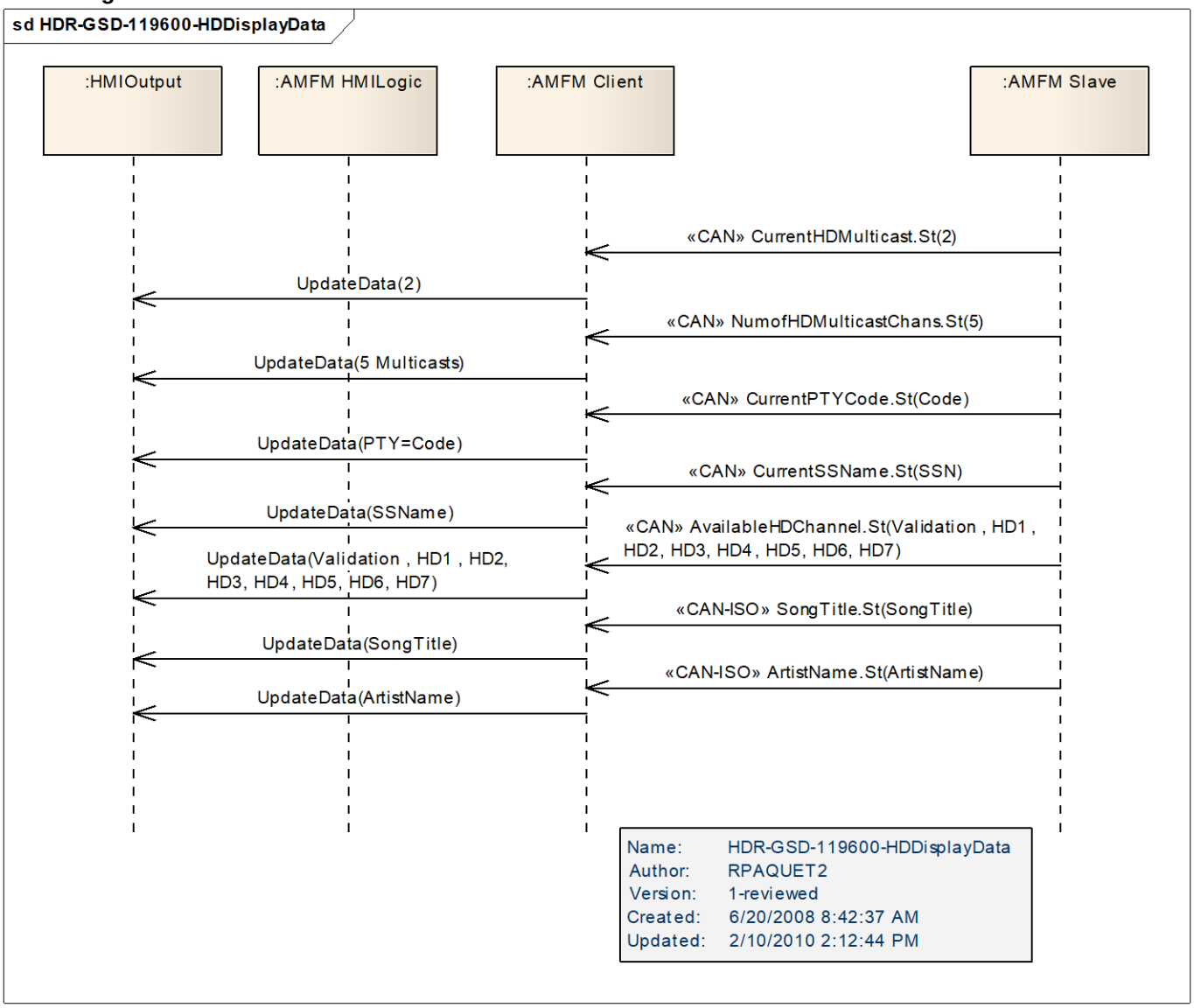
Pre-condition

Radio is searching for HD broadcast on tuned station.

Post-condition

HD Broadcast data is displayed to the user.

Sequence Diagram



2.11 AMFM-FUR-REQ-435090/A-Tuner Configurations for AMFM Functions

AM, Manual Tuning and Direct Tuning are to be made available when the configuration for each has been set to on. Any use cases or requirements calling out AM, Manual Tune or Direct Tune functionality will not be utilized when the items are configured off.

2.12 TU-FUR-REQ-435167/A-Display radio information

If required by HMI (e.g. dashcard view etc.) the radio information (e.g. Station Name, Radio Text, Dynamic Label Plus, etc.) shall be shown independent of radio source status.

2.13 TU-FUR-REQ-421468/A-Transmit radio information independently of radio source status

Radio information (e.g. Radio Text, Dynamic Label Plus, etc.) shall be available and be transmitted regardless of the current radio source status.

If any radio source is currently active only the radio information of this active radio source shall be transmitted.

3 Functional Definition

3.1 AMFMv2-FUN-REQ-420953/A-Select AM/FM Tuner as Source

3.1.1 Use Cases

3.1.1.1 AMFM-UC-REQ-023799/A-Listening to AM radio (TcSE ROIN-291592)

Actors	System
Pre-conditions	Audio is on. AM is currently the active mode.
Scenario Description	User is listening to AM mode.
Post-conditions	User hears analog AM broadcast. HMI displays {AM frequency}
List of Exception Use Cases	E1-Valid AM HD stream is detected
Interfaces	G-HMI, CAN, Audio out, AM/FM

3.1.1.2 AMFM-UC-REQ-023800/A-Valid AM HD stream is detected (TcSE ROIN-291593)

Actors	System
Pre-conditions	Same as Normal Usage Use Case
Scenario Description	User is listening to AM mode and valid HD stream is detected.
Post-conditions	Radio audio blends from analog to digital. Go to HDR-GUC-291609-Listening to AM radio with HD active
List of Exception Use Cases	N/A
Interfaces	G-HMI, CAN, Audio out, AM/FM

3.1.1.3 AMFM-UC-REQ-023801/A-Listening to FM radio w/o RDS/RBDS (TcSE ROIN-291594)

Actors	System
Pre-conditions	Audio is on. FM is currently the active mode. RDS/RBDS is not available or enabled.
Scenario Description	User is listening to FM mode.
Post-conditions	User hears analog FM broadcast. HMI displays {FM frequency}
List of Exception Use Cases	E1-Valid FM HD stream is detected E2-RDS/RDBS data is detected-RDS/RBDS is enabled
Interfaces	G-HMI, CAN, Audio out, AM/FM

3.1.1.4 AMFM-UC-REQ-023802/A-Valid FM HD stream is detected (TcSE ROIN-291595)

Actors	System
Pre-conditions	Same as Normal Usage Use Case

Scenario Description	User is listening to FM mode and valid HD stream is detected.
Post-conditions	Radio audio blends from analog to digital. Go to HDR-GUC-291611-Listening to FM radio with HD active
List of Exception Use Cases	NA
Interfaces	G-HMI, CAN, Audio out, AM/FM

3.1.1.5 AMFM-UC-REQ-023803/B-RDS/RDBS data is detected-RDS/RBDS is enabled (TcSE ROIN-291596)

Actors	System
Pre-conditions	Same as Normal Usage Use Case
Scenario Description	User is listening to FM mode and RDS/RDBS data is detected-RDS/RBDS is enabled.
Post-conditions	Go to AMFM-GUC-023804-Listening to FM radio with RBDS data or AMFM-GUC-023805-Listening to FM radio with RDS data
List of Exception Use Cases	NA
Interfaces	G-HMI, CAN, Audio out, AM/FM

3.1.1.6 AMFM-UC-REQ-023804/A-Listening to FM radio with RBDS data (TcSE ROIN-291597)

Actors	System
Pre-conditions	Audio is on. FM is currently the active mode. RBDS is enabled. System is not configured for RDS mode. RBDS data is available.
Scenario Description	User is listening to FM mode with an active RBDS stream.
Post-conditions	User hears analog FM broadcast. HMI displays {FM frequency, PS and RT data fields}.
List of Exception Use Cases	E1-Valid FM HD stream is detected
Interfaces	G-HMI, CAN, Audio out, AM/FM

3.1.1.7 AMFM-UC-REQ-023805/A-Listening to FM radio with RDS data (TcSE ROIN-291598)

Actors	System
Pre-conditions	Audio is ON FM is currently the active mode. System is configured in RDS mode. RDS data is available.
Scenario Description	User is listening to FM mode with an active RDS stream.

Post-conditions	User hears analog FM broadcast. HMI displays {FM frequency, PS and RT data fields}.
List of Exception Use Cases	E1-Valid FM HD stream is detected
Interfaces	G-HMI, CAN, Audio out, AM/FM

3.1.1.8 AMFM-UC-REQ-023806/A-Set Audio Source to AM (TcSE ROIN-291599)

Actors	User
Pre-conditions	Infotainment System is ON
Scenario Description	User selects <AM> via HMI. AMFM Server transitions to AM as active audio source and tunes to the previously tuned bank and frequency.
Post-conditions	User is listening to AM radio. HMI indicates {AM} source and other displays appropriate for currently selected audio source.
List of Exception Use Cases	E1-Battery connect Power ON E2-AM already the active source
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.1.1.9 AMFMv2-UC-REQ-420954/A-Battery connect Power ON

Actors	User
Pre-conditions	Same as Normal Usage Use Case
Scenario Description	Battery connected and system is powered on.
Post-conditions	AMFM Server powers on and transitions to default source as active audio source. Tuner set according to AMFM Server Default Requirements. HMI indicates default source and other displays appropriate for currently selected audio source.
List of Exception Use Cases	NA
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.1.1.10 AMFM-UC-REQ-023808/A-AM already the active source (TcSE ROIN-291601)

Actors	User
Pre-conditions	Same as Normal Usage Use Case
Scenario Description	User selects <AM> via HMI and AM is already the active source.
Post-conditions	AMFM Server maintains AM as active audio source.
List of Exception Use Cases	NA
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.1.1.11 AMFM-UC-REQ-023809/A-Set Audio Source to FM - with RDS (TcSE ROIN-291602)

Actors	User
Pre-conditions	Infotainment System is ON. RDS station actively tuned. System is configured in RDS mode.
Scenario Description	User selects <FM> via HMI. AMFM Server transitions to FM tuning to the previously tuned preset bank, channel and frequency. The AMFM Server compares RDS data (PI, AF) from memory against the data from current broadcast.
Post-conditions	User is listening to FM radio. HMI indicates {FM} source and other displays appropriate for currently selected audio source.
List of Exception Use Cases	E1-Frequency broadcast data mismatch, data is present E2-Frequency broadcast data mismatch, data not present E3-1st source change to FM (RDS) after battery disconnect/connect E4-FM already the active source
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.1.1.12 AMFM-UC-REQ-023810/A-Frequency broadcast data mismatch, data is present (TcSE ROIN-291603)

Actors	User
Pre-conditions	Same as Normal Usage Use Case
Scenario Description	User selects <FM> via HMI. Tuning to previous frequency provides broadcast data that does not match the broadcast data of previous channel but another station with matching broadcast data is present.
Post-conditions	The AMFM Server changes frequency to the strongest FM station with matching broadcast data. AMFM Server is playing selected FM station. HMI indicates {FM} source and other displays appropriate for currently selected audio source.
List of Exception Use Cases	NA
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.1.1.13 AMFM-UC-REQ-023811/A-Frequency broadcast data mismatch, data not present (TcSE ROIN-291604)

Actors	User
Pre-conditions	Same as Normal Usage Use Case
Scenario Description	User selects <FM> via HMI. Tuning to previous frequency provides broadcast data that does not match the broadcast data of previous channel and another station with matching broadcast data is not present.

Post-conditions	The AMFM Server changes frequency to the last active frequency. AMFM Server is playing selected FM station. HMI indicates {FM} source and other displays appropriate for currently selected audio source.
List of Exception Use Cases	NA
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.1.1.14 AMFM-UC-REQ-023812/A-1st source change to FM (RDS) after battery disconnect/connect (TcSE ROIN-291605)

Actors	User
Pre-conditions	Same as Normal Usage Use Case
Scenario Description	User selects <FM> via HMI and it is the 1st source change to FM after battery disconnect/connect.
Post-conditions	AMFM Server transitions to FM as active audio source. Tuner set according to AMFM Server Defaults Requirements. See also, AMFM-GUC-291632-Select FM Preset (RDS) HMI indicates {FM} source and other displays appropriate for currently selected audio source.
List of Exception Use Cases	NA
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.1.1.15 AMFM-UC-REQ-023813/A-FM already the active source (TcSE ROIN-291606)

Actors	User
Pre-conditions	Same as Normal Usage Use Case
Scenario Description	User selects <FM> via HMI and FM is already the active source.
Post-conditions	AMFM Server maintains FM as active audio source. HMI maintains displays for FM.
List of Exception Use Cases	NA
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.1.1.16 AMFM-UC-REQ-023814/A-Set Audio Source to FM - without RDS (TcSE ROIN-291607)

Actors	User
Pre-conditions	Infotainment System is ON
Scenario Description	User selects <FM> via HMI. AMFM Server transitions to FM tuning to the previously tuned preset bank, channel and frequency.
Post-conditions	User is listening to FM radio.

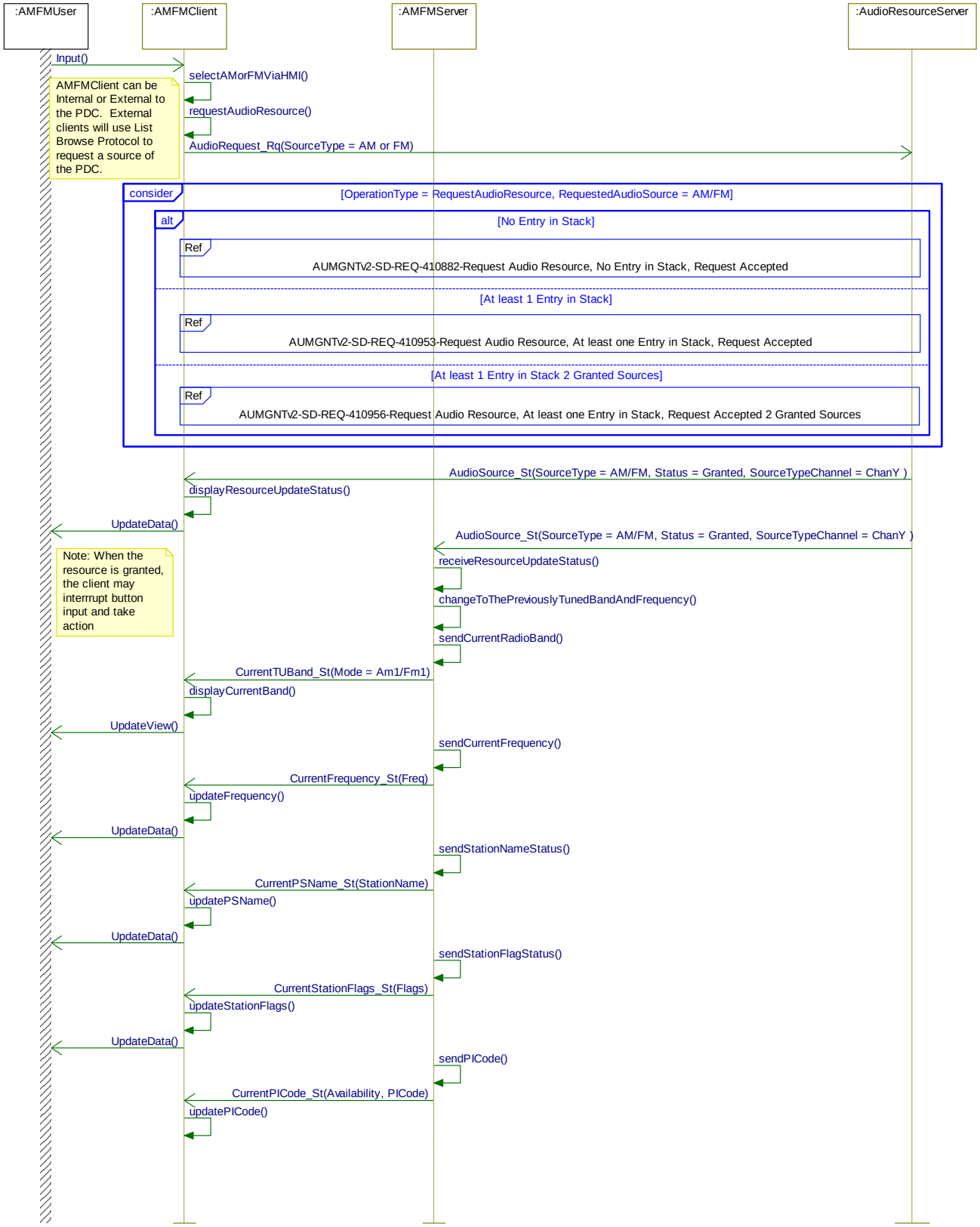
	HMI indicates {FM} source and other displays appropriate for currently selected audio source.
List of Exception Use Cases	E1-1st source change to FM (Non RDS) after battery disconnect/connect E2-FM already the active source
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.1.1.17 AMFM-UC-REQ-023815/A-1st source change to FM (Non RDS) after battery disconnect/connect (TcSE ROIN-291608)

Actors	User
Pre-conditions	Same as Normal Usage Use Case
Scenario Description	User selects <FM> via HMI and it is the 1st source change to FM after battery disconnect/connect.
Post-conditions	AMFM Server transitions to FM as active audio source. Tuner set according to AMFM Server Defaults Requirements. See also, AMFM-GUC-291635-Select FM Preset (non-RDS) HMI indicates {FM} source and other displays appropriate for currently selected audio source.
List of Exception Use Cases	NA
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.1.2 Sequence Diagrams

3.1.2.1 AMFMv2-SD-REQ-420955/A-Activate AM/FM Radio



3.2 HDR-FUN-REQ-023817/A-Listening to AM/FM Radio with HD Active (TcSE ROIN-293136)

3.2.1 Use Cases

3.2.1.1 HDR-UC-REQ-023818/A-Listening to AM radio with HD active (TcSE ROIN-291609)

Actors	System
Pre-conditions	Audio is ON. HD function is enabled in AM. Valid HD data stream is available.
Scenario Description	User selects AM mode or selects a new frequency in AM with a valid HD data stream.
Post-conditions	User hears decoded digital AM broadcast. HMI displays {AM frequency} and {HD text} (when HD text is available).
List of Exception Use Cases	E1-AM HD data stream lost or degraded
Interfaces	G-HMI, CAN, Audio out, AM/FM

3.2.1.2 HDR-UC-REQ-023819/A-AM HD data stream lost or degraded (TcSE ROIN-291610)

Actors	System
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	User selects AM mode or selects a new frequency in AM with a valid HD data stream and HD data stream lost or degraded.
Post-conditions	Radio audio blends from digital to analog. Go to AMFM-GUC-291592-Listening to AM radio.
List of Exception Use Cases	NA
Interfaces	G-HMI, CAN, Audio out, AM/FM

3.2.1.3 HDR-UC-REQ-023820/A-Listening to FM radio with HD active (TcSE ROIN-291611)

Actors	System
Pre-conditions	Audio is ON. HD function is enabled in FM. Valid HD data stream is available.
Scenario Description	User selects FM mode or selects a new frequency in FM with a valid HD data stream.
Post-conditions	User hears decoded digital FM broadcast. HMI displays {FM frequency} and {HD text} (when HD text is available).
List of Exception Use Cases	E1-FM HD data stream lost or degraded
Interfaces	G-HMI, CAN, Audio out, AM/FM

3.2.1.4 HDR-UC-REQ-023821/A-FM HD data stream lost or degraded (TcSE ROIN-291612)

Actors	System
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	User selects FM mode or selects a new frequency in FM with a valid HD data stream and HD data stream lost or degraded.
Post-conditions	Radio audio blends from digital to analog. Go to AMFM-GUC-291594-Listening to FM radio w/o RDS/RBDS or AMFM-GUC-291597-Listening to FM radio with RBDS data or AMFM-GUC-291598-Listening to FM radio with RDS data.
List of Exception Use Cases	NA
Interfaces	G-HMI, CAN, Audio out, AM/FM

3.2.2 Requirements

3.2.2.1 HDR-SR-REQ-023822/A-Listening to AM/FM Radio with HD active (TcSE ROIN-121061-1)

This function is to use the AMFM-GSD-111297-Activate AM/FM Radio Sequence Diagram found in the AM/FM Tuner Feature as the base operation for this function.

3.2.2.2 HDR-FUR-REQ-023823/D-HD Detect Decode (TcSE ROIN-27888-9)

HD Radio functionality must meet the following externally controlled IBiquity Specifications;

Document Title	Document Name
HD Radio™ Commercial Receiver Product Requirements Guideline	RX_SSS_5032
HD Radio™ Supplemental Program Services	RX_TN_5082
HD Radio™ Commercial Receiver Interface and System Functional Description	RX_SSFD_5029

(refer to the latest released versions as maintained by iBiquity)

HD Radio digital blending for tuning to a new station
When a station is tuned and an HD stream is available. The tuner initially plays the analog broadcast. Simultaneously, the HD tuner demodulates HD1. HMI shall provide an indication of HD acquiring until the data stream is decoded.
The shaping and blending characteristics to be determined jointly between the supplier and the Ford D&R engineer to be audibly non-obtrusive to the user.

Weak digital signal while Listening to HD-1

If a tuned HD Radio signal strength drops below its acceptable threshold while playing, the
HD tuner shall blend to the analog signal and attempt to reacquire the HD signal. HMI shall provide the normal indication of attempting to acquire and HD stream.

The fading and blending characteristics to be determined jointly between the supplier and the Ford D&R engineer.

Weak digital signal while listening to Streams other than HD-1

If a tuned HD Radio stream other than HD-1 drops below its acceptable signal strength threshold, the tuner shall mute and attempt to reacquire the HD signal.

Manual Frequency Tune

HD tune works the same as ***analog*** tune except it shall attempt to decode an HD ***datastream*** every time a new frequency is selected. If the user does not wait for the HD data to decode and become available and selects to tune again, it cancels the HD decode attempt and tunes to the next ***analog*** frequency.

The user shall select previous or next channel manually. Available methods are:

- Step by step (individual button press message received): previous / next channel.
- Continuous action (press and hold message received): previous / next channel.

When the user was already on an HD station, it shall step up or down through the available digital multicasts in the direction the user tuned if they are available.

When the user was already on an HD station with the multicast of HD-1 or the last HD multicast selected on the current frequency and the user manually tunes up or down in the direction that would take the tuner past the available digital multicasts, the tuner shall tune to the next frequency.

Multicast Availability

Upon tuning to an HD enabled frequency, the HD tuner shall provide the number of HD channels available on the current frequency to the HMI.

Data Truncations

The following data are the only data items to be truncated. All other data will not be truncated.

Data Name	Attribute	Truncated after x characters
SIS – SSN	Short Station Name	4
PSD – Artist	Artist	64
PSD – Title	Title	64
SIS – Program Type	Station Program Type	22
PSD – Genre	Song Genre	22

When the AHU is currently decoding HD Radio data, the AHU shall not send out any RBDS data.
Following the rule priority of HD data hysteresis in FAS-AHU-HDR-GREQ-206211-3-MPS Data Field Hysteresis, if HD Radio decoding is no longer available, the AHU shall clear the HD data fields (PAD title / PAD artist / SSN) then switch back to send out RBDS data (if available and if RBDS is turned on). If the AHU is tuned to an HD multicast stream (HD2+) and the HD Radio decoding is no longer available, the AHU shall clear the HD data fields (PAD title / PAD artist / SSN) and shall not send any more RBDS or HD radio data for that multicast stream until either the HD radio re-acquires the HD radio multicast stream or the user selects a new station that has data available. PTY is one exception to the rule. When HD is active, the AHU shall send out the RBDS PTY codes and not HD PTY codes for MPS stations and the AHU shall send out the HD PTY codes for SPS stations. If HD is not active, all PTY codes are send out as the RBDS PTY codes.

Determining status of the "HDChanStatus" signal

Follow these scenarios to determine when to assert one of the appropriate signal messages that the system will use to display the HD status to the customer.

1. If HD is On and the AHU determines that the selected station has no HD available, then set signal to "No Multicast".

2. If HD is On and the AHU determines that the selected station has HD content then set signal to Acquiring while the AHU is gathering the HD data from that point until the AHU has completed acquiring either HD1 (MPS) or HD2+ (SPS) data on that station.

3. Once the AHU is done gathering the HD Data, set the signal to "Acquired".

4. If HD is Off, set signal to "No Multicast". Additionally, in this state, no other information shall be sent by the AHU over CAN to state what multicast channels are available or which one is actively being tuned to.

5. AHU is not configured for HD (No HD Integrated) set signal to "Invalid".

6. When the user tries to direct tune to a multicast of 2+ or selects a preset that has a multicast of 2+ stored in it and the AHU does not find the user desired multicast although the station has HD but not that multicast number, the signal should be set as "Not Found"

7. When the user tries to direct tune to a multicast of 2+ or selects a preset that has a multicast of 2+ stored in it and the AHU does not find the multicast and the station has no HD, the signal should be set as "Not Found"

3.2.2.3 HDR-SR-REQ-023824/A-HD Information Handling (TcSE ROIN-222548-1)

The AM/FM/HD Client shall display HD data until the Server clears the data regardless of the HDChanStatus_St signal. The data that will be cleared by the Server is CurrentSSName_St, SongTitle_St, and ArtistName_St and this is handled by sending either nulls for a signal or by sending only an end of string character for the data sent in a TP method.

3.3 AMFMv2-FUN-REQ-321473/A-Tuning AM/FM Radio

3.3.1 Use Cases

3.3.1.1 AMFM-UC-REQ-321474/B-Frequency Tune by single step / press

Linked Elements
AMFM-FUR-REQ-321476/A-Manual Tune

Actors	User
Pre-conditions	Audio is ON. AM or FM is selected as the source.
Scenario Description	The user selects <Tune Up> or <Tune Down> via HMI. AMFM Server tunes one step in the direction specified by the user.
Post-conditions	The AMFM Server plays selected frequency.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.3.1.2 AMFM-UC-REQ-321475/A-Frequency Tune by Button press and hold

Actors	User
Pre-conditions	Audio is ON. AM or FM is the source.
Scenario Description	The user activates <manual tune up> or < manual tune down> continuously for T_button_hold via HMI. AMFM Server continuously manual tunes in the direction specified by the user. AMFM Server stops tuning on the currently tuned frequency after the user releases the < manual tune up> or < manual tune down> via HMI.
Post-conditions	The AMFM Server plays selected frequency.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.3.2 Requirements

3.3.2.1 AMFM-FUR-REQ-023828/B-Manual Tune (TcSE ROIN-27906-2)

The AHU shall soft mute upon activation of the tune function and soft un-mute after the tune function has been completed.

AM and FM manual tune up/down:

- Tune-Up / Tune-Down – The tuner shall use the standard specified tuning steps for the applicable consumer market for each Tune-Up or Tune-Down button press.

- Tune-Up/Down Press and Hold – When the user presses and holds the tune button for more than **T_button hold** seconds, the tuner shall continuously tune up/down in the direction specified until a message is received that the button has been released. The tuner shall stop on the last tuned station before the message was received. The AHU shall report the current frequency to the HMI during the tuning process.

When tuning up, if the highest frequency in the band is reached, the tuner shall wrap around and continue at the lowest frequency in the band.

When tuning down, if the lowest frequency in the band is reached, the tuner shall wrap around and continue at the highest frequency in the band.

During the manual tuning action the audio shall be muted. Unmuting shall be smooth after tuning is complete.

FM manual tune up/down with RDS present

In addition to the requirements above, the following requirements apply when RDS is present and active.

All RDS filters, which are user selected by the HMI (e.g. TA) shall be ignored, however, RDS indications via HMI are still allowed.

After a manual tune function, the AHU must not jump to another AF until after $\mathbf{T\_AF\_JUMP}$ seconds. During that time, another manual tune may be performed from the actual frequency. If an AF is found after $\mathbf{T\_AF\_JUMP}$ seconds, the next manual tune shall be initiated from the original tuned frequency.

Autocompare function shall be considered.

3.3.3 Sequence Diagrams

3.3.3.1 AMFM-SD-REQ-321477/A-Manual Frequency Tune

Scenario

Scenario

The user selects and releases <Tune Up> or <Tune Down> via HMI.
AHU tunes one step in the direction specified by the user.

Or User selects <Tune Up> or <Tune Down> continuously for T_button hold.
AHU continuously tunes in the direction specified by the user.
AHU stops tuning after <Tune Up> or <Tune Down> command is released via HMI.

Constraints

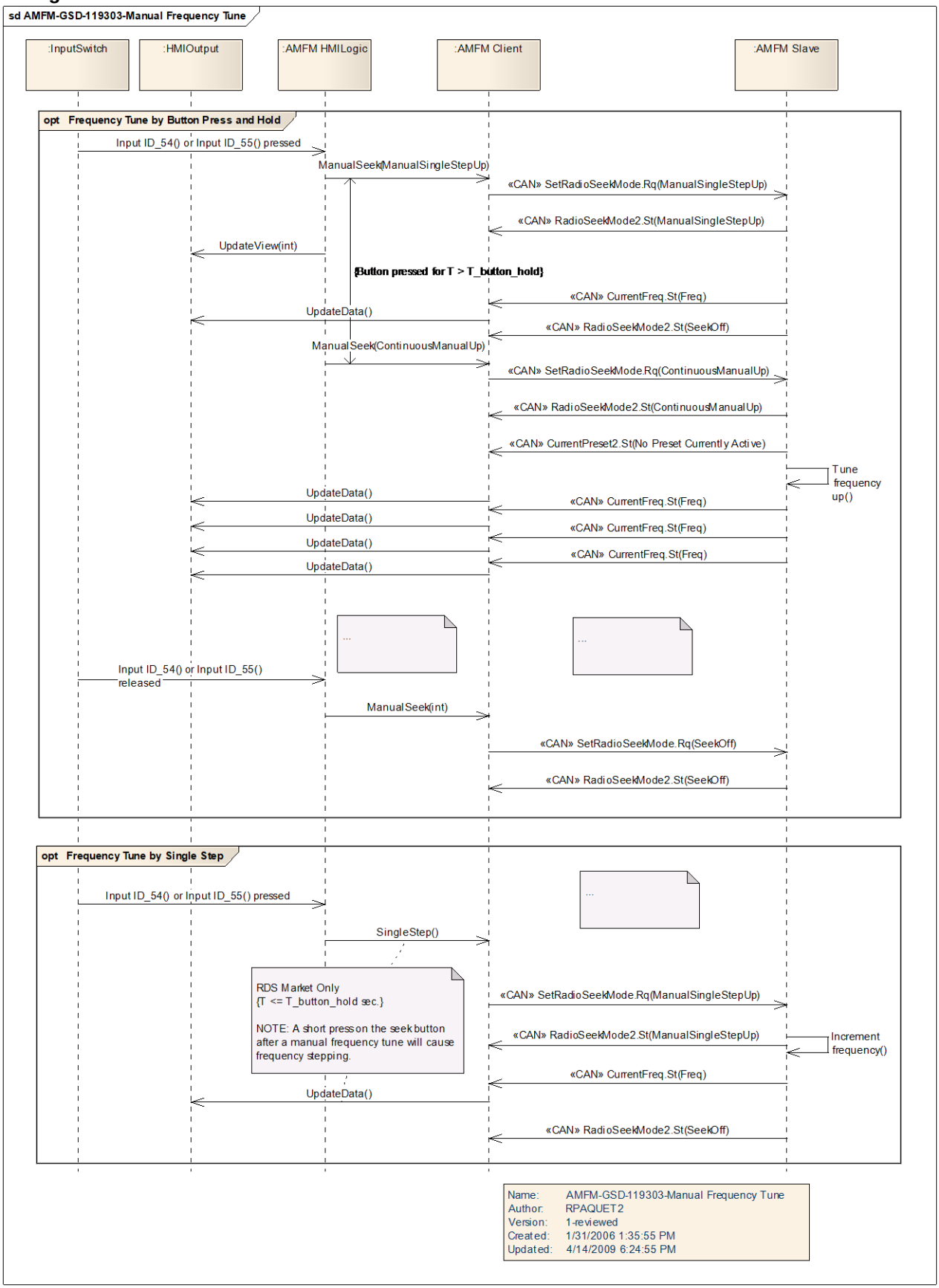
Pre-condition

User is listening to AM/FM Radio.

Post-condition

Selected frequency is now playing.

Sequence Diagram



3.4 HDR-FUN-REQ-023830/A-Manual Tuning when on an HD Multicast channel (TcSE ROIN-293143)

3.4.1 Use Cases

3.4.1.1 HDR-UC-REQ-023831/A-Manual Tuning when on an HD Multicast channel (TcSE ROIN-291615)

Actors	User
Pre-conditions	Audio is ON. FM is selected as the source. HD function is enabled in FM. Currently tuned station has digital HD multi-cast streams.
Scenario Description	The user selects <Tune Up> or <Tune Down> via HMI. AMFM Server tunes one step in the direction specified by the user within the currently active set of multicast streams.
Post-conditions	The AMFM Server plays selected station.
List of Exception Use Cases	E1-Last multicast HD Stream is already tuned
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.4.1.2 HDR-UC-REQ-023832/A-Last multicast HD Stream is already tuned (TcSE ROIN-291616)

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user selects <Tune Up> or <Tune Down> via HMI. AMFM Server tunes one step in the direction specified by the user within the currently active set of multicast streams and last multicast HD Stream is already tuned.
Post-conditions	AMFM Server tunes one step in the direction specified by the user on the analog tuner.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.5 AMFMv2-FUN-REQ-420956/A-Direct Station Selection

3.5.1 Use Cases

3.5.1.1 AMFM-UC-REQ-023834/A-Direct Station Selection (TcSE ROIN-291617)

Actors	User
Pre-conditions	Audio is ON. AM or FM is selected as the source (unless requested via VR session).

Scenario Description	The user selects a valid (but not necessarily active) <frequency or station> via HMI (e.g., voice recognition or direct entry method on the bezel buttons)
Post-conditions	AMFM Server plays the directly tuned frequency or station audio.
List of Exception Use Cases	E1-User selects invalid frequency or station E2- AMFM Server determines that HD status is OFF when a direct tune to an HD2+ station request is made
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.5.1.2 AMFM-UC-REQ-023835/A-User selects invalid frequency or station (TcSE ROIN-291618)

Linked Elements
TU-UC-REQ-195874/A-Request Mixed Mode Preset List
TU-UC-REQ-195875/A-Selecting a Mixed Mode preset that is already the active source
TU-UC-REQ-195876/A-Selecting a Mixed Mode preset that results in source change
TU-UC-REQ-416563/A-Request Mixed Mode Preset List
TU-UC-REQ-416564/A-Selecting a Mixed Mode preset that is already the active source
TU-UC-REQ-416565/A-Selecting a Mixed Mode preset that results in source change
TU-UC-REQ-416566/A-Setting the max number of presets to display
TU-UC-REQ-195877/A-Selecting the max number of presets to display

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user selects a valid (but not necessarily active) <frequency or station> via HMI (e.g., voice recognition or direct entry method on the bezel buttons) and User selects invalid frequency or station.
Post-conditions	The HMI indicates {invalid channel} and remains on the current frequency or station. If an invalid HD multicast stream is requested on a valid frequency, after the AMFM Server determines that the station request is invalid, the AMFM Server shall tune back to the previous station that the direct tune was initiated from before the direct tune was requested.
List of Exception Use Cases	NA
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.5.1.3 AMFM-UC-REQ-023836/A-AMFM Server determines that HD status is OFF when a direct tune to an HD2+ station request is made (TcSE ROIN-291619)

Linked Elements
TU-UC-REQ-195874/A-Request Mixed Mode Preset List
TU-UC-REQ-195875/A-Selecting a Mixed Mode preset that is already the active source
TU-UC-REQ-195876/A-Selecting a Mixed Mode preset that results in source change
TU-UC-REQ-195877/A-Selecting the max number of presets to display
TU-UC-REQ-416563/A-Request Mixed Mode Preset List
TU-UC-REQ-416564/A-Selecting a Mixed Mode preset that is already the active source
TU-UC-REQ-416565/A-Selecting a Mixed Mode preset that results in source change
TU-UC-REQ-416566/A-Setting the max number of presets to display

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user selects a valid (but not necessarily active) <frequency or station> via HMI (e.g., voice recognition or direct entry method on the bezel buttons) and AMFM Server determines that HD status is OFF when a direct tune to an HD2+ station request is made.
Post-conditions	AMFM Server shall set the HD status to ON and enable HD decoding.

	AMFM Server shall play the selected HD direct tune station request based on the entry condition of AMFM-GUC-291617-Direct station Selection.
List of Exception Use Cases	NA
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.5.2 Requirements

3.5.2.1 AMFM-FUR-REQ-023837/C-Direct Tune (TcSE ROIN-27912-1)

The Direct button allows the user direct access to any valid frequency in the current band.

Incomplete or invalid entries shall result in the no change in frequency.

Partial entries are ignored after the normal HMI timeout period.

Upon a complete and accepted entry, the AHU shall recognize legal frequencies and tune to the requested station based on its current market configuration. The AHU shall soft mute prior to changing to the new station and soft un-mute after the function has been completed.

Decimal points in the FM band are implicit.

HD radio multicast stations are directly accessible with the # used to indicate the multicast stream desired.

Direct Tuning Examples

AM Access:
950 AM: 9 5 0 Enter
1050 AM: 1050 Enter

FM Access:
101.1 FM: 1 0 1 1 Enter

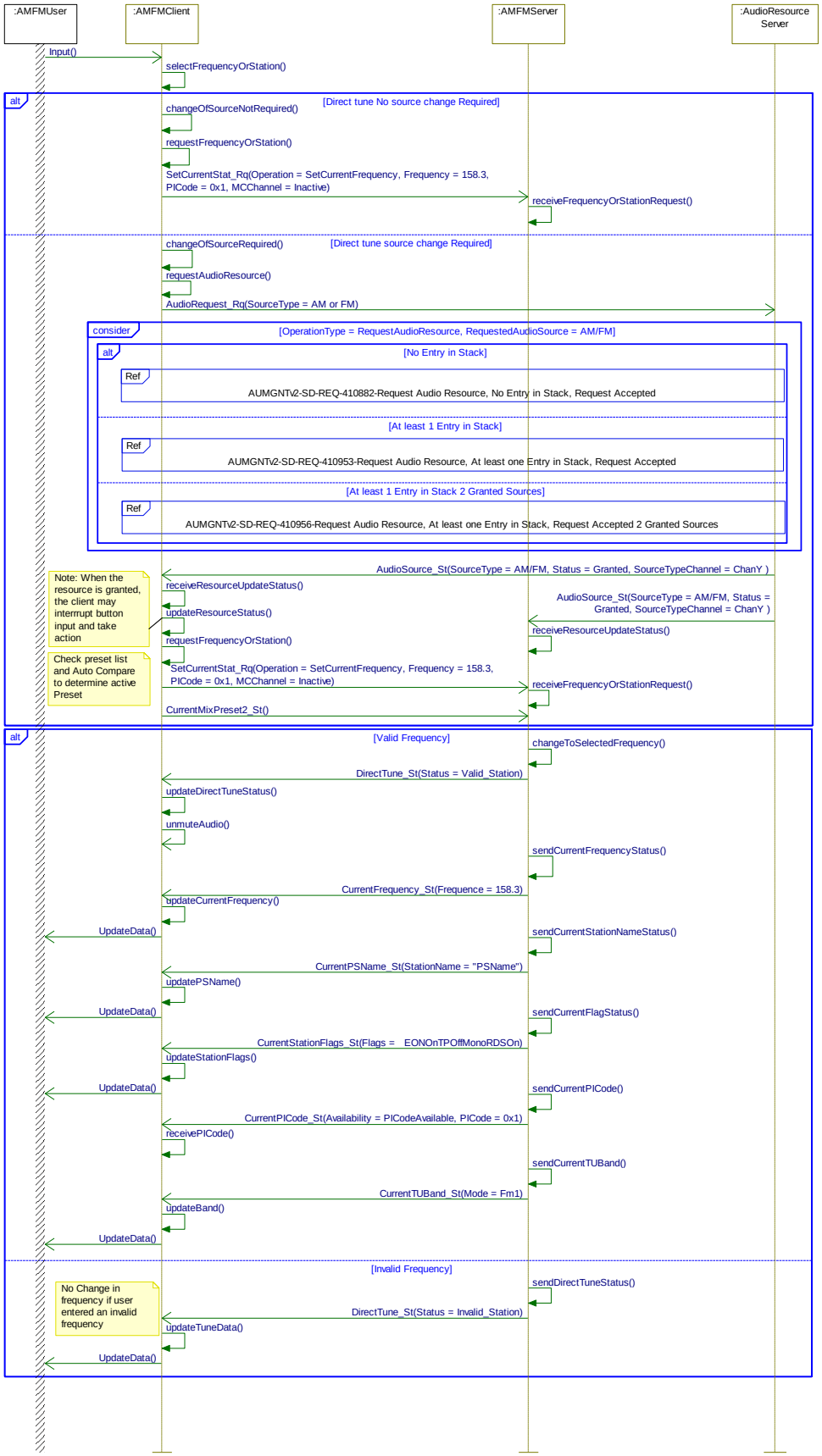
FM Access in countries that support 50 khz spacing:
102.35 FM: 1 0 2 3 5 Enter

FM HD Access:
101.1FM HD-2: 1 0 1 1 2 Enter

Direct tune will only be used in case the radio is configured for non-RDS markets.

3.5.3 Sequence Diagrams

3.5.3.1 AMFMv2-SD-REQ-420957/A-Direct Station Selection


:AMFMUser
:AMFMClient
:AMFMServer
:AudioResource Server
Input()
selectFrequencyOrStation()
alt
[Direct tune No source change Required]
changeOfSourceNotRequired()
requestFrequencyOrStation()
SetCurrentStat_Rq(Operation = SetCurrentFrequency, Frequency = 158.3, PICode = 0x1, MCChannel = Inactive)
receiveFrequencyOrStationRequest()
changeOfSourceRequired()
[Direct tune source change Required]
requestAudioResource()
AudioRequest_Rq(SourceType = AM or FM)
consider
[OperationType = RequestAudioResource, RequestedAudioSource = AM/FM]
alt
[No Entry in Stack]
Ref
AUMGNTv2-SD-REQ-410882-Request Audio Resource, No Entry in Stack, Request Accepted
[At least 1 Entry in Stack]
Ref
AUMGNTv2-SD-REQ-410953-Request Audio Resource, At least one Entry in Stack, Request Accepted
[At least 1 Entry in Stack 2 Granted Sources]
Ref
AUMGNTv2-SD-REQ-410956-Request Audio Resource, At least one Entry in Stack, Request Accepted 2 Granted Sources
AudioSource_St(SourceType = AM/FM, Status = Granted, SourceTypeChannel = ChanY)
Note: When the resource is granted, the client may interrupt button input and take action
receiveResourceUpdateStatus()
AudioSource_St(SourceType = AM/FM, Status = Granted, SourceTypeChannel = ChanY)
updateResourceStatus()
receiveResourceUpdateStatus()
requestFrequencyOrStation()
Check preset list and Auto Compare to determine active Preset
SetCurrentStat_Rq(Operation = SetCurrentFrequency, Frequency = 158.3, PICode = 0x1, MCChannel = Inactive)
receiveFrequencyOrStationRequest()
CurrentMixPreset2_St()
alt
[Valid Frequency]
changeToSelectedFrequency()
DirectTune_St(Status = Valid_Station)
updateDirectTuneStatus()
unmuteAudio()
sendCurrentFrequencyStatus()
CurrentFrequency_St(Frequence = 158.3)
updateCurrentFrequency()
UpdateData()
sendCurrentStationNameStatus()
CurrentPSName_St(StationName = "PSName")
updatePSName()
UpdateData()
sendCurrentFlagStatus()
CurrentStationFlags_St(Flags = EONOnTPOffMonoRDSOn)
updateStationFlags()
UpdateData()
sendCurrentPICode()
CurrentPICode_St(Availability = PICodeAvailable, PICode = 0x1)
receivePICode()
sendCurrentTUBand()
CurrentTUBand_St(Mode = Fm1)
updateBand()
UpdateData()
[Invalid Frequency]
sendDirectTuneStatus()
No Change in frequency if user entered an invalid frequency
DirectTune_St(Status = Invalid_Station)
updateTuneData()
UpdateData()

3.6 AMFMv3-FUN-REQ-420958/A-Seek

3.6.1 Use Cases

3.6.1.1 AMFM-UC-REQ-321488/A-Frequency Search by single step / press

Linked Elements
AMFM-FUR-REQ-321490/A-Tuner Seek

Actors	User
Pre-conditions	Audio is ON. AM or FM is the source.
Scenario Description	The user activates <seek up> or <seek down> via HMI. AMFM Server seeks until the next valid station is found.
Post-conditions	The AMFM Server plays selected frequency.
List of Exception Use Cases	E1-Search is cancelled for Seek before finding a new valid seek stop
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.6.1.2 AMFM-UC-REQ-326108/B-Frequency Search by Button press and hold

Actors	User
Pre-conditions	Audio is ON. AM or FM is the source.
Scenario Description	The user activates <seek up> or < seek down> continuously for T_button_hold via HMI. AMFM Server continuously seeks in the direction specified by the user. stops seeking on the next valid seek stop found after the user releases the <seek up> or <seek down> via HMI.
Post-conditions	The AMFM Server plays selected frequency.
List of Exception Use Cases	E1-Search is cancelled for Seek before finding a new valid seek stop
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.6.1.3 AMFMv2-UC-REQ-420959/A-Search is cancelled for Seek before finding a new valid seek stop

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	Search is cancelled before finding a new valid seek stop.
Post-conditions	The AMFM Server plays the last active station.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.6.2 Requirements

3.6.2.1 AMFM-FUR-REQ-023845/C-Tuner Seek (TcSE ROIN-27908-8)

The HMI shall determine how the user of the audio system interfaces the physical AHU tuner in order to translate the seek up/down presses of the manual seek buttons or other input methods. The AHU will simply respond to the appropriate short or long press messages that match the criteria of a seek up/down press and react according to the below specification. The HMI shall handle the visual output feedback to the user.

The AHU shall soft mute upon activation of the seek function and soft un-mute after the seek function has been completed.

Switching modes, changing stations, tuning or selecting seek again will cancel the seek function. After cancel seek the tuner shall jump back to the last tuned frequency.
VOLUME and other functions (e.g. Menu, Text messages, etc.) defined by HMI shall not cancel seek.

Auto seek

AM / FM auto seek up/down:

- Short press message – The tuner shall seek up/down the frequency band using seek stop requirements according to the direction specified by the button press message.

- Long press message – After a message is received informing the AHU that the user pressed and held the seek button function for more than **T_button_hold** seconds, the tuner shall repeatedly continue to seek up/down in the direction specified by the received message until another message is received stating that the button function was released. The tuner stops on the next valid frequency based on the seek stop according to the direction specified by the button press message. The seek speed is 2 MHz/s (for FM) or 100 kHz/s (for AM) in the same step sizes as the standard specified tuning steps.

While tuning up, if the highest frequency in the band is reached, the tuner shall wrap around and continue at the lowest frequency in the band.

While tuning down, if the lowest frequency in the band is reached, the tuner shall wrap around and continue at the highest frequency in the band.

These items additionally apply when RDS is active and on the FM band;

The AF function is immediately active after every stop. The stop frequency shall be temporary stored and when the next seek press activation is made by the user, the tuner shall begin from this temporary stored frequency.

All RDS filters, which are user selected by the HMI (e.g. TA) shall be ignored, however, RDS indications via HMI are still allowed.

The reception quality (seek stop quality) shall considered.

Autocompare shall be considered.

Auto seek shall be used to update the Learn memory.

Auto seek shall be endless until user stops or a station is found.

3.6.3 Sequence Diagrams

3.6.3.1 AMFM-SD-REQ-023846/A-Automatic Frequency Search (TcSE ROIN-119310-1)

Scenario

Scenario
The user selects <seek up> or <seek down> via HMI.
System seeks until the next station is found.

Constraints

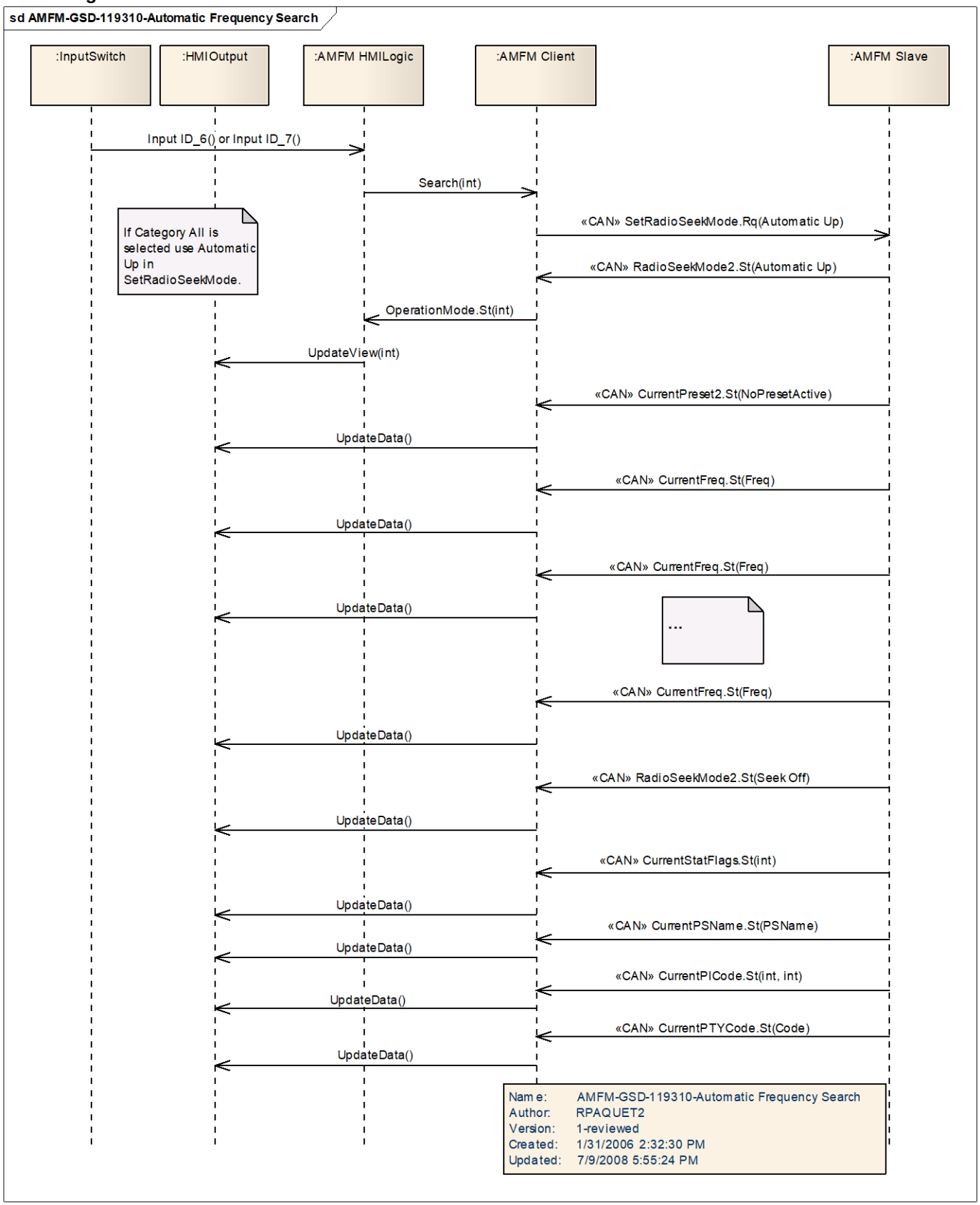
Pre-condition

AM or FM is the source.

Post-condition

The System plays the selected frequency.

Sequence Diagram



3.6.3.2 AMFM-SD-REQ-023848/A-Seek Press and Hold (TcSE ROIN-174134-1)

Scenario

Scenario

The user has pressed and held <Seek Up> or <Seek Down> for longer than the T_button_hold timer.

Constraints

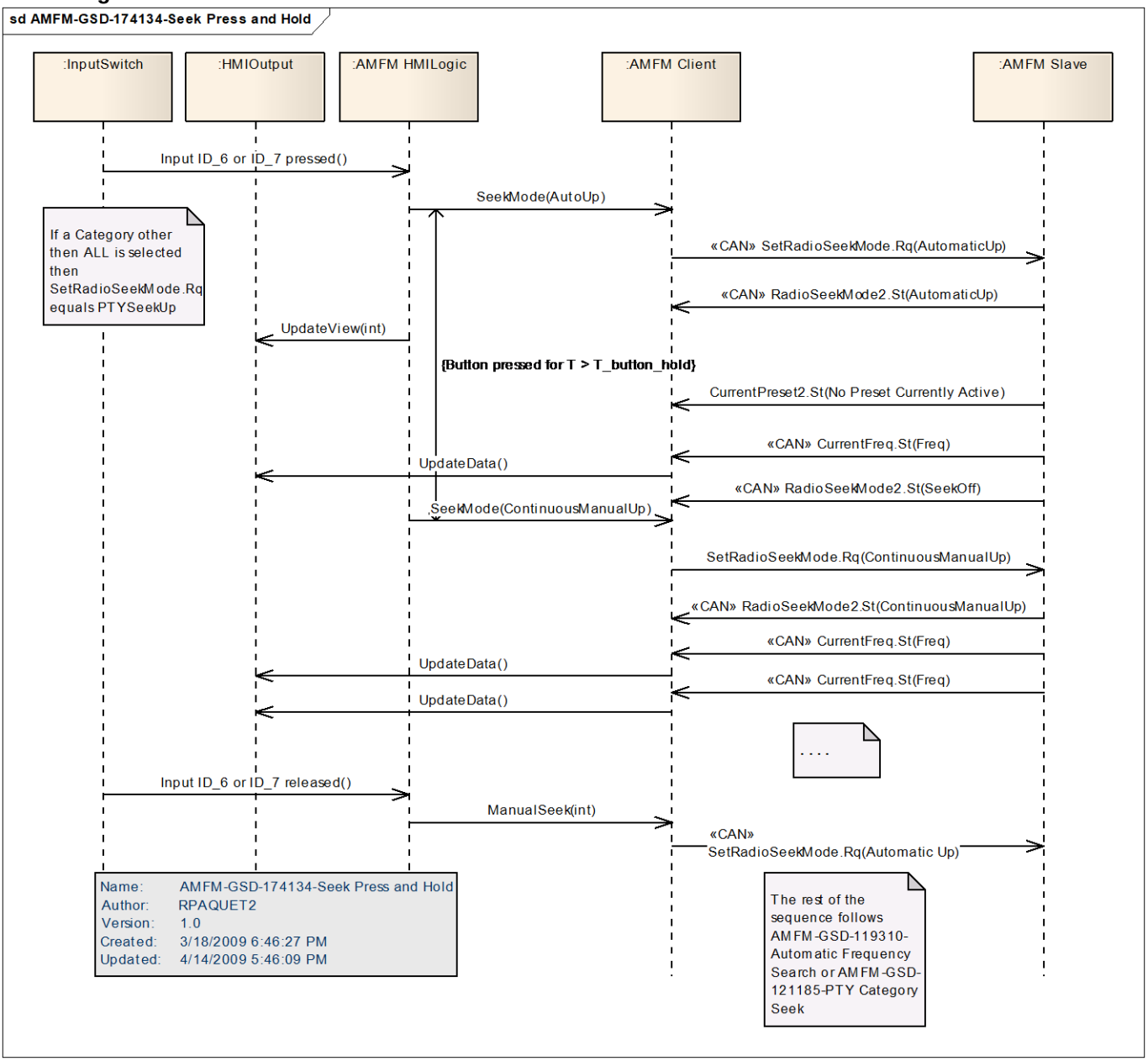
Pre-condition

User is listening to AM or FM Radio.

Post-condition

The radio continuously seeks until the user releases the button at which point the next valid station is playing.

Sequence Diagram



3.7 HDR-FUN-REQ-023850/A-Frequency search when on an HD Multicast channel (TcSE ROIN-293153)

3.7.1 Use Cases

3.7.1.1 HDR-UC-REQ-023851/A-Frequency Search when on an HD Multicast channel (TcSE ROIN-291625)

Actors	User
Pre-conditions	Audio is ON. FM is selected as the source. HD function is enabled in FM. HD stream available. Currently tuned station is a digital HD multi-cast stream.
Scenario Description	The user selects <seek up> or <seek down> via HMI. Seek function does not conduct a frequency seek and instead will go to previous or next digital HD multicast stream.
Post-conditions	The AMFM Server plays selected station.
List of Exception Use Cases	E1-The last/first multicast HD Stream is already tuned
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.7.1.2 HDR-UC-REQ-023852/A-The last/first multicast HD Stream is already tuned (TcSE ROIN-291626)

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user selects <seek up> or <seek down> via HMI when the last/first multicast HD Stream is already tuned.
Post-conditions	AMFM Server analog seeks in the direction specified by the user.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.7.2 Requirements

3.7.2.1 *HDR-SR-REQ-023853/B-Seek while on an HD multicast (TcSE ROIN-178509-4)*

No Category Selected

When the Seek function is enabled while on an HD multicast "AMFM-GFUN-119998-Seek" shall be followed.
If the Seek press and hold function is cancelled while CurrentHDMulticast.St signal is set to 0x1 – 0x7 (Still on an HD multicast) then the AMFM Client shall send SeekOff as shown in the "AMFM-GSD-119303-Manual Frequency Tune" diagram.

If the Seek press and hold function is cancelled while CurrentHDMulticast.St signal is set to 0x0 (Not on an HD multicast) then the AMFM Client shall send AutoUp/Down.

Category Selected

When the Seek function is enabled while on an HD multicast "AMFM-GFUN-120048-PTY Category Selection and Search" shall be followed.

3.8 AMFMv2-FUN-REQ-420960/A-Store AM/FM Preset

3.8.1 Use Cases

3.8.1.1 AMFM-UC-REQ-435098/A-Store AM/FM Preset (RDS)

Actors	User
Pre-conditions	Audio is ON. AM or FM is selected as the source. Infotainment System is configured in RDS mode.
Scenario Description	The user <stores> the active station in the user selected location via HMI. HMI provides {feedback}. The new preset replaces the previously set one.
Post-conditions	The current AM or FM station is stored to the dedicated preset and continues playing current station.
List of Exception Use Cases	E1-PSName is not available
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.8.1.2 AMFM-UC-REQ-435100/A-PSName is not available

Actors	User
Pre-conditions	Audio is ON. AM or FM is selected as the source. Infotainment System is configured in RDS mode.
Scenario Description	The user <stores> the active station in the user selected location via HMI. HMI provides {feedback}. The new preset replaces the previously set one.
Post-conditions	The current AM or FM station is stored to the dedicated preset and continues playing current station. PSName not available so Frequency is show. Once PSName becomes available the display show PSName and stored preset data is updated.
List of Exception Use Cases	
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.8.1.3 AMFM-UC-REQ-023858/A-Store AM/FM Preset (non RDS) (TcSE ROIN-291630)

Actors	User
Pre-conditions	Audio is ON. AM or FM is selected as the source.

	Infotainment System is not configured in RDS mode.
Scenario Description	The user <stores> the active station onto the current preset bank in the user selected location via HMI. HMI provides {feedback}. The new preset replaces the previously set one.
Post-conditions	The current AM or FM station is stored to the dedicated preset and continues playing current station.
List of Exception Use Cases	E1-HD Stream is active during preset storage E2-User attempts to store a direct tuned HD multicast station that does not exist (eg. During a direct tune request before the AMFM Server determines it is an invalid station)
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.8.1.4 AMFM-UC-REQ-023856/A-HD Stream is active during preset storage (TcSE ROIN-291628)

Linked Elements
AMFM-FUR-REQ-132994/A-EU - Preset Storage

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user <stores> the active station onto the current preset bank in the user selected location via HMI and HD Stream is active during preset storage. HMI provides {feedback}. The new preset replaces the previously set one.
Post-conditions	Content of the stored station is per AMFM-GREQ-27904-2-Preset Storage.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.8.1.5 AMFM-UC-REQ-023857/A-User attempts to store a direct tuned HD multicast station that does not exist (eg. During a direct tune request before the AMFM (TcSE ROIN-291629)

Linked Elements
AMFM-FUR-REQ-132994/A-EU - Preset Storage

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	User attempts to store a direct tuned HD multicast station that does not exist (eg. During a direct tune request before the AMFM Server determines it is an invalid station).
Post-conditions	Only the station frequency is stored.
List of Exception Use Cases	NA
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.8.2 Requirements

3.8.2.1 AMFM-FUR-REQ-023859/D-Preset Storage Non-RDS (TcSE ROIN-27904-4)

Each preset shall store frequency and band.

HD2+ enabled channels will additionally store the "Short Name" and the HD multicast number.

Preset Store
When the user presses and holds a preset button for more than **T_PRESET_STORE**, the preset store function shall be activated. This function shall store the above information in the preset location corresponding to the preset button being pressed. The AHU shall mute the audio for 0.5 seconds upon receiving a valid request to store preset information to a specific preset location.

Preset Recall
When the user presses a preset button for less than **T_PRESET_STORE** the AHU shall tune to the frequency and band indicated in the selected preset.

Preset Recall with HD radio
When the user selects a non HD2+ preset from the currently available preset bank the analog frequency is immediately selected on the analog tuner. The HD tuner shall determine if an HD stream is available and then decode and process HD-1 if available.

If the preset selected is an HD2+ multicast, the audio shall remain muted while the HD tuner determines if the desired HD stream is available. During the time the HD tuner is determining if an HD stream is available, the HMI shall indicate that HD is available.

If "T_HD decode" seconds pass and the selected HD multicast stream is not available, the AHU shall transmit the "HD_CHANNEL_UNAVAILABLE" message and remain muted.

3.8.2.2 AMFMv2-FUR-REQ-420961/A-Preset Storage RDS

Each preset shall store frequency and band.
Presets for RDS enabled channels will additionally store PI, PS, frequency, and the AF table.

Preset Store

When the user presses and holds a preset button for more than **T_PRESET_STORE**, the preset store function shall be activated. This function shall store the above information in the preset location corresponding to the preset button being pressed. The AHU shall mute the audio for 0.5 seconds upon receiving a valid request to store preset information to a specific preset location.

If the PS is not available at the moment when the user stores the station, the next valid received PS shall be stored in the preset. It shall be possible to store the same station on more than 1 preset and also with different PS and PI (dynamic regional stations).

The AF memory for each preset shall store as many AF's as required to ensure proper AF switching, to get the best AF every time if the user is inside of the station reception area using the *Best AF strategy* *.
This *Best AF strategy* * is concept specific and could be different for each supplier although the resulting "Best AF" for the preset recall shall be the same.

> * *Best AF strategy* means that the tuner shall select the best possible AF for the target station. The weighting factors are field strength, multipath, adjacent channel and the RDS bit error rate information (if available). To get this information as accurate as possible, different suppliers have different methods and strategies that are owned by the supplier. Verification of the success of the AF strategy implementation shall be done cooperatively with the supplier and Ford engineering during the field test drive (jury evaluation).

Preset Recall
When the user presses a preset button for less than **T_PRESET_STORE** the AHU shall tune to the frequency and band indicated in the selected preset.

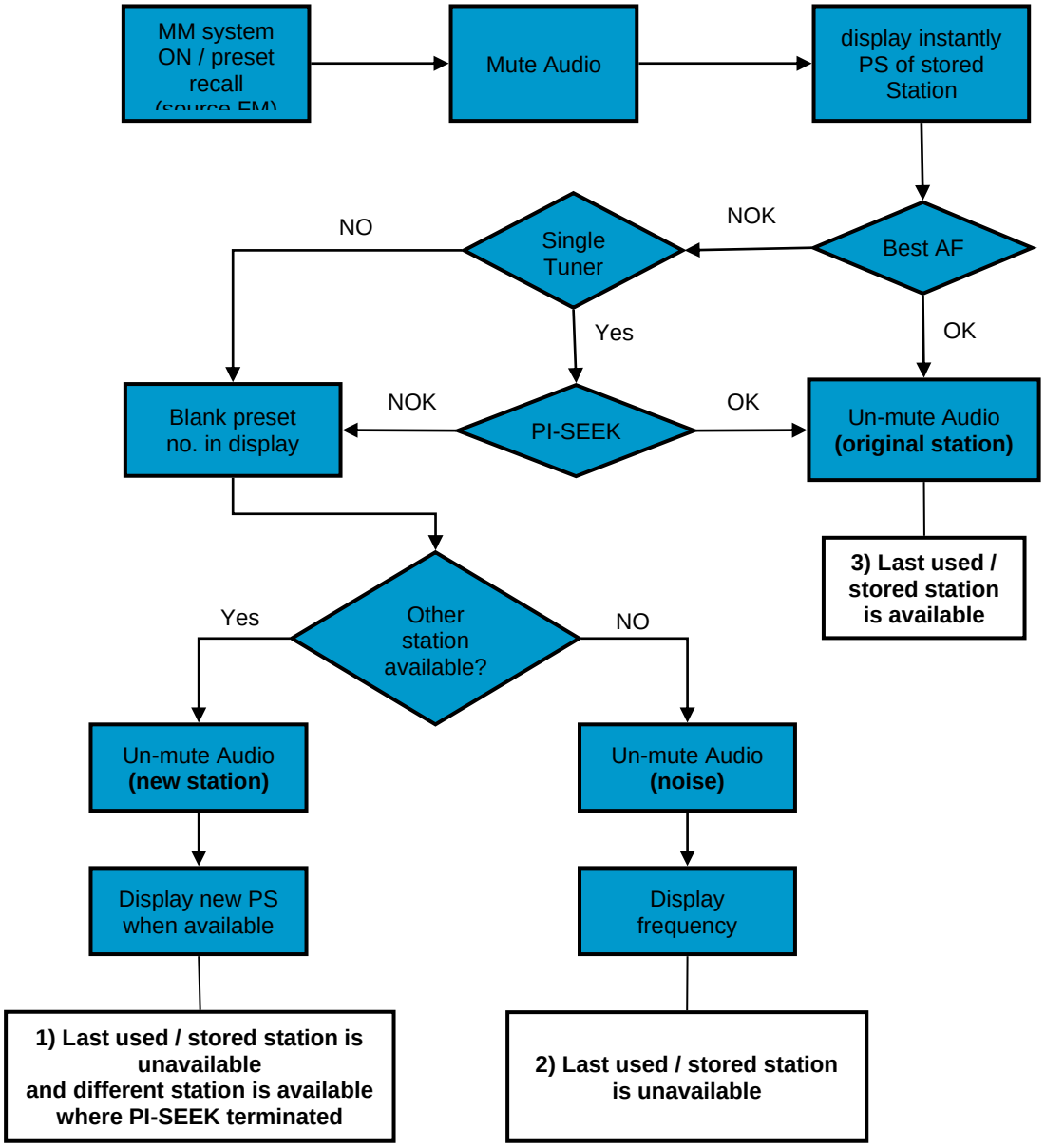
When selecting a Preset, the AHU shall check from the verified PI code to identify the best available AF within **T_PI** seconds.

If the stored station is not available then the AHU shall tune to the last used AF. If there is an invalid PI for this preset then the AHU shall stay tuned to the current frequency, but it shall delete the preset number and PS name. The new PS name shall be updated after the 1st confirmation (origin +1 confirmation) of the new PS name.

Regional stations and AF sorting shall be according to the industry standard "RDS-Method A and B".

In case of reception loss follow AMFM-FUR-REQ-237460-FM Station name.

"Best AF" after Power ON / Preset Recall Strategy



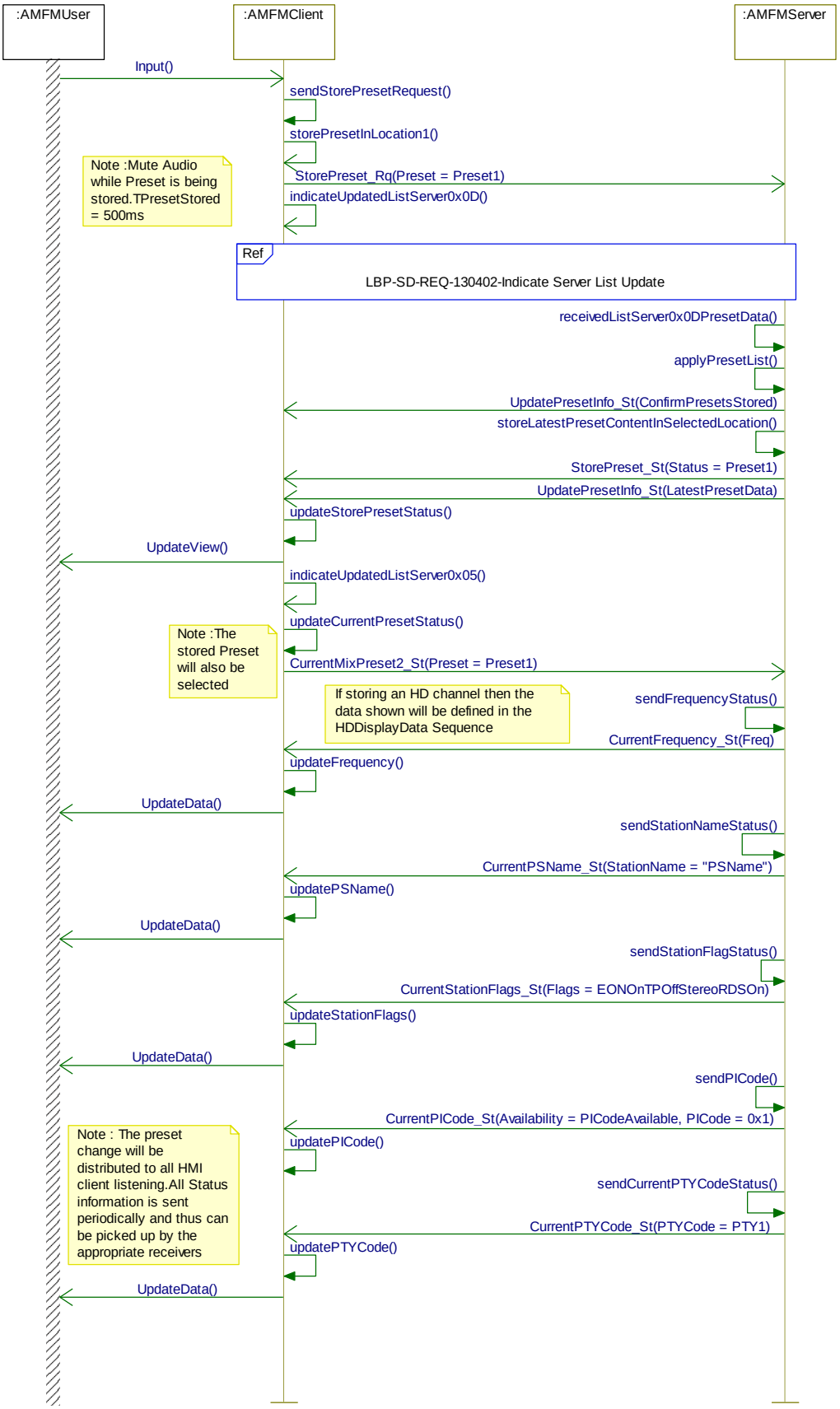
Notes:

- In 'garage condition', this algorithm shall result in bullet point 2' in the chart below. When the signal becomes available again, the PS code and preset numbers shall be restored.
- No AF change shall occur within **$T_{\_AF\_TURNON}$** seconds after power ON.

Fine tuning shall be done cooperatively with the supplier and Ford engineering during the field test (jury evaluation).

3.8.3 Sequence Diagrams

3.8.3.1 AMFMv2-SD-REQ-422473/A-Store Preset


:AMFMUser
:AMFMClient
:AMFMServer
Input()
sendStorePresetRequest()
storePresetInLocation1()
Note :Mute Audio while Preset is being stored.TPresetStored = 500ms
StorePreset_Rq(Preset = Preset1)
indicateUpdatedListServer0x0D()
Ref
LBP-SD-REQ-130402-Indicate Server List Update
receivedListServer0x0DPresetData()
applyPresetList()
UpdatePresetInfo_St(ConfirmPresetsStored)
storeLatestPresetContentInSelectedLocation()
StorePreset_St(Status = Preset1)
UpdatePresetInfo_St(LatestPresetData)
updateStorePresetStatus()
UpdateView()
indicateUpdatedListServer0x05()
updateCurrentPresetStatus()
Note :The stored Preset will also be selected
CurrentMixPreset2_St(Preset = Preset1)
If storing an HD channel then the data shown will be defined in the HDDisplayData Sequence
sendFrequencyStatus()
CurrentFrequency_St(Freq)
updateFrequency()
UpdateData()
sendStationNameStatus()
CurrentPSName_St(StationName = "PSName")
updatePSName()
UpdateData()
sendStationFlagStatus()
CurrentStationFlags_St(Flags = EONOnTPOffStereoRDSOn)
updateStationFlags()
UpdateData()
sendPICode()
CurrentPICode_St(Availability = PICodeAvailable, PICode = 0x1)
updatePICode()
Note : The preset change will be distributed to all HMI client listening.All Status information is sent periodically and thus can be picked up by the appropriate receivers
sendCurrentPTYCodeStatus()
CurrentPTYCode_St(PTYCode = PTY1)
updatePTYCode()
UpdateData()

3.9 HDR-FUN-REQ-023862/A-Storing a Preset with HD enabled (TcSE ROIN-293160)

3.9.1 Use Cases

3.9.1.1 HDR-UC-REQ-023863/A-Store AM/FM Preset with HD active (TcSE ROIN-291631)

Linked Elements
AMFM-FUR-REQ-132994/A-EU - Preset Storage

Actors	User
Pre-conditions	Audio is ON. AM or FM is selected as the source. HD function is enabled in the selected band.
Scenario Description	The user <stores> the active station onto the current preset bank in the user selected location via HMI. The new preset replaces the previously set one. HMI provides {feedback}.
Post-conditions	The current AM or FM station is stored to the dedicated preset and continues playing current station.
List of Exception Use Cases	E1-User attempts to store a direct tuned HD multicast station that does not exist (eg. During a direct tune request before the AMFM Server determines it is an invalid station)
Interfaces	G-HMI, V-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.10 AMFMv3-FUN-REQ-420963/A-Select AM/FM Preset

3.10.1 Use Cases

3.10.1.1 AMFM-UC-REQ-425359/A-Select FM Preset (RDS)

Actors	User
Pre-conditions	Audio is ON. Infotainment System is configured in RDS mode.
Scenario Description	The user selects an available AM or FM <preset> from the HMI. The AMFM Server tunes to the frequency and channel stored in the selected preset. The AMFM Server shall select the station frequency according to the [Preset recall strategy].
Post-conditions	AMFM Server is playing selected station.
List of Exception Use Cases	E1-Preset data does not match broadcast data but another station w/matching broadcast data is present E2-Preset data does not match broadcast data, and another station w/matching broadcast data is not present
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.10.1.2 AMFM-UC-REQ-425360/A-Preset data does not match broadcast data but another station w/matching broadcast data is present

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user selects an available <preset> via HMI and Preset data does not match broadcast data but another station w/matching broadcast data is present.
Post-conditions	The AMFM Server changes the frequency according to the [PI strategy]. AMFM Server is playing selected FM station.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.10.1.3 AMFM-UC-REQ-425361/A-Preset data does not match broadcast data, and another station w/matching broadcast data is not present

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user selects an available <preset> via HMI and Preset data does not match broadcast data, and another station w/matching broadcast data is not present.
Post-conditions	The AMFM Server changes frequency to the stored frequency in the selected preset. AMFM Server is playing selected FM frequency. HMI shall not highlight or indicate that the preset selected is now active.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.10.1.4 AMFM-UC-REQ-425362/A-Select FM Preset (non-RDS)

Actors	User
Pre-conditions	Audio is ON. FM is selected as the source. Infotainment System is not configured in RDS mode.
Scenario Description	The user selects an available <preset> via HMI. The AMFM Server tunes to the FM frequency stored in the selected preset.
Post-conditions	AMFM Server is playing selected FM frequency.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

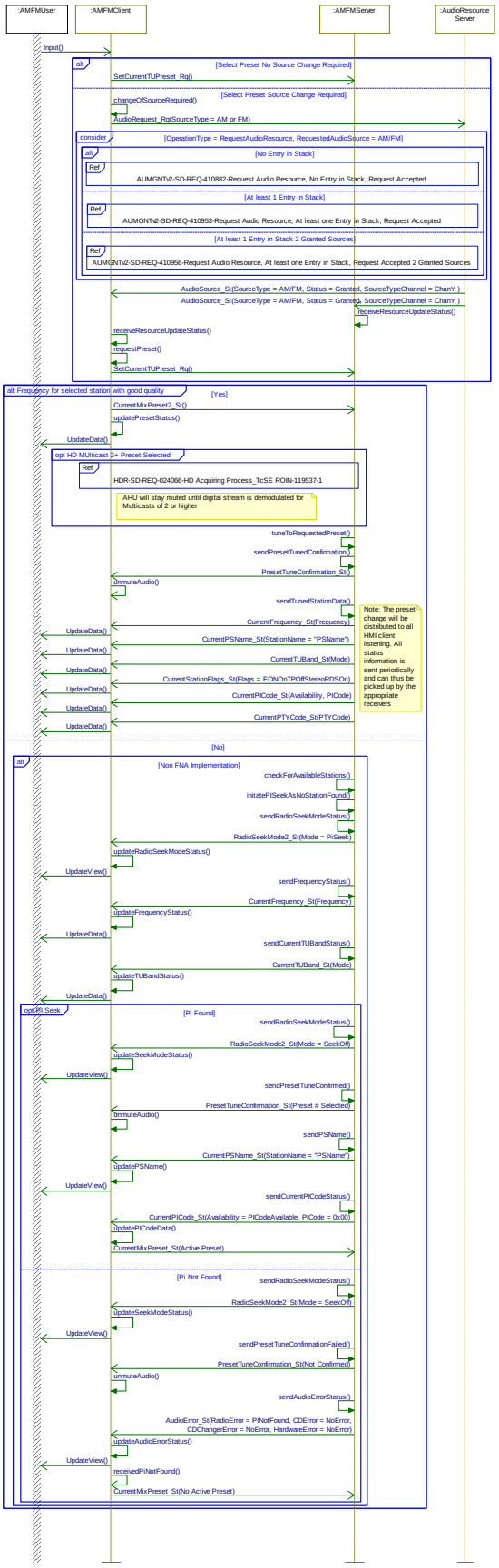
3.10.1.5 AMFM-UC-REQ-425363/A-Select AM Preset

Actors	User
Pre-conditions	Audio is ON.

	AM is selected as the source.
Scenario Description	The user selects an available <preset> via HMI. Frequency is selected to match the stored preset setting.
Post-conditions	AMFM Server is playing selected AM frequency.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.10.2 Sequence Diagrams

3.10.2.1 AMFMv2-SD-REQ-420964/A-Select AMFM Preset


:AMFMUser
:AMFMClient
:AMFMServer
:AudioResource Server
Input()
alt
[Select Preset No Source Change Required]
SetCurrentTUPreset_Rq()
[Select Preset Source Change Required]
changeOfSourceRequired()
AudioRequest_Rq(SourceType = AM or FM)
consider
[OperationType = RequestAudioResource, RequestedAudioSource = AM/FM]
alt
[No Entry in Stack]
Ref
AUMGNTv2-SD-REQ-410882-Request Audio Resource, No Entry in Stack, Request Accepted
[At least 1 Entry in Stack]
Ref
AUMGNTv2-SD-REQ-410953-Request Audio Resource, At least one Entry in Stack, Request Accepted
[At least 1 Entry in Stack 2 Granted Sources]
Ref
AUMGNTv2-SD-REQ-410956-Request Audio Resource, At least one Entry in Stack, Request Accepted 2 Granted Sources
AudioSource_St(SourceType = AM/FM, Status = Granted, SourceTypeChannel = ChanY)
AudioSource_St(SourceType = AM/FM, Status = Granted, SourceTypeChannel = ChanY)
receiveResourceUpdateStatus()
receiveResourceUpdateStatus()
requestPreset()
SetCurrentTUPreset_Rq()
alt Frequency for selected station with good quality
[Yes]
CurrentMixPreset2_St()
updatePresetStatus()
UpdateData()
opt HD Multicast 2+ Preset Selected
Ref
HDR-SD-REQ-024066-HD Acquiring Process_TcSE ROIN-119537-1
AHU will stay muted until digital stream is demodulated for Multicasts of 2 or higher
tuneToRequestedPreset()
sendPresetTunedConfirmation()
PresetTuneConfirmation_St()
unmuteAudio()
sendTunedStationData()
CurrentFrequency_St(Frequency)
UpdateData()
CurrentPSName_St(StationName = "PSName")
UpdateData()
CurrentTUBand_St(Mode)
UpdateData()
CurrentStationFlags_St(Flags = EONOnTPOffStereoRDSOn)
UpdateData()
CurrentPICode_St(Availability, PICode)
UpdateData()
CurrentPTYCode_St(PTYCode)
UpdateData()
Note: The preset change will be distributed to all HMI client listening. All status information is sent periodically and can thus be picked up by the appropriate receivers
[No]
alt
[Non FNA Implementation]
checkForAvailableStations()
initatePISeekAsNoStationFound()
sendRadioSeekModeStatus()
RadioSeekMode2_St(Mode = PiSeek)
updateRadioSeekModeStatus()
UpdateView()
sendFrequencyStatus()
CurrentFrequency_St(Frequency)
updateFrequencyStatus()
UpdateData()
sendCurrentTUBandStatus()
CurrentTUBand_St(Mode)
updateTUBandStatus()
UpdateData()
opt PI Seek
[PI Found]
sendRadioSeekModeStatus()
RadioSeekMode2_St(Mode = SeekOff)
updateSeekModeStatus()
UpdateView()
sendPresetTuneConfirmed()
PresetTuneConfirmation_St(Preset # Selected)
unmuteAudio()
sendPSName()
CurrentPSName_St(StationName = "PSName")
updatePSName()
UpdateView()
sendCurrentPICodeStatus()
CurrentPICode_St(Availability = PICodeAvailable, PICode = 0x00)
updatePICodeData()
CurrentMixPreset_St(Active Preset)
[PI Not Found]
sendRadioSeekModeStatus()
RadioSeekMode2_St(Mode = SeekOff)
updateSeekModeStatus()
UpdateView()
sendPresetTuneConfirmationFailed()
PresetTuneConfirmation_St(Not Confirmed)
unmuteAudio()
sendAudioErrorStatus()
AudioError_St(RadioError = PINotFound, CDError = NoError, CDChangerError = NoError, HardwareError = NoError)
updateAudioErrorStatus()
UpdateView()
receivedPiNotFound()
CurrentMixPreset_St(No Active Preset)

3.11 HDR-FUN-REQ-023874/A-Selecting a Preset in AM/FM with HD enabled (TcSE ROIN-293225)

3.11.1 Use Cases

3.11.1.1 HDR-UC-REQ-023875/A-Select AM or FM Preset with HD enabled (TcSE ROIN-291637)

Actors	User
Pre-conditions	Audio is ON. AM or FM is selected as the source. HD function is enabled on requested band.
Scenario Description	The user selects an available <preset> via HMI. Frequency is selected to match the stored preset setting.
Post-conditions	AMFM Server is playing selected analog frequency. A valid HD data stream is detected. Radio audio blends from analog to digital.
List of Exception Use Cases	E1- AMFM Server determines that HD data stream is unavailable E2-Preset had Stream 2+ as the stored preset
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.11.1.2 HDR-UC-REQ-023876/A-AMFM Server determines that HD data stream is unavailable (TcSE ROIN-291638)

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user selects an available <preset> via HMI. Frequency is selected to match the stored preset setting and AMFM Server determines that HD data stream is unavailable.
Post-conditions	AMFM Server is playing selected analog frequency.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.11.1.3 HDR-UC-REQ-023877/A-Preset had Stream 2+ as the stored preset (TcSE ROIN-291639)

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user selects an available <preset> via HMI. Frequency is selected to match the stored preset setting and Preset had Stream 2+ as the stored preset.
Post-conditions	Go to HDR-GUC-291640-Select FM Preset with HD stream 2+ stored.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.11.1.4 HDR-UC-REQ-023878/A-Select FM Preset with HD stream 2+ stored (TcSE ROIN-291640)

Actors	User
Pre-conditions	Audio is ON. FM is selected as the source.
Scenario Description	The user selects an available <preset> via HMI. Preset has an HD 2+ stream stored in it. Station is selected to match the stored preset setting.
Post-conditions	AMFM Server is muted until digital stream is acquired.
List of Exception Use Cases	E1- AMFM Server determines that HD data stream 2+ is unavailable E2- AMFM Server determines that HD status is OFF when an HD preset request is made
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.11.1.5 HDR-UC-REQ-023879/A-AMFM Server determines that HD data stream 2+ is unavailable (TcSE ROIN-291641)

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user selects an available <preset> via HMI. Preset has an HD 2+ stream stored in it. Station is selected to match the stored preset setting and AMFM Server determines that HD data stream is unavailable.
Post-conditions	AMFM Server remains muted until it sees a valid digital signal. HMI indicates {HD PROGRAM NOT AVAILABLE}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.11.1.6 HDR-UC-REQ-023880/A-AMFM Server determines that HD status is OFF when an HD preset request is made (TcSE ROIN-291642)

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user selects an available <preset> via HMI. Preset has an HD 2+ stream stored in it. Station is selected to match the stored preset setting and AMFM Server determines that HD status is OFF when an HD preset request is made.
Post-conditions	AMFM Server shall set the HD status to ON and enable HD decoding. AMFM Server shall play the selected HD preset station based on the entry condition of HDR-GUC-291640-Select FM Preset with HD stream 2+ stored with HD enabled.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, SWC-HMI, CAN, Audio out, AM/FM

3.12 TUv2-FUN-REQ-420982/A-Mixed Mode Presets

3.12.1 Use Cases

3.12.1.1 TU-UC-REQ-416563/A-Request Mixed Mode Preset List

Actors	User, System
Pre-conditions	Infotainment System Powered On (HMI-HMIMode_St = On)
Scenario Description	The user or system requests the Mixed Mode preset list for browsing or now playing screens.
Post-conditions	The Tuner Server responds with the Mixed Mode preset list.
List of Exception Use Cases	
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Audio out, Tuner

3.12.1.2 TU-UC-REQ-416564/A-Selecting a Mixed Mode preset that is already the active source

Actors	User
Pre-conditions	Infotainment System Powered On (HMI-HMIMode_St = On) System is configured for Mixed Mode Presets
Scenario Description	The user requests a preset for a source that is already active.
Post-conditions	The Tuner Client requests the preset and then Tuner Server (AMFM, SDARS or DAB Client requests the preset from the AMFM/DAB Server or SDARS Remote Server.
List of Exception Use Cases	
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Audio out, Tuner

3.12.1.3 TU-UC-REQ-416565/A-Selecting a Mixed Mode preset that results in source change

Actors	User
Pre-conditions	Infotainment System Powered On (HMI-HMIMode_St = On) System is configured for Mixed Mode Presets
Scenario Description	The user requests a preset for a source that is not active.
Post-conditions	The Tuner Client requests the preset and then Tuner Server (AMFM, SDARS or DAB Client requests the source. Once source is granted the AMFM, SDARS or DAB Client requests the preset from the AMFM/DAB Server or SDARS Remote Server.
List of Exception Use Cases	
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Audio out, Tuner

3.12.1.4 TU-UC-REQ-416566/A-Setting the max number of presets to display

Actors	User
Pre-conditions	Infotainment System Powered On (HMI-HMIMode_St = On) System is configured for Mixed Mode Presets

Scenario Description	The user adds or deletes presets causing the number of presets to change
Post-conditions	The Tuner Settings Client indicates the max number of presets on the bus to the Tuner Clients and Tuner Server.
List of Exception Use Cases	
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Audio out, Tuner

3.12.1.5 TU-UC-REQ-433358/A-Deleting A Preset

Actors	User
Pre-conditions	Infotainment System Powered On (HMI-HMIMode_St = On) System is configured for Mixed Mode Presets
Scenario Description	The user deletes a preset or multiple presets
Post-conditions	The preset is deleted and the lists in the PDC and PAC are synchronized. Clients are informed of the MMP list being updated.
List of Exception Use Cases	
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Tuner

3.12.1.6 TU-UC-REQ-433359/A-Reordering A Preset

Actors	User
Pre-conditions	Infotainment System Powered On (HMI-HMIMode_St = On) System is configured for Mixed Mode Presets
Scenario Description	The user reorders the preset list
Post-conditions	The preset list is reordered and the lists in the PDC and PAC are synchronized. Clients are informed of the MMP list being updated.
List of Exception Use Cases	
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Audio out, Tuner

3.12.1.7 TU-UC-REQ-433360/A-Profile Change

Actors	User
Pre-conditions	Infotainment System Powered On (HMI-HMIMode_St = On) System is configured for Mixed Mode Presets
Scenario Description	The user profile has changed.
Post-conditions	The preset lists in the PDC and PAC are synchronized and the preset list for the active Profile is made available to the user.
List of Exception Use Cases	
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Audio out, Tuner

3.12.1.8 TU-UC-REQ-433361/A-Boot Up Sequence

Actors	User
Pre-conditions	Infotainment System Powered On (HMI-HMIMode_St = On) System is configured for Mixed Mode Presets
Scenario Description	The system boots up.
Post-conditions	The preset lists in the PDC and PAC are synchronized and the preset list for the active Profile is made available to the user.
List of Exception Use Cases	
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Audio out, Tuner

3.12.1.9 TU-UC-REQ-433362/A-Tuning Away from an FM or DAB Preset (FoE Only)

Actors	User
Pre-conditions	Infotainment System Powered On (HMI-HMIMode_St = On) System is configured for Mixed Mode Presets Configured for FoE markets
Scenario Description	The user tunes away from an FM RDS or DAB preset.
Post-conditions	PAC provides the last tuned frequency for the preset that was just tuned away from. PDC update the preset data stored with the last tuned frequency received
List of Exception Use Cases	
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, Audio out, Tuner

3.12.2 Requirements

3.12.2.1 TUv2-SR-REQ-420983/A-Preset Indication for Mixed Mode Presets based on Number of Presets the User Desires

The Tuner Settings Client shall indicate to the other Tuner Clients and Tuner Server how many presets are going to be shown based on the user selected value.

The Tuner Clients shall use this indication as the max value to except from CurrentMixPreset2_St for display purposes or max list size requests.

Example: User has 12 presets saved. The Tuner Settings Client transmits the value on the bus. All displays that indicate the current active preset shall ignore any value in CurrentMixPreset2_St greater than 12. If CurrentMixPreset2_St indicates preset 13 is active then the displays shall not indicate that prest 13 is active.

3.12.2.2 TUv2-SR-REQ-420984/A-Tuner Banks used when Configured as Mixed Mode Presets

When configured for Mixed Mode Presets the Tuner Clients shall only indicate the current tuner source as either AM, FM, SAT or DAB.

When cycling through the tuner sources the Tuner Clients shall only ask for AM1, FM1, SAT1 or DAB1.

When the user requests a Tuner bank via VR the Tuner Client shall only request the first bank of the given Tuner requested.

The user shall not be allowed to request a tuner bank and preset as the preset list is not link to tuner banks while configured for Mixed Mode Presets.

3.12.2.3 TUv2-SR-REQ-420986/A-Prefetching Mixed Mode Presets

If required due to HMI dependencies the Tuner Client shall follow this requirement on how to perform the preset list prefetching and storage.

The Tuner Client shall store the latest preset list information received from the server in internal flash. The preset list data in internal flash shall be stored through ignition cycles. On the very first battery connect the Tuner Client shall show blank presets if the preset data is not received from the server before the HMI is ready to show the preset buttons. Once the preset list data is available then the HMI shall update their display with the data.

The data stored in internal flash shall be used for HMI purposes when the HMI needs to display the data and has not requested or received the data from the Tuner Server yet. Once the Tuner Client requests and receives the preset list data from the Tuner Server the Tuner Client shall update the preset list data stored in their internal flash and update their display in the case that there is a mismatch in the data shown vs. data received.

3.12.2.4 TUv2-SR-REQ-420988/A-List Server Radio 1 - Cluster/Centerstack/Rear HMI

Radio Root

ListServerID =	Generic Radio 1 (0x05)							
ActiveListID =	Radio Root (0x0000)							
ParentListID =	Radio Root (0x0000)							
NbrItemsInSelection =	8							
ItemIndex	DataType	ActivationEvent	ObjectType	ObjectState	ItemDescriptor	getItem(ItemIndex) Behavior	setItem(ItemIndex) Behavior	Static List Entry
0x0000	Generic Text (0x02)	Not Supported (0x0)	List Label (0x0)	Inactive (0x0)	'Radio'	Invalid	Invalid	No
0x0001	Generic Text (0x02)	Not Supported (0x0)	List Object (0x2)	Inactive (0x0) || active (0x1) *	Radio Presets	(Goto ActiveListID 0x0001)	Invalid	Yes
0x0002	Radio Source (0xA4)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{SourceIcon}AM		Activate AM Radio	No
0x0003	Radio Source (0xA4)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{SourceIcon}FM		Activate FM Radio	No
0x0004	Radio Source (0xA4)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{SourceIcon}DAB OR {SourceIcon}SDARS		Activate DAB / SDARS Radio	No
		* ObjectState shall reflect to current active band or if there is a match to MixedModePresets then Radio Presets is active.						

Radio Preset List

ListServerID =	Generic Radio 1 (0x05)							
ActiveListID =	MixedModePreset List (0x0001)							
ParentListID =	Radio Root (0x0000)							
NbrItemsInSelection =	30							
ItemIndex	DataType	ActivationEvent	ObjectType	ObjectState	ItemDescriptor	getItem(ItemIndex) Behavior	setItem(ItemIndex) Behavior	Static List Entry
0x0000	Generic Text (0x02)	Not Supported (0x0)	List Label (0x0)	Inactive (0x0)	Radio Presets	Invalid	Invalid	No
0x0001	Radio Mixed Prestes (0xA3)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{PresetNumber}{PresetState}{RadioBand}{Frequency}{HDNumber}{StationNameShort}{StationNameLong}	Invalid	Activate Preset1	No
0x0002	Radio Mixed Prestes (0xA3)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{PresetNumber}{PresetState}{RadioBand}{Frequency}{HDNumber}{StationNameShort}{StationNameLong}	Invalid	Activate Preset2	No
0x0003	Radio Mixed Prestes (0xA3)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{PresetNumber}{PresetState}{RadioBand}{Frequency}{HDNumber}{StationNameShort}{StationNameLong}	Invalid	Activate Preset3	No
0x0004	Radio Mixed Prestes (0xA3)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{PresetNumber}{PresetState}{RadioBand}{Frequency}{HDNumber}{StationNameShort}{StationNameLong}	Invalid	Activate Preset4	No
0x0005	Radio Mixed Prestes (0xA3)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{PresetNumber}{PresetState}{RadioBand}{Frequency}{HDNumber}{StationNameShort}{StationNameLong}	Invalid	Activate Preset5	No
0x0006	Radio Mixed Prestes (0xA3)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{PresetNumber}{PresetState}{RadioBand}{Frequency}{HDNumber}{StationNameShort}{StationNameLong}	Invalid	Activate Preset6	No
...								
0x001E	Radio Mixed Prestes (0xA3)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{PresetNumber}{PresetState}{RadioBand}{Frequency}{HDNumber}{StationNameShort}{StationNameLong}	Invalid	Activate Preset30	No
		*ObjectState shall reflect to current active preset.						

Empty

ListServerID =	Generic Radio 1 (0x05)							
ActiveListID =	Empty (0x0009)							
ParentListID =	Radio Root (0x0000)							
NbrItemsInSelection =	1							
ItemIndex	DataType	ActivationEvent	ObjectType	ObjectState	ItemDescriptor	getItem(ItemIndex) Behavior	setItem(ItemIndex) Behavior	Static List Entry
0x0000	Generic Text (0x02)	Not Supported (0x0)	List Label (0x0)	Inactive (0x0)	Empty	Invalid	Invalid	No
0x0001	Generic Text (0x02)	Not Supported (0x0)	Entry Object (0x1)	Inactive (0x0)	OK	Invalid	Goto Root	No

FM Station List

ListServerID =	Generic Radio 1 (0x05)							
ActiveListID =	Radio FM (0x000A)							
ParentListID =	Radio Root (0x0000)							
NbrItemsInSelection =	253							
ItemIndex	DataType	ActivationEvent	ObjectType	ObjectState	ItemDescriptor	getItem(ItemIndex) Behavior	setItem(ItemIndex) Behavior	Static List Entry
0x0000	Generic Text (0x02)	Not Supported (0x0)	List Label (0x0)	Inactive (0x0)	FM	Invalid	Invalid	No
0x0001	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station1	No
0x0002	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station2	No
0x0003	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station3	No
0x0004	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station4	No
0x0005	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station5	No
0x0006	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station6	No
...								
0x00FE	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station30	No
		*ObjectState shall reflect to current active preset.						

DAB Station List

ListServerID =	Generic Radio 1 (0x05)							
ActiveListID =	Radio DAB (0x000B)							
ParentListID =	Radio Root (0x0000)							
NbrItemsInSelection =	253							
ItemIndex	DataType	ActivationEvent	ObjectType	ObjectState	ItemDescriptor	getItem(ItemIndex) Behavior	setItem(ItemIndex) Behavior	Static List Entry
0x0000	Generic Text (0x02)	Not Supported (0x0)	List Label (0x0)	Inactive (0x0)	DAB	Invalid	Invalid	No
0x0001	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station1	No
0x0002	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station2	No
0x0003	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station3	No
0x0004	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station4	No
0x0005	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station5	No
0x0006	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station6	No
...								
0x00FE	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station30	No
		*ObjectState shall reflect to current active preset.						

SDARS Station List

ListServerID =	Generic Radio 1 (0x05)							
ActiveListID =	Radio SDARS (0x000C)							
ParentListID =	Radio Root (0x0000)							
NbrItemsInSelection =	253							
ItemIndex	DataType	ActivationEvent	ObjectType	ObjectState	ItemDescriptor	getItem(ItemIndex) Behavior	setItem(ItemIndex) Behavior	Static List Entry
0x0000	Generic Text (0x02)	Not Supported (0x0)	List Label (0x0)	Inactive (0x0)	SDARS	Invalid	Invalid	No
0x0001	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station1	No
0x0002	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station2	No
0x0003	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station3	No
0x0004	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station4	No
0x0005	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station5	No
0x0006	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station6	No
...								
0x00FE	Radio Station (0xA0)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{RadioBand}{IndexNumber}{Frequency}{StationIcon}{StationName}	Invalid	Activate Station30	No
		*ObjectState shall reflect to current active preset.						

DAB and SDARS can only be available separately based on configuration (EU/NA)
Station List server Structure is added as future protection.

3.12.2.5 TU-SR-REQ-425940/A-PAC Preset Synchronization List Update Indication

The PAC shall not indicate, using the List Browse Protocol List Update Indication, that their list serve list 0x0E has updated.

3.12.2.6 TU-SR-REQ-425941/A-PDC Request for Stored Presets in PAC

The PDC shall request the 0x0E List Serve from the PAC whenever the following conditions occur.

1. After a Preset Store confirmation
2. After every system boot up
3. After a User Profile change

The request for the list is added so that the data stored in the PAC is visible on the CAN bus in the case that we have a preset failure. The PDC is not required to review the content of the PAC but can use it if needed.

3.12.2.7 TU-REQ-434407/A-Maximum Number of Presets per Vehicle Profile

The PDC shall be capable of storing 30 presets per vehicle profile.

3.12.2.8 TU-REQ-434408/A-Presets Memory

The PDC shall store all presets for all vehicle profiles in non-volatile memory and persist through normal ignition cycles and OTA updates.

3.12.2.9 TU-REQ-434409/A-Persist User's Preset Settings

The PDC shall persist the displayed preset list order and all preset settings through normal ignition cycles and OTA updates.

3.12.2.10 TU-REQ-434410/A-Updated Preset List Indication

On every boot up or vehicle profile change, PDC shall indicate to PAC that a preset list update is available.

3.12.2.11 TU-REQ-434411/A-Request Preset Synchronization List from PDC

The PAC shall request the PDC Preset Synchronization list from the PDC when the updated preset list indication is received.

3.12.2.12 TU-REQ-434412/A-Request Preset Synchronization List from PAC

When the preset list is updated and confirmed in the PAC (i.e. after boot up, vehicle profile change, add, reorder, delete) the PDC shall request the entire PAC Preset Synchronization list. Reference TU-SD-REQ-427637/A-Request Stored Preset Data from PAC.

3.12.2.13 TU-REQ-434413/A-Confirmation of Preset List Stored in PAC

The PAC shall send a confirmation via UpdatePresetInfo_St (ConfirmPresetStored) to the PDC after the Preset Synchronization list has been stored and applied.

3.12.2.14 TU-REQ-434414/A-Preset Station Data Update

When PAC indicates a preset station data update via the network, the PDC shall update the station data for the specified preset index. Note: The PDC does not need to indicate a preset list update back to PAC after the preset station data update.

3.12.2.15 TU-REQ-434687/A-PAC Preset Data Update

The PAC shall update the preset information for the active stored preset whenever new or missing data becomes available.

3.12.2.16 TU-REQ-434688/A-Preset Data Update after Store Confirmation

The PAC shall send UpdatePresetInfo_St (Transmit Stored Preset Content) to PDC after storing a preset.

3.12.2.17 TU-REQ-434689/B-Last Used Frequency Preset Update

The PAC shall send the last used frequency via UpdatePresetInfo_St (Transmit Stored Preset Content) to PDC when tuning away from a preset or transitioning to Audio OFF.

3.12.2.18 TU-SR-REQ-434780/A-List Server Radio Data Service5 - PDC Preset Sychronization Data

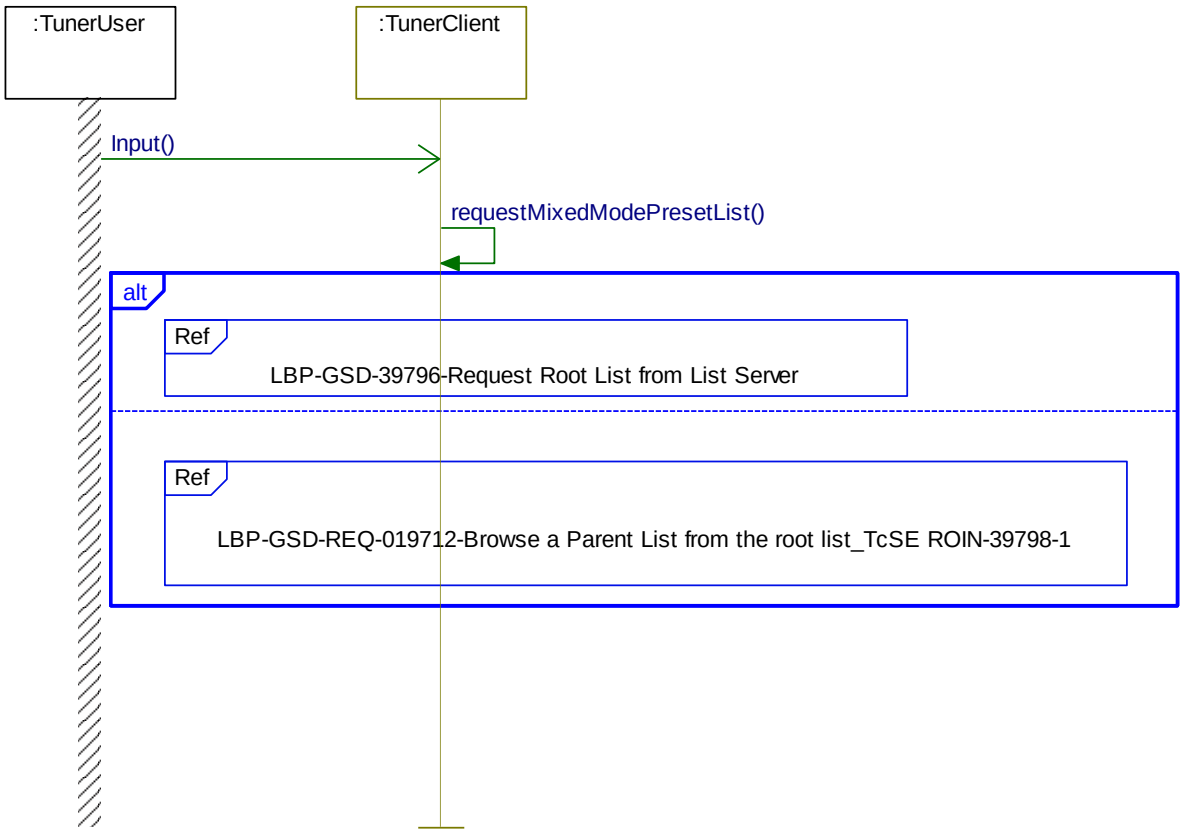
PDC Preset Sychronization List						
ListServerID =	Radio Data Service5 (0x0D)					
ActiveListID =	PDC Preset Sychronization Root (0x0000)					
ParentList ID =	PDC Preset Sychronization Root (0x0000)					
NbrItemsInSelection=	30					
ItemIndex	***DataType***	***ActivationEvent***	***Object Type***	***ItemDescriptor***	***getItem(ItemIndex)***	***setItem()***
0x0000	Generic Text (0x02)	Not Supported (0x0)	List Label	{Preset List}	Invalid	Invalid
0x0001	Radio Preset Data List (0xA6)	Not Supported (0x0)	Entry Object (0x1)	{PresetNumber}{RadioBand}{StoredFrequency}{LastFrequency}{HD Number}{PICode}{SCID}{SID}{ServiceLinkInfo}{ServiceLinkTimeDelay}{ StationNameLong}{StationNameShort}	Invalid	Invalid
0x0002	Radio Preset Data List (0xA6)	Not Supported (0x0)	Entry Object (0x1)	{PresetNumber}{RadioBand}{StoredFrequency}{LastFrequency}{HD Number}{PICode}{SCID}{SID}{ServiceLinkInfo}{ServiceLinkTimeDelay}{ StationNameLong}{StationNameShort}	Invalid	Invalid
0x0003	Radio Preset Data List (0xA6)	Not Supported (0x0)	Entry Object (0x1)	{PresetNumber}{RadioBand}{StoredFrequency}{LastFrequency}{HD Number}{PICode}{SCID}{SID}{ServiceLinkInfo}{ServiceLinkTimeDelay}{ StationNameLong}{StationNameShort}	Invalid	Invalid
0x0004	Radio Preset Data List (0xA6)	Not Supported (0x0)	Entry Object (0x1)	{PresetNumber}{RadioBand}{StoredFrequency}{LastFrequency}{HD Number}{PICode}{SCID}{SID}{ServiceLinkInfo}{ServiceLinkTimeDelay}{ StationNameLong}{StationNameShort}	Invalid	Invalid
				...		
0x001E	Radio Preset Data List (0xA6)	Not Supported (0x0)	Entry Object (0x1)	{PresetNumber}{RadioBand}{StoredFrequency}{LastFrequency}{HD Number}{PICode}{SCID}{SID}{ServiceLinkInfo}{ServiceLinkTimeDelay}{ StationNameLong}{StationNameShort}	Invalid	Invalid

3.12.2.19 TU-SR-REQ-434781/A-List Server Radio Data Service6 - PAC Preset Sychronization Data

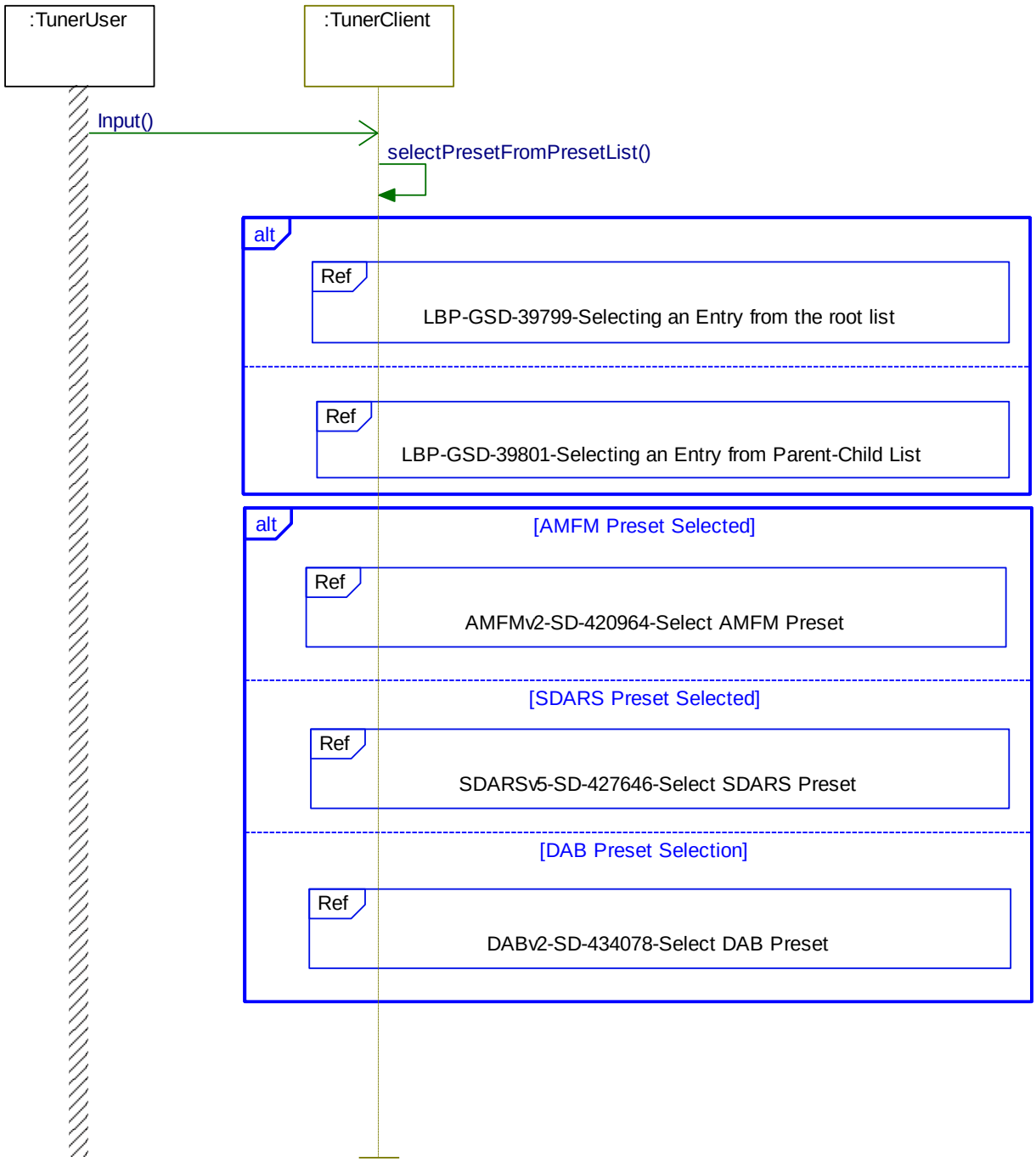
PAC Preset Sychronization List						
ListServerID =	Radio Data Service6 (0x0E)					
ActiveListID =	PAC Preset Sychronization Root (0x0000)					
ParentList ID =	PAC Preset Sychronization Root (0x0000)					
NbrItemsInSelection=	30					
ItemIndex	***DataType***	***ActivationEvent***	***Object Type***	***ItemDescriptor***	***getItem(ItemIndex)***	***setItem()***
0x0000	Generic Text (0x02)	Not Supported (0x0)	List Label	{Preset List}	Invalid	Invalid
0x0001	Radio Preset Data List (0xA6)	Not Supported (0x0)	Entry Object (0x1)	{PresetNumber}{RadioBand}{StoredFrequency}{LastFrequency}{HD Number}{PICode}{SCID}{SID}{ServiceLinkInfo}{ServiceLinkTimeDelay}{ StationNameLong}{StationNameShort}	Invalid	Invalid
0x0002	Radio Preset Data List (0xA6)	Not Supported (0x0)	Entry Object (0x1)	{PresetNumber}{RadioBand}{StoredFrequency}{LastFrequency}{HD Number}{PICode}{SCID}{SID}{ServiceLinkInfo}{ServiceLinkTimeDelay}{ StationNameLong}{StationNameShort}	Invalid	Invalid
0x0003	Radio Preset Data List (0xA6)	Not Supported (0x0)	Entry Object (0x1)	{PresetNumber}{RadioBand}{StoredFrequency}{LastFrequency}{HD Number}{PICode}{SCID}{SID}{ServiceLinkInfo}{ServiceLinkTimeDelay}{ StationNameLong}{StationNameShort}	Invalid	Invalid
0x0004	Radio Preset Data List (0xA6)	Not Supported (0x0)	Entry Object (0x1)	{PresetNumber}{RadioBand}{StoredFrequency}{LastFrequency}{HD Number}{PICode}{SCID}{SID}{ServiceLinkInfo}{ServiceLinkTimeDelay}{ StationNameLong}{StationNameShort}	Invalid	Invalid
				...		
0x001E	Radio Preset Data List (0xA6)	Not Supported (0x0)	Entry Object (0x1)	{PresetNumber}{RadioBand}{StoredFrequency}{LastFrequency}{HD Number}{PICode}{SCID}{SID}{ServiceLinkInfo}{ServiceLinkTimeDelay}{ StationNameLong}{StationNameShort}	Invalid	Invalid

3.12.3 Sequence Diagrams

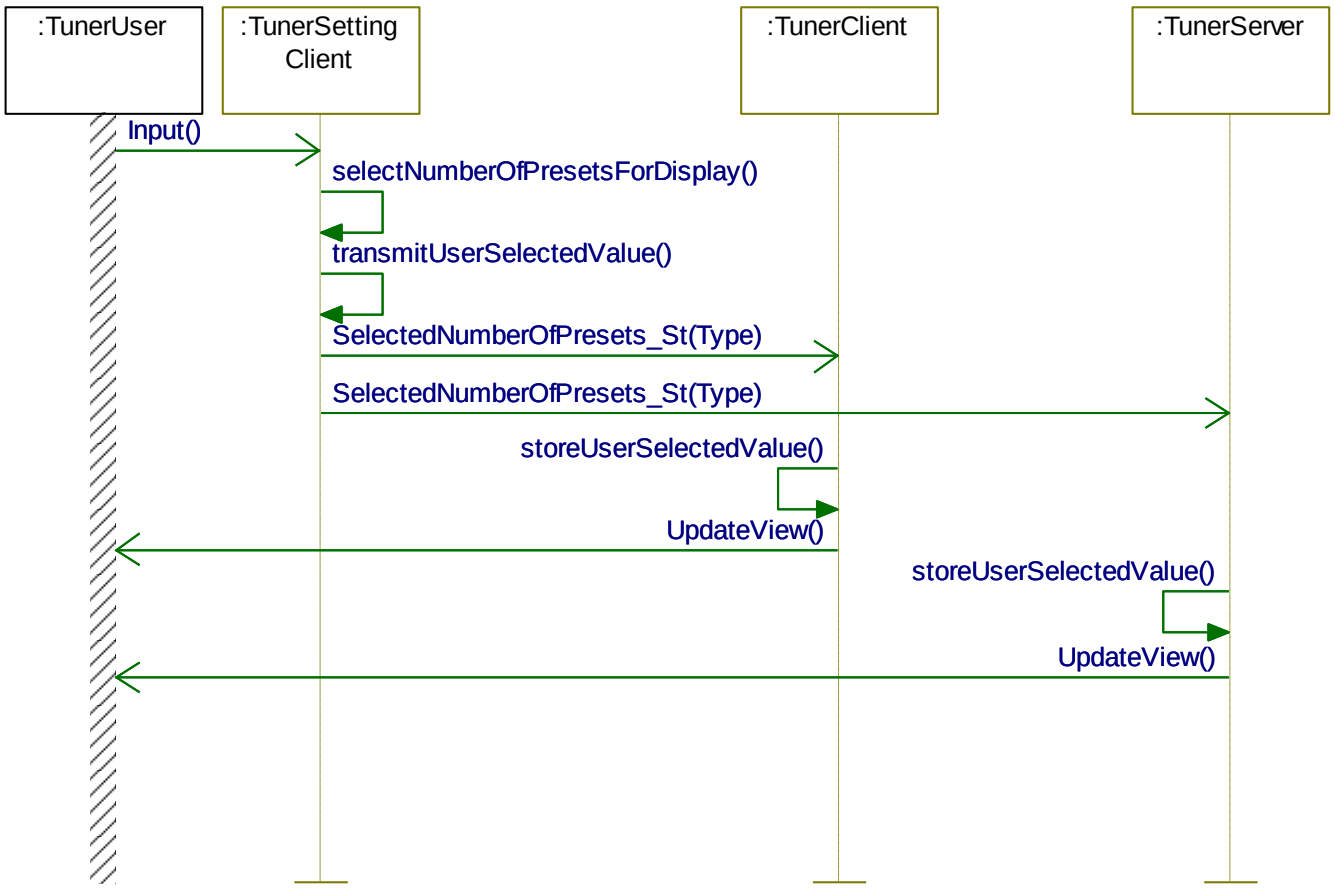
3.12.3.1 TUv2-SD-REQ-420989/A-Request Mixed Mode Preset List



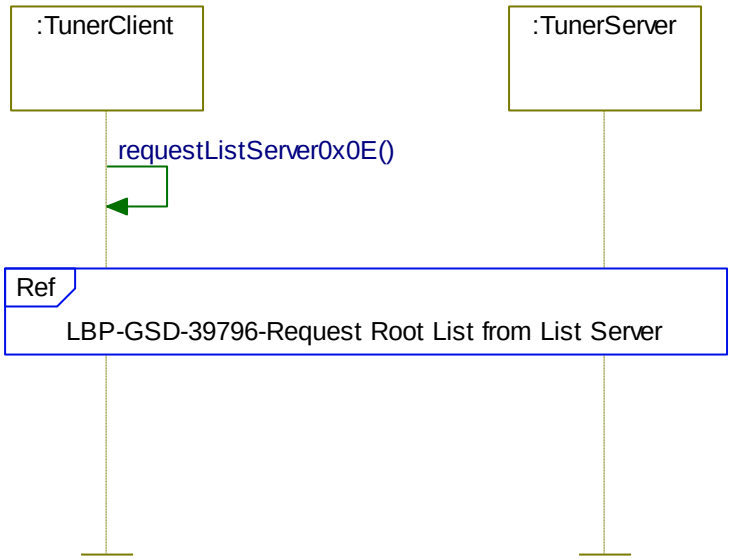
3.12.3.2 TUv2-SD-REQ-420990/A-Select Preset



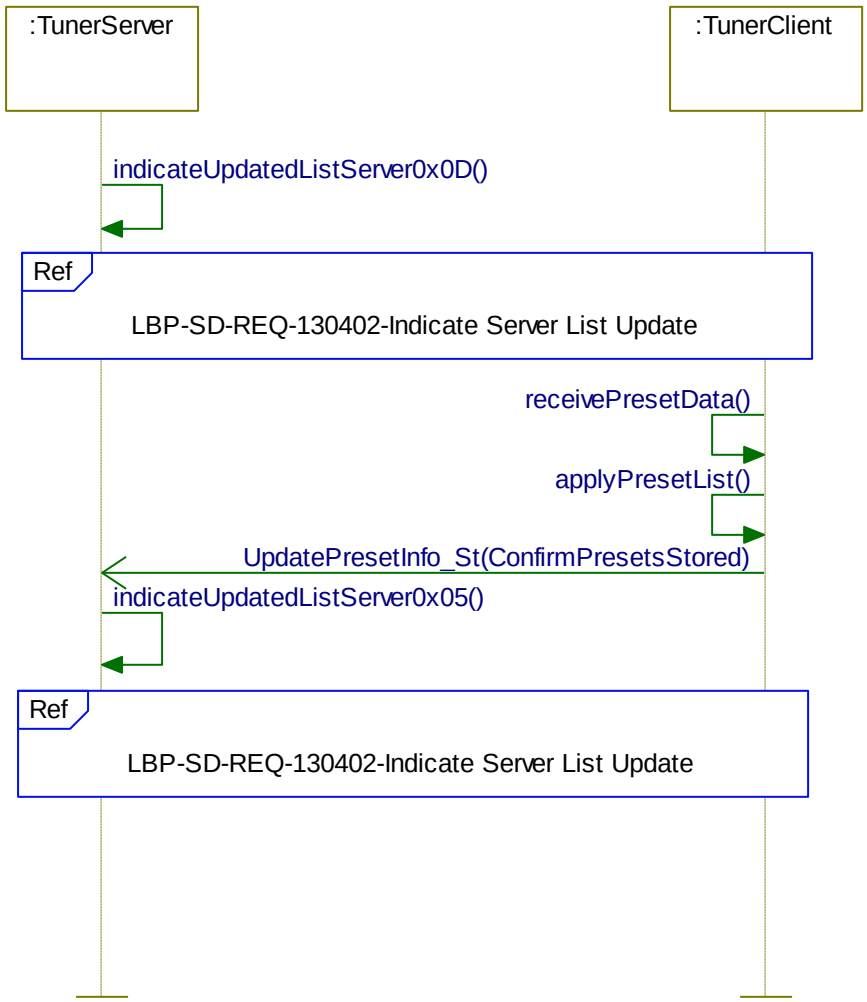
3.12.3.3 TUv2-SD-REQ-420991/A-User Selected Max Number Of Presets



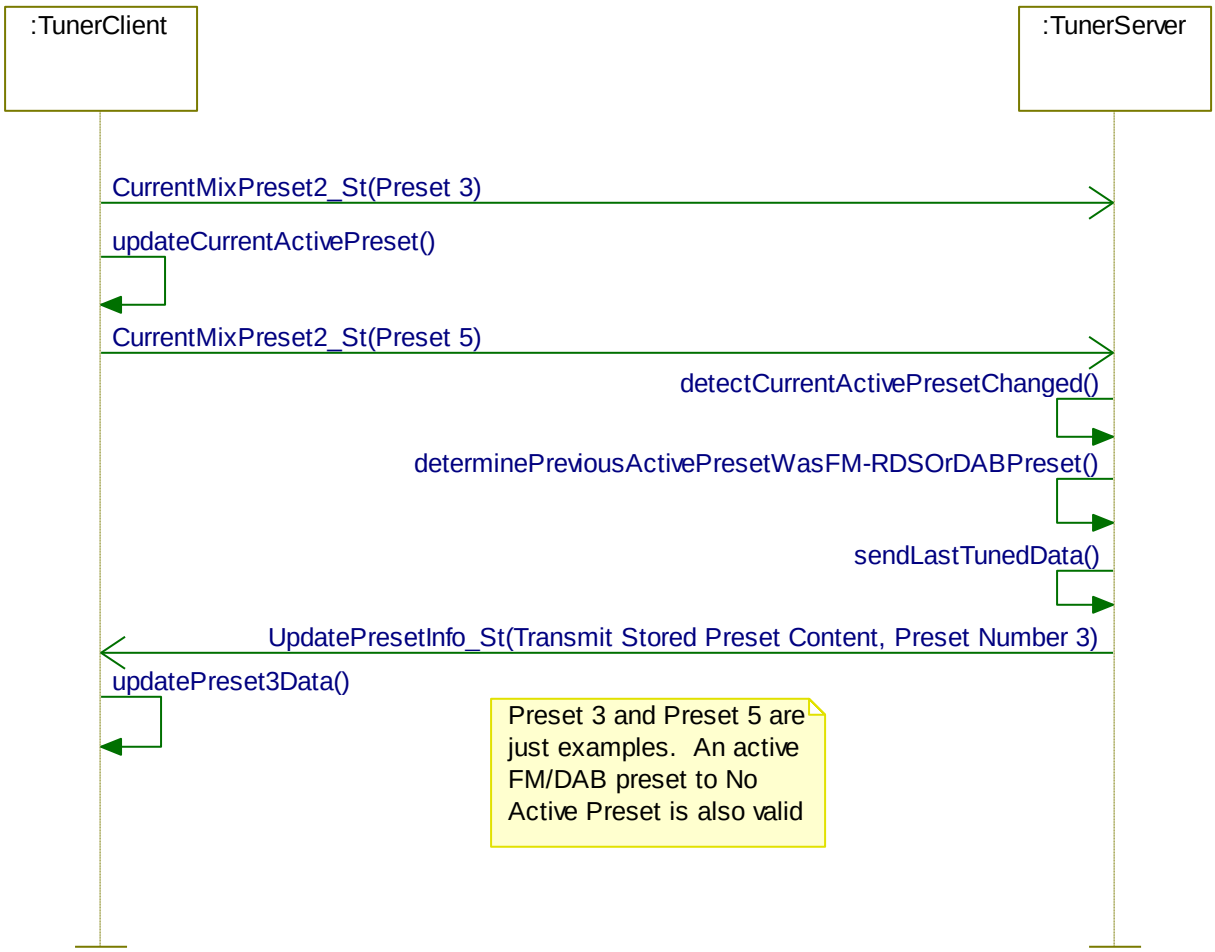
3.12.3.4 TU-SD-REQ-427637/A-Request Stored Preset Data from PAC



3.12.3.5 TU-SD-REQ-427647/A-Boot Up/Profile Change/Delete/Reorder Preset Data Exchange



3.12.3.6 TU-SD-REQ-427712/A-Current Active Preset changed and Previous Preset was FM-RDS or DAB



3.13 AMFMv2-FUN-REQ-420966/A-Browse AM/FM Tuner Station List

3.13.1 Use Cases

3.13.1.1 AMFMv2-UC-REQ-420967/A-Initiate Station List Browse

Actors	User
Pre-conditions	Infotainment System is ON. FM is granted source
Scenario Description	User selects <Browse> via HMI The user can <browse through the available stations / frequencies> via HMI.
Post-conditions	HMI will display {a list of available stations} Previously selected audio is played throughout.
List of Exception Use Cases	E1-No valid stations are available
Interfaces	G-HMI, AM/FM, CAN

3.13.1.2 AMFMv2-UC-REQ-420969/A-Station List Selection

Actors	User
Pre-conditions	Infotainment System is ON. FM is granted source Station List Browse is active.
Scenario Description	User selects <station/frequency> via HMI.
Post-conditions	AMFM Server changes to the selected station and plays user selection.
List of Exception Use Cases	NA
Interfaces	G-HMI, CAN, Audio out, A2B

3.13.1.3 AMFM-UC-REQ-023908/A-Exit Station List (TcSE ROIN-291657)

Actors	User
Pre-conditions	Infotainment System is ON. Station List is currently active on HMI.
Scenario Description	The User exits the station list via the HMI.
Post-conditions	HMI {returns to previous point}
List of Exception Use Cases	NA
Interfaces	G-HMI, AM/FM, CAN

3.13.1.4 AMFMv2-UC-REQ-420968/A-No valid stations are available

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	User selects <Browse> via HMI and no valid stations are available.
Post-conditions	HMI indicates currently tuned station/frequency
List of Exception Use Cases	NA
Interfaces	G-HMI, AM/FM, CAN

3.13.2 Requirements

3.13.2.1 AMFMv2-SR-REQ-420970/A-Browsing FM Station List

When browsing the FM Station List the HMI master shall request the Analog FM List directly. Follow AMFM-SD-433991-Browse Station List for direction on how to perform FM Station List retrieval.

3.13.2.2 AMFM-SR-REQ-434003/A-PTY List Requests Not Used

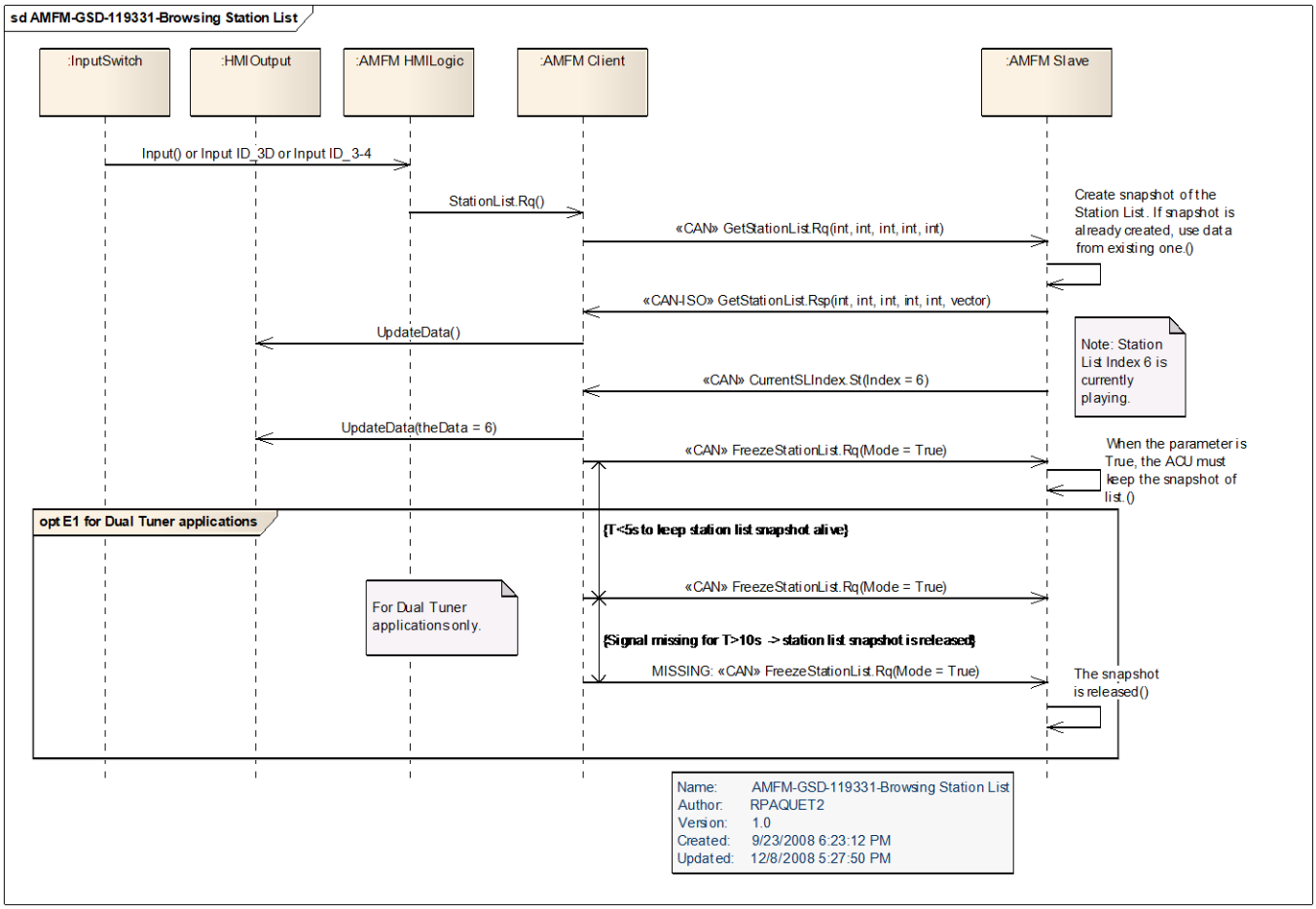
PTY lists are not available to be selected so in the GetStationList_Rq MD the following items are not used or set accordingly:

StationList value 0x5 Analog FM PTY List

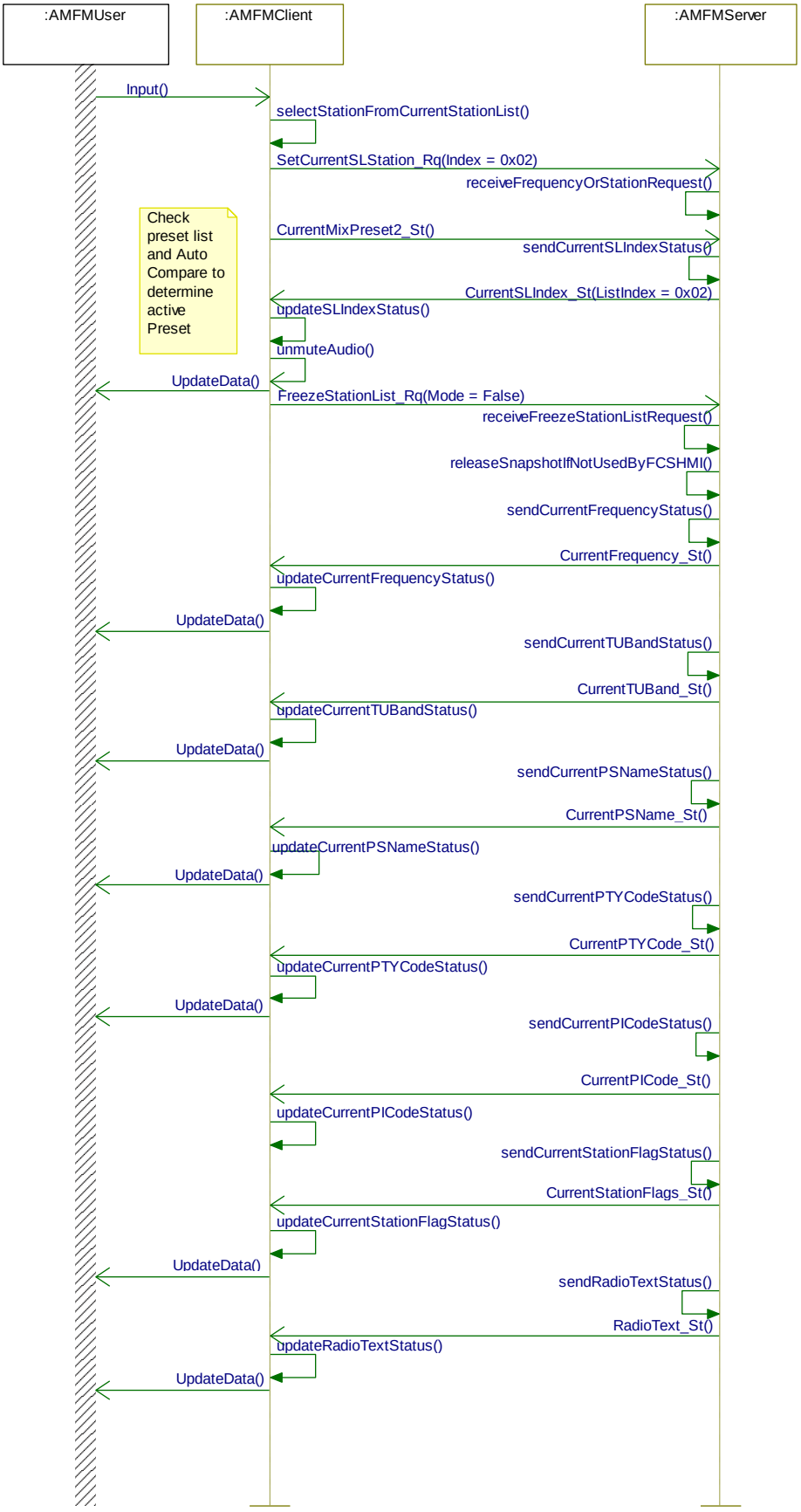
PTYCode (Shall always be set to 0x0

3.13.3 Sequence Diagrams

3.13.3.1 AMFM-SD-REQ-433991/A-Browse Station List



3.13.3.2 AMFMv2-SD-REQ-420971/A-Station List Selection



3.13.3.3 AMFM-SD-REQ-023921/A-E1-User does not select a browsed station and cancels the Station List (TcSE ROIN-200229-1)

Scenario

Scenario

Browsing Station List has been exited with no station selected.

Constraints

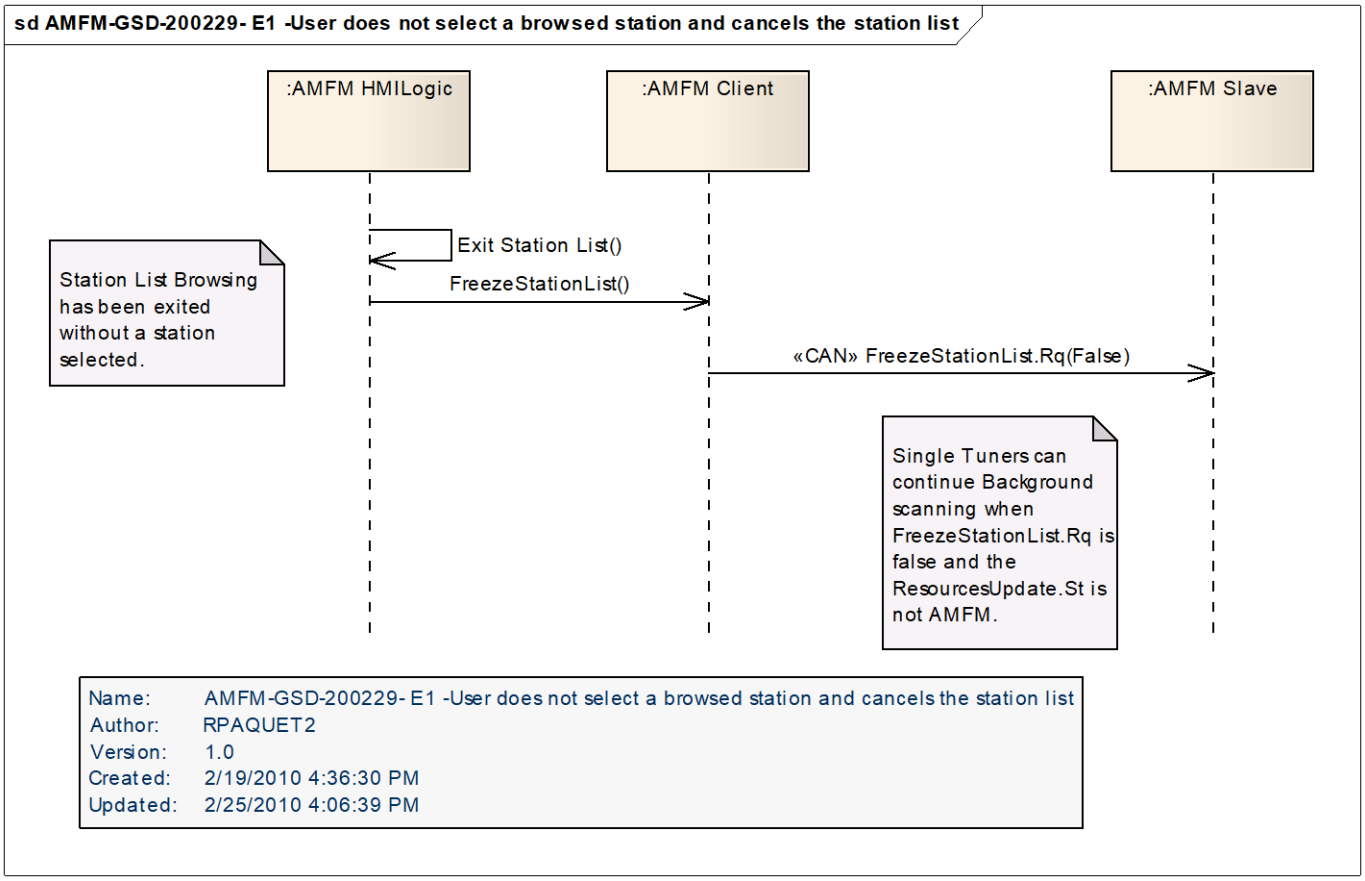
Pre-condition

Station List is being browsed.

Post-condition

The Station list is no longer being browsed.

Sequence Diagram



3.14 HDRv2-FUN-REQ-433999/A-HD Station List

3.14.1 Sequence Diagrams

3.14.1.1 HDR-SD-REQ-434001/A-Enter Station List with HD Radio stops list available

Scenario

Scenario

The user selects <All> or <HD> in the analog FM station list.

Constraints

Pre-condition

The user is in the analog FM Station list.

Pre-condition
All or HD Station list is available.

Post-condition

Sequence Diagram
Using the same Sequence Diagram as AMFM-SD-433991-Browse Station List.

3.15 HDR-FUN-REQ-023942/A-Enable/Disable HD Radio decoding function (TcSE ROIN-293275)

3.15.1 Use Cases

3.15.1.1 HDR-UC-REQ-023943/A-Enable HD radio decoding function (TcSE ROIN-291668)

Actors	User
Pre-conditions	Audio is ON. AM or FM is the source. HD radio decoding function is disabled for the selected band.
Scenario Description	The User <enables the HD radio decoding function> via the HMI for the selected AM/FM band.
Post-conditions	HD radio decoding function is persistently enabled for the selected band until disabled by the user.
List of Exception Use Cases	NA
Interfaces	G-HMI, V-HMI, CBI-HMI, CAN, AM/FM, Audio out

3.15.1.2 HDR-UC-REQ-023944/A-Disable HD radio decoding function (TcSE ROIN-291669)

Actors	User
Pre-conditions	Audio is ON. AM or FM is the source. HD radio decoding function is enabled for the selected band.
Scenario Description	The User <disables the HD radio decoding function> via the HMI for the selected AM/FM band.
Post-conditions	HD radio decoding function is disabled for the selected band.
List of Exception Use Cases	E1-HD1 decoding is active when HD decoding is disabled E2-HD2+ decoding is active when HD decoding is disabled
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM, Audio out

3.15.1.3 HDR-UC-REQ-023945/A-HD1 decoding is active when HD decoding is disabled (TcSE ROIN-291670)

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The User <disables the HD radio decoding function> via the HMI for the selected AM/FM band and HD1 decoding is active.

Post-conditions	AMFM Server blends to analog signal before disabling HD decoding.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM, Audio out

3.15.1.4 HDR-UC-REQ-023946/A-HD2+ decoding is active when HD decoding is disabled (TcSE ROIN-291671)

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The User <disables the HD radio decoding function> via the HMI for the selected AM/FM band and HD2+ decoding is active.
Post-conditions	AMFM Server shall set the HD status to OFF over the CAN bus and disable HD decoding. AMFM Server shall clear all HD data outputs via CAN. AMFM Server shall revert to the analog frequency of the current HD station that was tuned to when it received the request to disable HD. AMFM Server shall then adhere to the standard rules for R(B)DS if it is enabled.
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM, Audio out

3.15.2 Requirements

3.15.2.1 HDR-SR-REQ-023947/A-Storing last HDMode.St setting (TcSE ROIN-206015-1)

The AMFM Slave shall be responsible for storing the last known value of the HDMode.St signal for each Band. The slave shall remember the last state of the signal when leaving the band so that upon re-entering the band they can set the status to the last known value for that band.

When leaving the Band the signal value shall not change unless going to a new band with the last known value for HDMode.St being different.

The AMFM Slave shall wait to send any HD Data until they have set the HDMode.St to the new band's last known value of HDMode.St. This is required so that the AMFM Slave does not send HD Data upon entering the new band before the signal is set to Off if the last state for that band was Off. See scenario 3 below.

The AMFM Client shall monitor the HDMode.St signal and adjust the display and/or menu accordingly.

This allows the user to set HD On/Off for each Band independent of each other.

Scenario 1:
If user is in AM with HD Off and the system changes to FM the AMFM Slave shall look at the last status value for FM and set the signal accordingly. If FM HD was On then the AMFM Slave shall set the signal to On. If the system changes back to AM then the AMFM Slave shall set the signal to the last known value for AM in this case HD Off.

Scenario 2:
If user is in a source other than AM or FM and they switch to AM or FM by selecting an HD station then the AMFM Slave needs to set the HDMode.St signal to On if the signal is not already On.

Scenario 3:

If user is in FM with HD On and the system changes to AM the AMFM slave shall look at the last status value for AM and set the signal accordingly. If AM HD was Off then the AMFM Slave shall set the signal to Off and no HD Data should be shown upon entering the AM band.

Scenario 4:
If user is in a source other than AM or FM and they switch to AM or FM by selecting a new source then the AMFM Slave shall set the HDMode.St signal to the known last value for the band selected.

3.15.3 Sequence Diagrams

3.15.3.1 HDR-SD-REQ-023948/A-Select HD (TcSE ROIN-119607-2)

Scenario

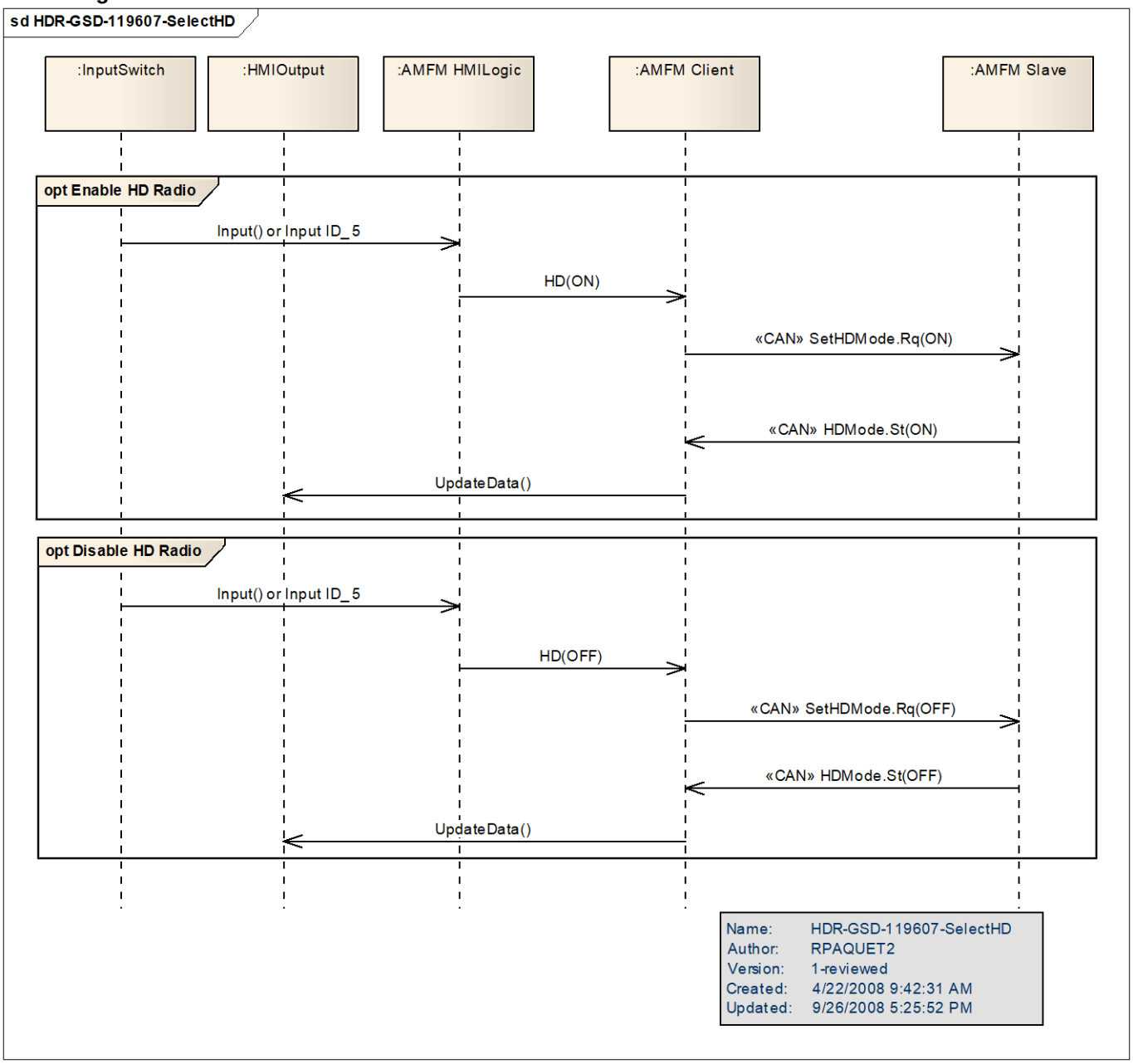
Normal Usage
The user turns HD On or Off.

Constraints

Pre-condition
HD is either On or Off.

Post-condition
HD Radio is set to the user input.

Sequence Diagram



3.16 AMFMv2-FUN-REQ-420974/A-RDS/RBDS

3.16.1 Use Cases

3.16.1.1 AMFM-UC-REQ-023950/A-Enable RBDS (TcSE ROIN-291672)

Actors	User
Pre-conditions	Audio is ON. RBDS is disabled. Infotainment System is not configured in RDS mode.

Scenario Description	The User <enables RBDS> via the HMI.
Post-conditions	RBDS function is persistently enabled until disabled by the user. HMI displays {PS and RT data fields whenever in FM mode} if available
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM

3.16.1.2 AMFM-UC-REQ-023951/A-Disable RBDS (TcSE ROIN-291673)

Actors	User
Pre-conditions	Audio is ON. RBDS is enabled. Infotainment System is not configured in RDS mode.
Scenario Description	The User <disables RBDS> via the HMI.
Post-conditions	RBDS function is disabled. HMI cancels any display of {RBDS information}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM

3.16.2 Requirements

3.16.2.1 AMFM-FUR-REQ-023952/A-RDS Latin Mapping Table (TcSE ROIN-112612-1)

Description ()
Table: Mapping from RDS Latin to Unicode UTF-16.
RDS Latin is used for PS Name, Preset Name and Radio Text.

CODE (RDS Latin)	Character	CODE (Unicode UTF-16)	Character	Comment
00…1F		0000-001F		Control characters
20	SP	0020		
21	!	0021		
22	"	0022		
23	#	0023		
24	¤	00A4		not in Latin 9
25	%	0025		
26	&	0026		
27	'	0027		
28	(	0028		
29	)	0029		

2A	*	002A		
2B	+	002B		
2C	,	002C		
2D	-	002D		
2E	.	002E		
2F	/	002F		
30	0	0030		
31	1	0031		
32	2	0032		
33	3	0033		
34	4	0034		
35	5	0035		
36	6	0036		
37	7	0037		
38	8	0038		
39	9	0039		
3A	:	003A		
3B	;	003B		
3C	<	003C		
3D	=	003D		
3E	>	003E		
3F	?	003F		
40	@	0040		
41	A	0041		
42	B	0042		
43	C	0043		
44	D	0044		
45	E	0045		
46	F	0046		
47	G	0047		
48	H	0048		
49	I	0049		
4A	J	004A		
4B	K	004B		
4C	L	004C		
4D	M	004D		
4E	N	004E		

4F	O	004F		
50	P	0050		
51	q	0051		
52	R	0052		
53	S	0053		
54	T	0054		
55	U	0055		
56	V	0056		
57	W	0057		
58	X	0058		
59	Y	0059		
5A	Z	005A		
5B	[	005B		
5C	\	005C		
5D	]	005D		
5E		00AD		not in Latin 9
5F	_	005F		
60	ll	007C	|	mapped (orig.: 01C1)
61	a	0061		
62	b	0062		
63	c	0063		
64	d	0064		
65	e	0065		
66	f	0066		
67	g	0067		
68	h	0068		
69	i	0069		
6A	j	006A		
6B	k	006B		
6C	l	006C		
6D	m	006D		
6E	n	006E		
6F	o	006F		
70	p	0070		
71	q	0071		

72	r	0072		
73	s	0073		
74	t	0074		
75	u	0075		
76	v	0076		
77	w	0077		
78	x	0078		
79	y	0079		
7A	z	007A		
7B	{	007B		
7C	|	007C		
7D	}	007D		
7E	¯	00AF		not in Latin 9
7F				Control character
80	á	00E1		
81	à	00E0		
82	é	00E9		
83	è	00E8		
84	í	00ED		
85	ì	00EC		
86	ó	00F3		
87	ò	00F2		
88	ú	00FA		
89	ù	00F9		
8A	Ñ	00D1		
8B	Ç	00C7		
8C	Ş	015E		not in Latin 9
8D	ß	00DF		
8E	İ	0130		Latin-9: A1
8F	IJ	0132		not in Latin 9
90	â	00E2		
91	ä	00E4		
92	ê	00EA		

93	ë	00EB		
94	î	00EE		
95	ï	00EF		
96	ô	00F4		
97	ö	00F6		
98	û	00FB		
99	ü	00FC		
9A	ñ	00F1		
9B	ç	00E7		
9C	ş	015F		not in Latin 9
9D	ğ	011F		not in Latin 9
9E		00AC	¬	mapped (orig. ????)
9F	ij	0133		not in Latin 9
A0	ª	00AA		
A1	α	002A	*	mapped (orig. ????)
A2	©	00A9		
A3	‰	002A	*	mapped (orig. 2030)
A4	Ğ	011E		not in Latin 9
A5	ě	011B		not in Latin 9
A6	ň	0148		not in Latin 9
A7	ő	0151		not in Latin 9
A8	π	043F	п	mapped (orig. 03C0)
A9	₹	002A	*	mapped (orig. 20A0)
AA	£	00A3		
AB	$	0024		
AC	←	00AD		mapped (orig. 2190)
AD	↑	007C	|	mapped (orig. 2191)
AE	→	00AD		mapped (orig. 2192)
AF	↓	007C	|	mapped (orig. 2193)
B0	º	00BA		
B1	¹	00B9		not in Latin 9
B2	²	00B2		
B3	³	00B3		

B4	±	00B1		
B5	İ	0130		not in Latin 9
B6	ń	0144		not in Latin 9
B7	ű	0171		not in Latin 9
B8	µ	00B5		
B9	¿	00BF		
BA	÷	00F7		
BB	°	00B0		
BC	¼	00BC		not in Latin 9
BD	½	00BD		not in Latin 9
BE	¾	00BE		not in Latin 9
BF	§	00A7		
C0	Á	00C1		
C1	À	00C0		
C2	É	00C9		
C3	È	00C8		
C4	Í	00CD		
C5	Ì	00CC		
C6	Ó	00D3		
C7	Ò	00D2		
C8	Ú	00DA		
C9	Ù	00D9		
CA	Ř	0158		not in Latin 9
CB	Č	010C		not in Latin 9
CC	Š	0160		Latin-9: A6
CD	Ž	017D		Latin-9: B4
CE	Đ	0110		not in Latin 9
CF	Ŀ	013F		not in Latin 9
D0	Â	00C2		
D1	Ä	00C4		
D2	Ê	00CA		
D3	Ë	00CB		
D4	Î	00CE		

D5	Ï	00CF		
D6	Ô	00D4		
D7	Ö	00D6		
D8	Û	00DB		
D9	Ü	00DC		
DA	ř	0159		not in Latin 9
DB	č	010D		not in Latin 9
DC	š	0161		Latin-9: A8
DD	ž	017E		Latin-9: B8
DE	đ	0111		not in Latin 9
DF	l·	0140		not in Latin 9
E0	Ã	00C3		
E1	Å	00C5		
E2	Æ	00C6		
E3	Œ	0152		Latin-9: BC
E4	ŷ	0177		not in Latin 9
E5	Ý	00DD		
E6	Õ	00D5		
E7	Ø	00D8		
E8	Þ	00DE		
E9	Ŋ	014A		not in Latin 9
EA	Ŕ	0154		not in Latin 9
EB	Ć	0106		not in Latin 9
EC	Ś	015A		not in Latin 9
ED	Ź	0179		not in Latin 9
EE	Ŧ	0166		not in Latin 9
EF	ð	00F0		
F0	ã	00E3		
F1	å	00E5		
F2	æ	00E6		
F3	œ	0153		Latin-9: BD
F4	ŵ	0175		not in Latin 9
F5	ý	00FD		

F6	õ	00F5		
F7	ø	00F8		
F8	þ	00FE		
F9	ŋ	014B		not in Latin 9
FA	ŕ	0155		not in Latin 9
FB	ć	0107		not in Latin 9
FC	ś	015B		not in Latin 9
FD	ź	017A		not in Latin 9
FE	ŧ	0167		not in Latin 9
FF				??

3.16.2.2 AMFM-FUR-REQ-023954/C-EU - RDS (TcSE ROIN-27896-3)

RDS must meet IEC 62106:2015 Specification of the radio data system (RDS).
Reference this externally controlled specification (not owned by Ford Motor Company).

The AHU shall handle both industry standard RDS strategies A and B as defined in the above referenced specification.

Any data (PI, PS, AF, TP, TA, EON, RT, PTY, CT, ECC, TMC) from the RDS bit stream shall be extracted and used to update the FM learn memory. This includes managing mapped AFs and algorithms for systematic updates.

AF's shall be checked at all times while the radio is ON. All AF checks shall be inaudible.

The tuner shall provide quality parameters (high frequency noise, adjacent channel and signal strength, multipath, IF counts and RDS bit error rate) in real time.

The tuner receiver design must be type "B" = "LEARNING RECEIVER"

Fine tuning shall be done during field testing (jury evaluation).

RDS Feature Set

The head unit should support a full RDS feature set:

RDS Feature	Comments
Program **S**ervice	Eight characters are displayed, PS name update continuously according the transmitted signal
Alternative **F**requency following	The user can disable this feature or use it manually
Traffic **P**rogram (including **E**nhanced **O**ther **N**etworks)	Display when tuned to a station supporting traffic information. An Icon should be used to indicate that it is an EON station
Traffic **A**nnouncement	When this feature is selected by the user listening is interrupted by incoming traffic announcements. A single key press can easily abort these announcements
News (PTY1)	When this feature is selected by the user listening is interrupted by incoming News announcements

	A single key press can easily abort these announcements
Emergency (PTY31)	When this feature is selected by the user listening is interrupted by incoming Alarm announcements A single key press can easily abort these announcements
Regional Following	If Regional Following is active the AHU should keep the Regional subprogram although the radio station got better reception on a different frequency. Regional follow should default turned off.

3.16.2.3 AMFM-FUR-REQ-023955/A-RBDS (TcSE ROIN-27897-1)

Radio Broadcast Data System

RBDS data shall be decoded and made from these categories;

1)	**PS - Program Service**	Shall support 8 characters
2)	**PTY - Program Type**	Shall support the 31 RBDS defined program types The AHU shall truncate any data past 22 characters.
3)	**RT - Radio Text**	Shall support 64 characters

The appearance of all indications and text shall be done by the HMI.

3.16.2.4 AMFM-FUR-REQ-233017/A-Learn Memory

FM Learn Memory

This is to optimize AF change behaviour, minimize the need for PI-seeks and support FM station list.

The FM Learn Memory is applicable for all receivable stations. All information shall be used to clearly identify the station. Specific information is contained in PI, PS, AF's (inclusive of the quality rating), TP, TA, EON, PTY, TMC, ECC, and whether or not the frequency is an RDS / RBDS station.

The FM station list, which is provided to the HMI, is a part of the FM Learn Memory. The FM Learn Memory provides all station information to the HMI so that the HMI can sort the FM list in any order and set Filter (e.g. TP)

The FM Learn Memory works independently in the background without any user interaction or knowledge. No user interrupts are allowed during radio mode. No TA attempt shall be missed during the background update in radio mode. If the AHU is switched off and RUN/ACC or Delayed/ACC is still ON, the AHU shall continuously update the AF list. .

The FM Learn Memory works if AM or other modes are the active source. All operational mutes (e.g. source change, preset change, etc) shall be use of to aquire the FM Learn Memory data to keep it as updated as possible.
After every initial battery connection the AHU shall initiate an update of the FM Learn Memory.

The FM Learn Memory shall be updated while it is not being used for other activities (e.g. Phase combining of the 2 antenna signal). The Learn Memory will be as accurate as possible while in the actual receivable station environment.

The FM Learn Memory content remains stored even if the AHU is off.

A Preset recall shall not delete the AF list of the dedicated Preset.

3.16.2.5 AMFM-FUR-REQ-024112/B-Autocompare (TcSE ROIN-27892-1)

The tuner must compare the actual tuned station / frequency with the preset memory.
The following is the indication if there is accordance;

1. In FM mode
   - RDS station: The PI code is identical
   - Non-RDS station: The frequency is identical

2. In AM mode
   - The frequency is identical

The following paragraph only applies for RDS.

If a ~~local~~ station is stored more than one time~~, the PS shall be compared. If they are identical,~~ the lowest preset number shall be selected.

~~The same behaviour also applies to all other stations but without comparing the PS.~~
The tuner shall take the AF list out from the preset memory, but it shall be ensured that the best AF applies every time.

3.16.2.6 AMFM-FUR-REQ-237460/A-FM Station name

FM Station name

The FM station name must be shown by the HMI.

After 1 Min of non-FM synchronization the AHU shall delete preset number and replace station name with the actual received frequency.

The 1 Min timer for RDS synchronization loss shall only be reset if synchronization is back for more than 20 seconds.

3.16.3 Sequence Diagrams

3.16.3.1 AMFM-SD-REQ-023956/A-Select RBDS (TcSE ROIN-111309-2)

Scenario

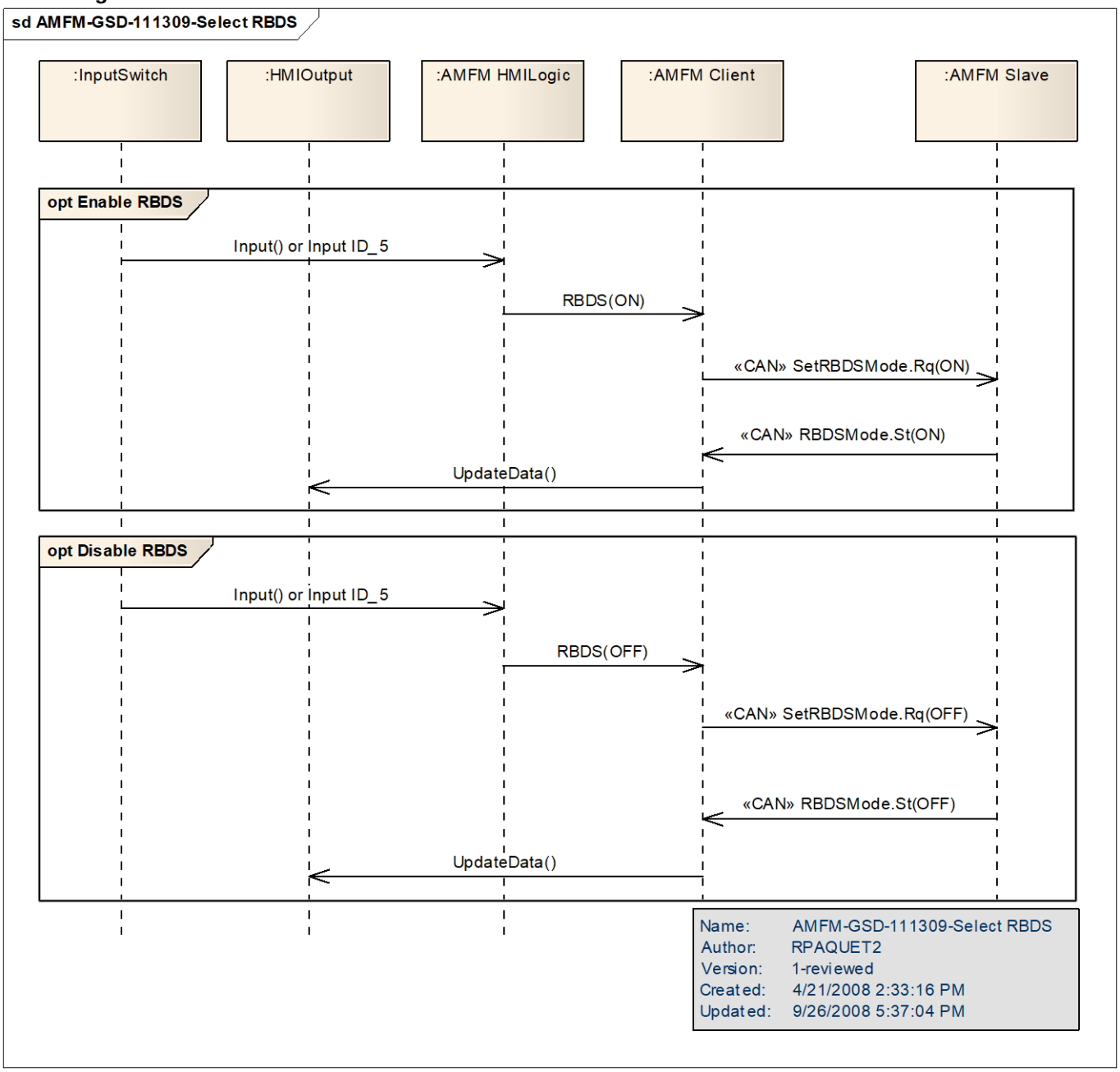
Scenario
The User turns RBDS On/Off in the options tab.

Constraints

Pre-condition
Multimedia System is ON and in AM/FM Tuner mode.

Post-condition
RBDS information is turned On or Off depending on the previous state.

Sequence Diagram



3.16.3.2 AMFM-SD-REQ-023957/A-Display PS Name (TcSE ROIN-119522-1)

Scenario

Scenario

The user is listening to FM station.

Constraints

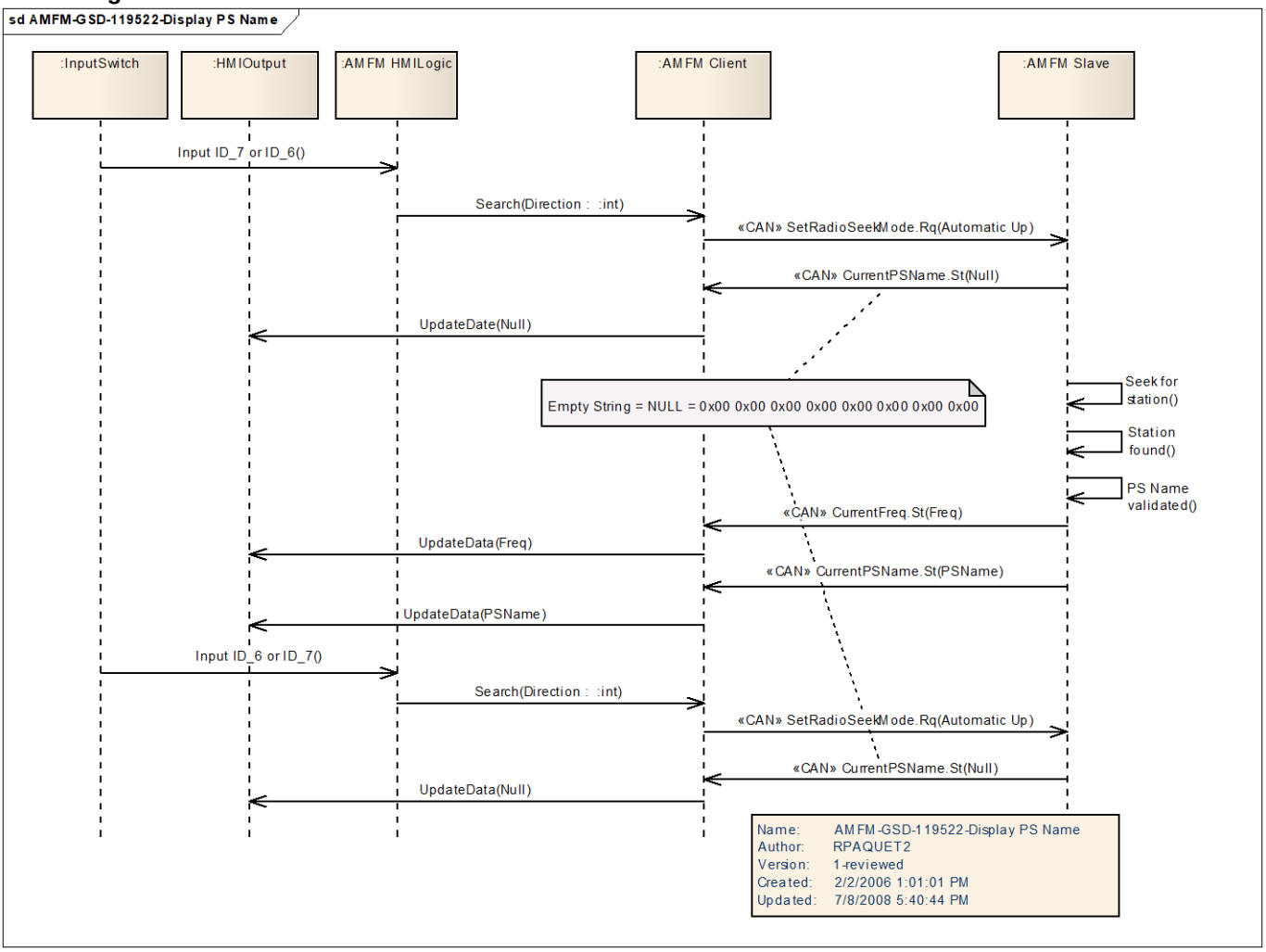
Pre-condition

The tuned station supports RDS/RBDS.

Post-condition

AM/FM Radio is seeking for a new station to show how to display PSName when a station is found.

Sequence Diagram



3.16.3.3 AMFM-SD-REQ-023958/A-Display Radio Text (TcSE ROIN-119529-1)

Scenario

Scenario

The user is listening to FM station.

Constraints

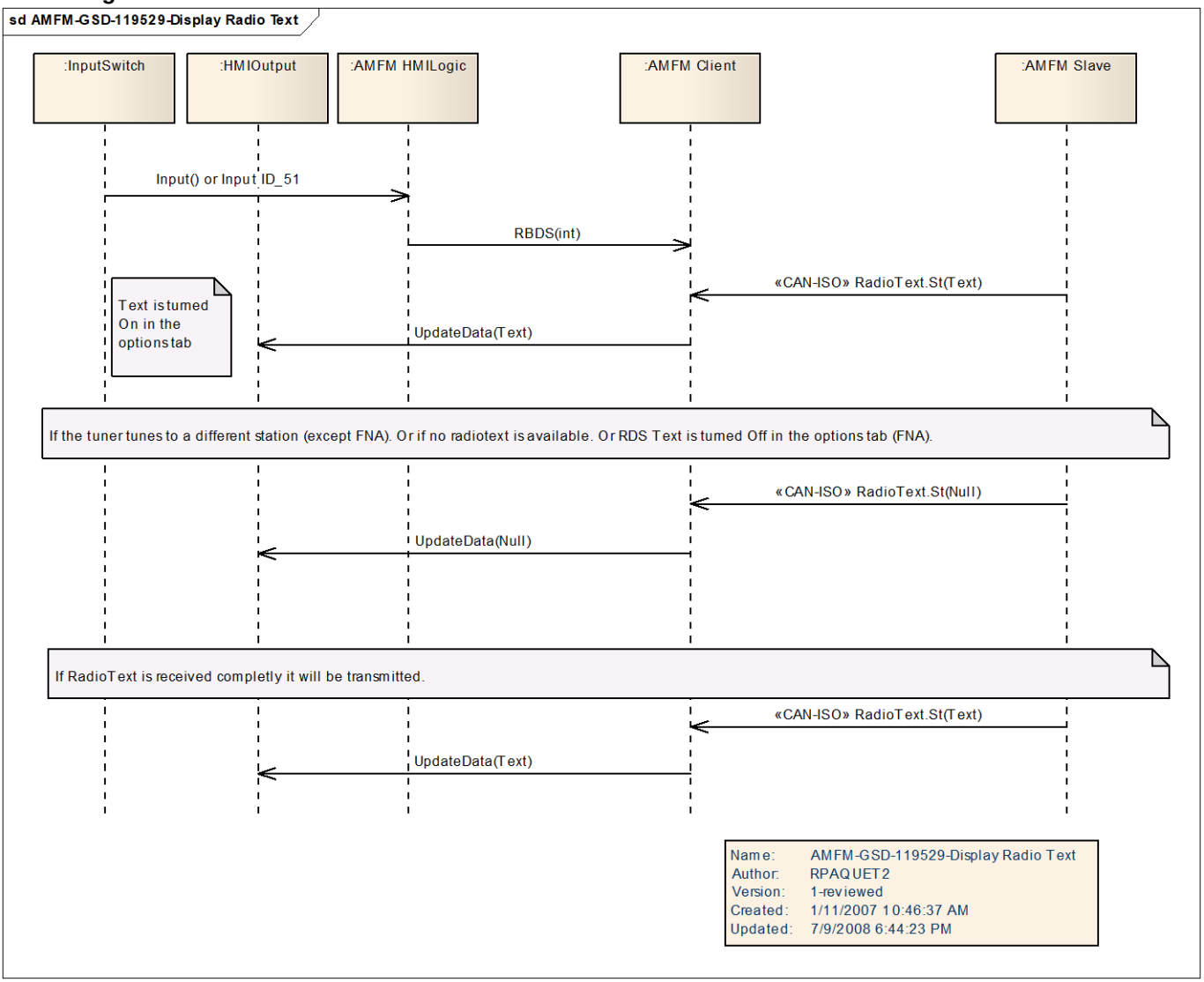
Pre-condition

The tuned station supports RDS/RBDS.

Post-condition

Radio Text is displayed.

Sequence Diagram



3.16.3.4 AMFM-SD-REQ-023959/A-Display RDS Flags (TcSE ROIN-119614-1)

Scenario

Scenario

The user is listening to AM/FM Radio (FM only in RBDS markets).

Constraints

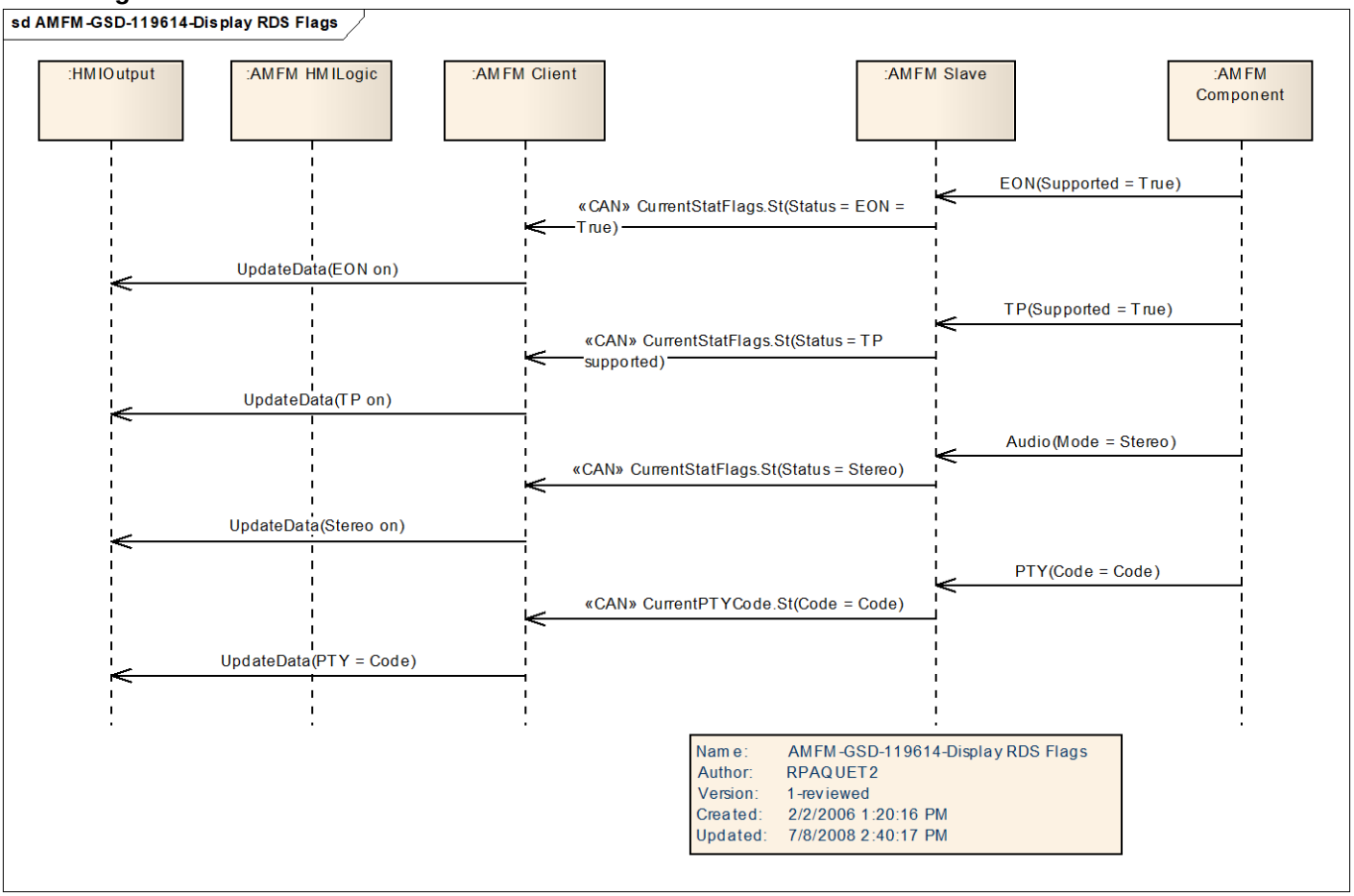
Pre-condition

The tuned station supports RDS/RBDS.

Post-condition

RDS/RBDS flags are communicated to the system.

Sequence Diagram



3.17 AMFMv2-FUN-REQ-421470/A-Traffic Announcements

3.17.1 Use Cases

3.17.1.1 AMFM-UC-REQ-023961/A-Enable (TA) Traffic Announcements (TcSE ROIN-291674)

Actors	User
Pre-conditions	Infotainment System is ON. TA is disabled. Infotainment System is configured in RDS mode.
Scenario Description	The User enables <the Traffic Announcement function> via the HMI. Note: The HMI shall provide a first surface accessible control to operate this function (e.g. hard key, permanently accessible touch screen area, etc.)
Post-conditions	Traffic Announcement function is persistently enabled until disabled by the user. HMI displays {TA indication}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM

3.17.1.2 AMFM-UC-REQ-023962/A-Disable Traffic Announcements (TcSE ROIN-291675)

Actors	User
Pre-conditions	Infotainment System is ON. TA is enabled. Infotainment System is configured in RDS mode.
Scenario Description	The User disables <the Traffic Announcement function> via the HMI.
Post-conditions	Traffic Announcement function is disabled. HMI cancels display of {TA indication}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM

3.17.1.3 AMFM-UC-REQ-023963/D-Traffic Announcement is enabled, (TP) Traffic Program Seek Initiated (TcSE ROIN-291676)

Actors	User
Pre-conditions	Audio is ON. The currently tuned station does not support traffic program. TA is not enabled. Infotainment System is configured in RDS mode.
Scenario Description	The user enables <TA> via HMI
Post-conditions	The AMFM Server will initiate a TP seek according to AMFM-FUR-REQ-023845/B-Tuner Seek (TcSE ROIN-27908-8)”Search and stay on the new TP station after a successful seek. HMI indicates TA status
List of Exception Use Cases	E1-Search is cancelled for TP Seek before it finds a valid seek stop
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM, Audio out

3.17.1.4 AMFM-UC-REQ-023965/B-Search is cancelled for TP Seek before it finds a valid seek stop (TcSE ROIN-291678)

Actors	User
Pre-conditions	Same as Normal Usage Use Case.
Scenario Description	The user enables <TA> via HMI and search is cancelled before it finds a valid seek stop.
Post-conditions	The AMFM Server will immediately revert back to the previous station it was on before the search was enabled. HMI indicates TA status
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM, Audio out

3.17.1.5 AMFM-UC-REQ-023967/A-Cancellation of TA Interrupt (TcSE ROIN-291680)

Linked Elements
TNR-REQ-038872/A-6 (TcSE ROIN-183666-2)

Actors	User
Pre-conditions	Audio is ON. There is an ongoing TA announcement. Infotainment System is configured in RDS mode.
Scenario Description	The user <cancels the announcement> via HMI. Note: This TA cancellation is just for the actual TA announcement, this will not disable the TA function.
Post-conditions	The previously used source is playing. HMI indicates {previous information}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM, Audio out

3.17.2 Requirements

3.17.2.1 TU-FUR-REQ-435238/A-EU - TA TP Traffic

TP Station

Method for selection of a FM-RDS-TP, FM-RDS-EON-TP or DAB-TP station if the TP function is active:

- The selections are always made from the permanently updated FM / DAB Learn Memory.
- During the TP selection, the HMI provides indication of the TP station to the user.
- Every automatic tuner action shall be done in the background and inaudible for the user, only a visual HMI indication is allowed.

Automatic TP SEEK

Each station change initiates the automatic TP-seek according the rules below.

Selection logic:

A) System behaviour for user selected TP stations:

User selected Radio station	System selected TP station
DAB TP station	same DAB TP station
DAB station with corresponding FM TP station	corresponding FM TP station
FM-TP station	same FM-TP station
FM-EON-TP station	same FM-EON-TP station
non TP station of a network (e.g. WDR)	strongest regional station of this network

B) System behaviour for non-TP stations and synchronization loss.

- Non-DAB-TP station selected:
  - Take the local, regional, supra-regional FM-TP station with the strongest field strength, PI code Byte 2 = (0, 3, 4-F) with the same country code as the currently selected DAB station

  - Take the FM national / international TP station with the strongest field strength, PI code Byte 2 = (1, 2) with the same country code as the currently selected DAB station
  - Receivable DAB station which supports Traffic Announcements

- Selected RDS-TP station out of A) is no longer receivable (see “Reception loss”):
  - Take the local, regional, supra-regional FM-TP station with the strongest field strength, PI code Byte 2 = (0, 3, 4-F)
  - Take the FM national / international TP station with the strongest field strength, PI code Byte 2 = (1, 2)
  - Receivable FM-TP station which supports Traffic Announcements

- Selected DAB-TP station out of A) is no longer receivable (details see “Reception loss”):
  - Take the local, regional, supra-regional FM-TP station with the strongest field strength, PI code Byte 2 = (0, 3, 4-F) with the same country code as the currently selected DAB station
  - Take the FM national / international TP station with the strongest field strength, PI code Byte 2 = (1, 2) with the same country code as the currently selected DAB station
  - Receivable DAB station which supports Traffic Announcements

Take the following priorities in case there a multiple candidates available:
- Field strength
- Reception quality
- First out of the ensemble (according the HMI selected sorting)

This prioritization shall be flexible during the development.

The automatic TP Seek shall not be active if the tunnel detection is active.

Reception loss time definition:
Reception loss is defined by 1 Min of RDS / DAB FIC synchronization loss. The 1 Min timer for RDS / DAB synchronization loss shall only be reset if synchronization is back for more than 20 seconds.

Temporary TP station:
If DAB FIC / RDS synchronisation is ok and the TP signalisation is set for temporary TP stations then conduct a TP seek. This condition may occur when a traffic station is just a temporary traffic station, e.g. some stations are Traffic designated stations during the day time (e.g. RDS-TP flag = 1) and non-Traffic stations during the night (RDS-TP flag = 0). If this happens the tuner shall search for a new traffic station according to the rules above.

TP selection by the user

The user initiated selection of a TP station is only possible in FM or DAB mode.

In FM mode:
- AHU runs out of transmitted station and shall not automatically change to a different TP program. The AHU remains tuned to the selected station.
- If the user has selected a non-TP station and activates TA, the AHU shall start with seek for a TP station in FM. The HMI shall indicate the status.
- If the user has selected a non-TP station and another source like USB, CD, etc. is selected the AHU shall initiate a TP seek in the background and the HMI shall indicate the status. By increasing changing the source back to the previous radio source the AHU shall go back to the previous selected non-TP station if still available, if no longer available (details see “Reception loss”) the AHU shall stay on the new TP station.
- If TA is active and the user selects a non-TP station manually, the AHU switches to the non-TP station and stays on the station. The HMI shall indicate the status.

In DAB mode:
- AHU runs out of transmitted station and shall not automatically change to a different TP program. The AHU remains tuned to the station selected.

- If the user has selected a non-TP station and activates TA, the AHU shall start with seek for a TP station in DAB. The HMI shall indicate the status
- If the user has selected a non-TP station and another source like USB, CD, etc. is selected the AHU shall initiate a TP seek in the background and the HMI shall indicate the status. By changing the source back to the previous radio source the AHU shall go back to the previous selected non-TP station if still available, if no longer available (details see “Reception loss”) the AHU shall stay on the new TP station.
- If TA is active and the user selects a non-TP station manually, the AHU switches to the non-TP station and stays on the station. The HMI shall indicate the status.

In AM mode no DAB tuner available:

- There is no TA function in AM mode with a single AM/FM tuner.
- With an AHU that has tuners the 2nd FM-tuner has to ensure that a TP station is available, when TA is selected by the user – according §selection logic”

In AM mode a DAB tuner is available:

- There is no TA function in AM mode with a single AM/FM tuner.
- With an AHU that has tuners the 2nd FM-tuner has to ensure that a TP station is available, when TA is selected by the user – according §selection logic”.
- In case FM cannot support TA the DAB tuner has to ensure that a TP station is available, when TA is selected by the user – according §selection logic”.

In other non-tuner modes (e.g. CD) no DAB tuner available:

- Background TA support by the AHU. Radio station switches are allowed. By switching back from the other source (e.g. CD) to tuner FM, the AHU shall switch back to the initial radio station if available. If not the station is no longer available the new TP station shall stay tuned.

In other non-tuner modes (e.g. CD) a DAB tuner is available:

- Background TA support by the AHU. Radio station switches are allowed. By switching back from the other source (e.g. CD) to tuner FM, the AHU shall switch back to the initial radio station if available. If not the station is no longer available the new TP station shall stay tuned.
- In case FM cannot support TA the DAB tuner has to ensure that a TP station is available, when TA is selected by the user.

The user initiated TP-seek is endless through the complete band (FM and DAB) until a TP station is available.

Fine tuning shall be done during field testing (jury evaluation).

3.17.2.2 TU-FUR-REQ-237462/D-TA Priority

The radio system shall support Traffic Announcements (TA) with the priority shown in the following tables. The shown DAB relation only needs to be considered by DAB variants.

FM as selected source

Selected source	Selected station type	TA-source	TA icon	Comments
FM	TP	FM	TA	FM TA ON/ OFF signalisation and audio needs to be live; TA shall be played even if the TA start was missed
	EON-TP station	FM	TA	FM EON-TA ON/ OFF signalisation and audio needs to be live TA shall be played even if the EON-TA start was missed
	non-TP station	None	TA	No TA provided
	non-TP station --> User initiated FM TP seek failed	FM	TA	No TA provided
	non-TP station --> User initiated FM TP seek successfull	FM	TA	FM EON-TA ON/ OFF signalisation and audio needs to be live TA shall be played even if the EON-TA start was missed
	non-TP station --> User initiated FM TP seek failed (only for non-DAB variants)	None	TA	No TA provided
	non-TP station --> User initiated FM TP seek failed, but DAB can support TA	DAB	TA	DAB-TA ON/ OFF signalisation and audio needs to be live TA shall be played even if the start was missed
	non-TP station --> User initiated FM TP seek and DAB BG TP seek failed	None	TA	No TA provided

AM and other non-radio sources (e.g. USB, BT-Audio, etc.) as selected source

Selected source	Last listened FM station type	TA-source	TA icon	Comments
AM or other non-radio sources (e.g. USB, BT-Audio,...)	TP	FM	TA	FM TA ON/ OFF signalisation needs to be live; TA shall be played even if the start was missed
	EON-TP station	FM	TA	
	non-TP station --> FM BG TP seek successfull	FM	TA	
	non-TP station --> FM BG TP seek failed (only for non-DAB variants)	None	TA	No TA provided
	non-TP station --> FM BG TP seek failed, but DAB can support TA	DAB	TA	DAB-TA ON/ OFF signalisation needs to be live TA shall be played even if the start was missed
	non-TP station --> FM BG TP seek failed and DAB cannot support TA	None	TA	No TA provided

DAB as selected source (only applicable for DAB variants)

Selected source	Selected station type	Audible source	FM-link station type	TA-source	TA icon	Comments
DAB	DAB-TP service or non DAB-TP service	DAB	n/a	DAB	TA	Play DAB TA live and ignore FM signalisation
		FM-link; FM ahead of DAB	TP station	FM-link with delayed audio	TA	FM TA ON/ OFF signalisation needs to be delayed
			EON-TP station	FM-link with delayed audio	TA	FM EON-TA ON/ OFF signalisation needs to be delayed
			non-TP station --> no FM BG TP	None	TA	No TA provided
		FM-link; DAB ahead of FM or unknown DAB-FM delay time	TP station	Live FM-link	TA	FM TA ON/ OFF signalisation needs to be live
			EON-TP station	Live FM-link	TA	FM EON-TA ON/ OFF signalisation needs to be live
			non-TP station --> no FM BG TP	None	TA	No TA provided
		DAB mute (no corresponding FM station available) or DAB non-TP audible	non-TP station --> FM BG TP seek	Live FM-link	TA	FM TA ON/ OFF signalisation needs to be live
			non-TP station --> FM BG TP seek	Live FM-link	TA	FM EON-TA ON/ OFF signalisation needs to be live
			non-TP station --> FM BG TP seek failed	None	TA	No TA provided

3.17.2.3 TU-FUR-REQ-421467/A-Radio Announcement while Audio States

If Audio is Off no Radio Announcement shall be sent.
If while an active Radio Announcement, Audio goes to Off, the currently active Radio Announcement shall be indicated as inactive.
As soon as Audio goes to On, and if Radio Announcment is still being broadcasted, the Radio Announcement shall be indicated as active.

Note: TA shall be prior enabled by the user.

3.17.3 Sequence Diagrams

3.17.3.1 AMFM-SD-REQ-023969/A-Select Traffic Announcements (TcSE ROIN-119421-2)

Scenario

Scenario

The user enables or disables Traffic Announcements.

Constraints

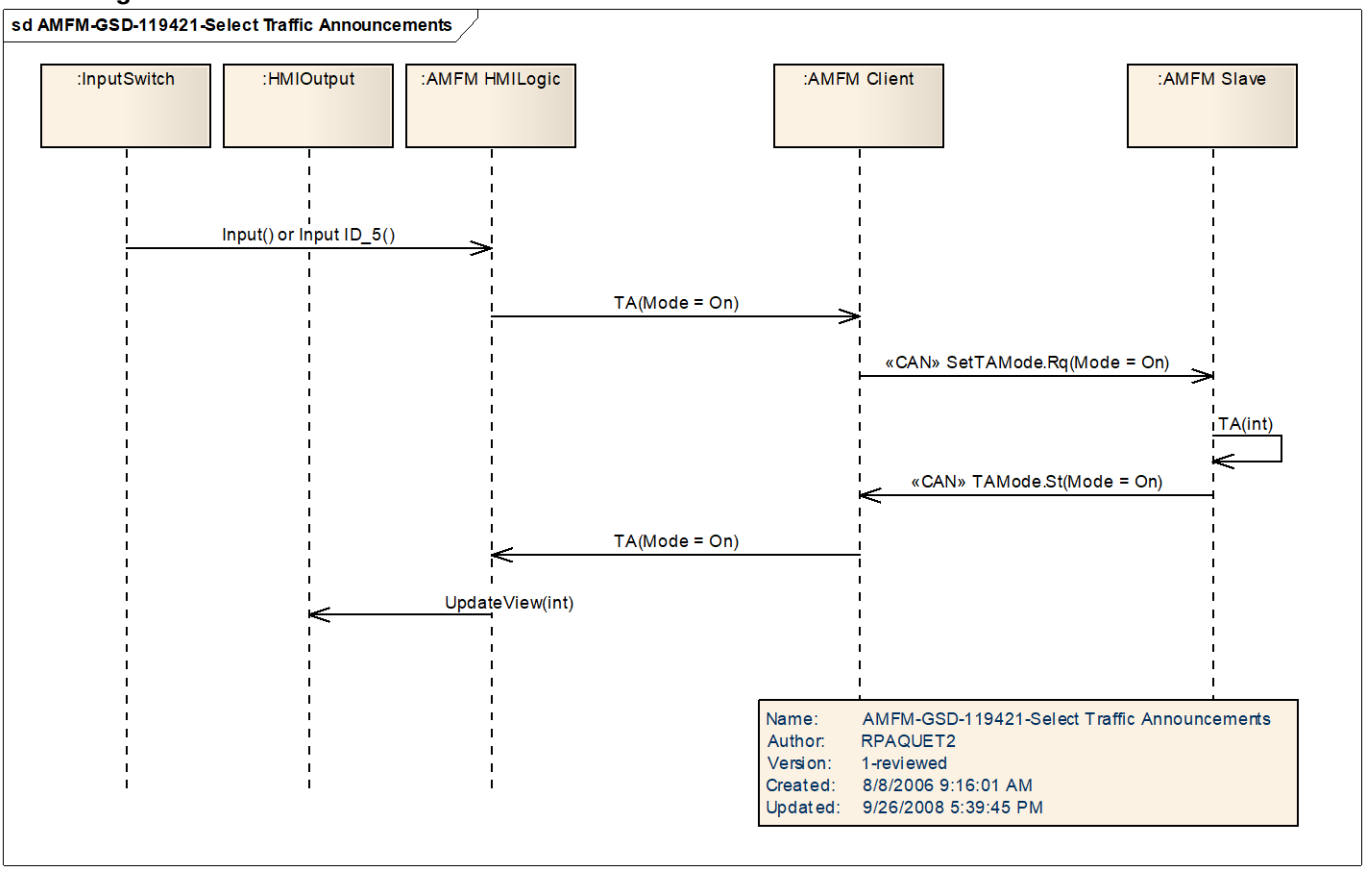
Pre-condition

The System is configured in EU Mode.

Post-condition

Traffic Announcement is either disabled or enabled depending on the user input.

Sequence Diagram



3.17.3.2 AMFM-SD-REQ-421471/A-Reception of Radio Announcement

Scenario

Scenario

There is a TA Interrupt being received.

Constraints

Pre-condition

The TA function has been switched on.

Pre-condition

The user is listening to a FM.

Post-condition

AM/FM Radio is playing, TA is active.

Sequence Diagram

3.17.3.3 AMFM-SD-REQ-421472/A-Radio Announcement Ended

Scenario

Scenario

TA Interrupt has ended.

Constraints

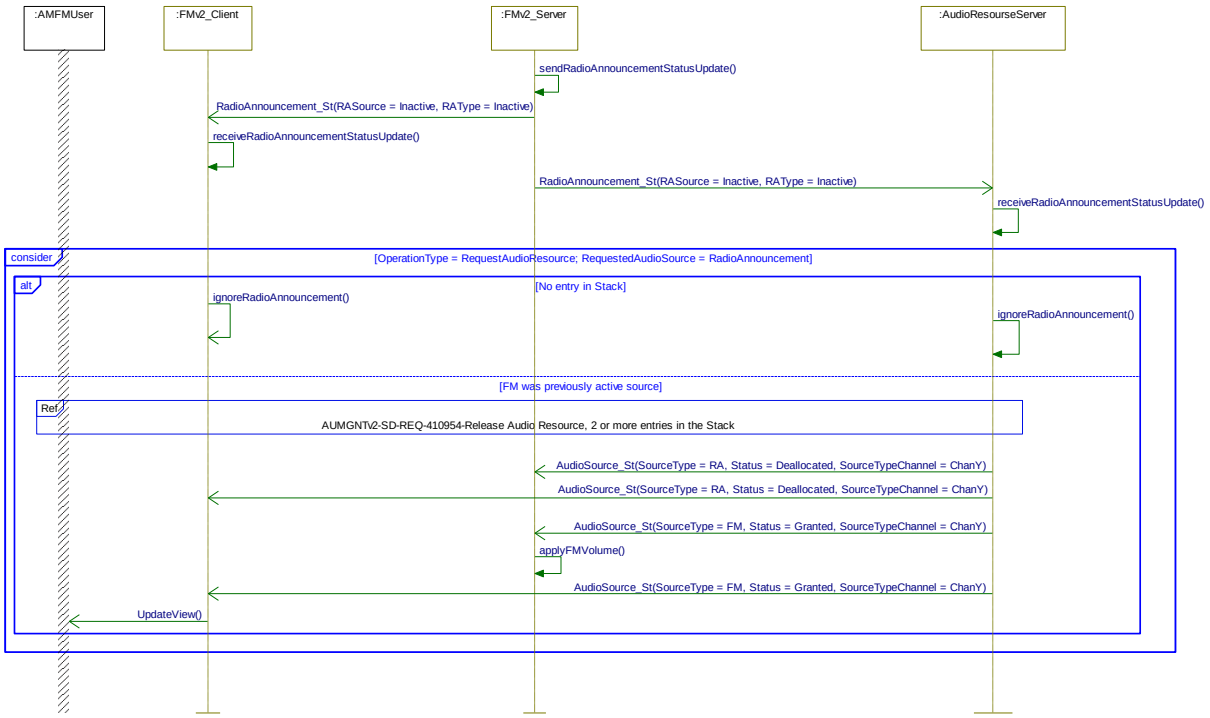
Pre-condition

The user is listening to a TA Interrupt.

Post-condition

FM is now the audio that is selected and playing.

Sequence Diagram



3.17.3.4 AMFM-SD-REQ-421473/A-Cancellation of Radio Announcement

Scenario

Scenario

The user cancels TA Interrupt before Interrupt has completed.

Constraints

Pre-condition

The user is listening to TA Interrupt.

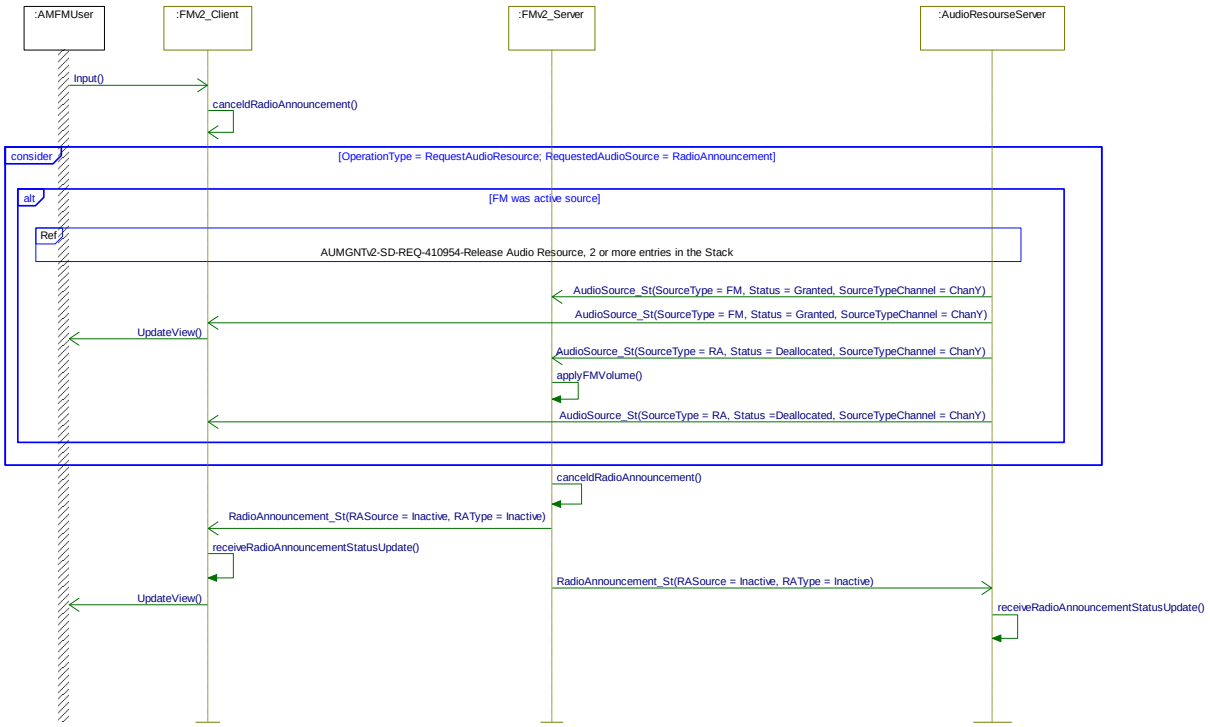
Pre-condition

FM is active source before the TA event has occurred.

Post-condition

FM audio is now the source.

Sequence Diagram



3.17.3.5 AMFM-SD-REQ-421474/A-Cancellation of Radio Announcement by Selecting Source

Scenario

Scenario

TA Interrupt is cancelled because the user has changed sources.

Constraints

Pre-condition

The user is listening to a TA Interrupt.

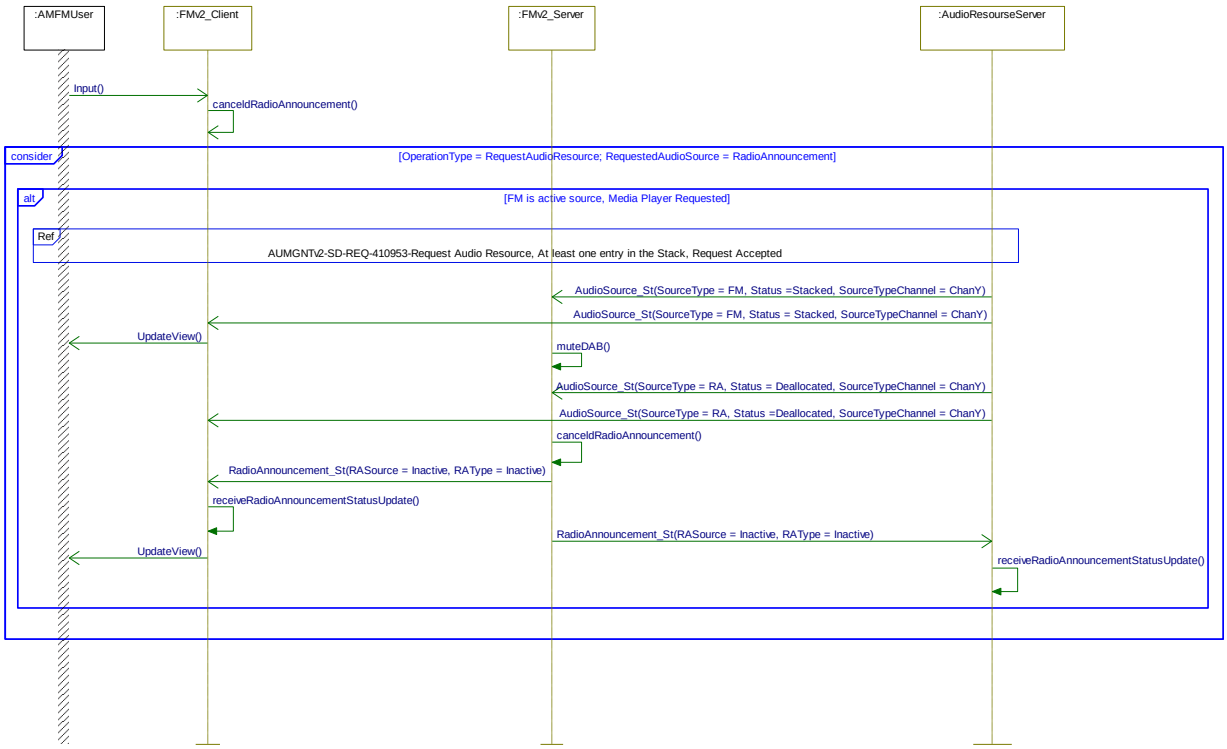
Pre-condition

FM is active source before the TA event has occurred.

Post-condition

AM/FM Radio is now the selected source.

Sequence Diagram



3.18 AMFM-FUN-REQ-435241/A-PTY News and Emergency Announcements

3.18.1 Use Cases

3.18.1.1 AMFM-UC-REQ-023975/B-Cancellation of (PTY31) Emergency broadcast alarm Interrupt - with RDS (TcSE ROIN-291681)

Actors	User
Pre-conditions	Audio is ON. There is an ongoing PTY31 announcement. Infotainment System is configured in EU mode.
Scenario Description	The user <cancels the announcement> via HMI. Note: The HMI shall provide a first surface accessible control to operate this function (e.g. hard key, permanently accessible touch screen area, etc.)
Post-conditions	The previously used source is playing. HMI indicates {previous information}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM, Audio out

3.18.1.2 AMFM-UC-REQ-023976/B-Enable PTY NEWS Announcements - with RDS (TcSE ROIN-291682)

Actors	User
Pre-conditions	Audio is ON. PTY NEWS Announcements is disabled. Infotainment System is configured in EU mode.
Scenario Description	The User enables <PTY NEWS announcement function> via the HMI.
Post-conditions	PTY NEWS announcement function is persistently enabled until disabled by the user. HMI displays {PTY NEWS announcement function enabled}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM

3.18.1.3 AMFM-UC-REQ-023977/B-Disable PTY NEWS Announcements - with RDS (TcSE ROIN-291683)

Actors	User
Pre-conditions	Audio is ON. PTY NEWS is enabled. Infotainment System is configured in EU mode.
Scenario Description	The User disables <PTY NEWS announcement function> via the HMI.
Post-conditions	PTY NEWS announcement function is disabled. HMI displays {PTY NEWS announcement function disabled}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM

3.18.1.4 AMFM-UC-REQ-023978/B-Cancellation of NEWS Interrupt - with RDS (TcSE ROIN-291684)

Actors	User
Pre-conditions	Audio is ON. There is an ongoing NEWS announcement. Infotainment System is configured in EU mode.
Scenario Description	The user <cancels the announcement> via HMI. Note: The HMI shall provide a first surface accessible control to operate this function (e.g. hard key, permanently accessible touch screen area, etc.)
Post-conditions	The previously used source is playing. HMI indicates {previous information}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, AM/FM, Audio out

3.18.2 Requirements

3.18.2.1 AMFM-FUR-REQ-023979/B-EU - PTY31 Emergency (TcSE ROIN-27915-1)

The HMI shall provide all PTY31 announcements. The PTY31 function may not be disabled, however, the HMI shall allow the user to abort the interruption notification.

PTY31 has a higher priority than TA only if the system is configured in EU Mode.

3.18.2.2 AMFM-FUR-REQ-435242/A-EU - PTY News

The user shall have the possibility to activate the NEWS function via the HMI.
The HMI shall provide all NEWS announcements if the user has activated this function and the currently selected station broadcasts NEWS information.
TA has a higher priority than NEWS.

Special behaviors for each source are described as follows:

In FM mode:

- If the vehicle drives out of range of the current transmitted station, it shall not automatically change to a different NEWS program.
- If NEWS is active and the user selects a non-NEWS station manually, the AHU shall switch to the non NEWS station and remains on the new station. The HMI shall indicate a "non NEWS-STATION" notification.
- If the user has a non-NEWS station selected and then switches the NEWS function on, the AHU does not automatically tune to a NEWS station, but it shall switch to NEWS behavior if a NEWS announcement happens.

In AM mode (only for 2 tuner solutions):

- The 2nd tuner shall continuously ensure that if the user has a NEWS station previously selected, this station is still available and if NEWS was also activated, that NEWS Announcements becomes active.
- If the vehicle drives out of range of the transmitted station, it shall not automatically change to a different NEWS program.
- If the user switches the NEWS function on while listening to AM, the 2nd tuner shall tune to the previous tuned station and switch to the NEWS behaviour if a NEWS announcement happens, however the 2nd tuner shall not automatically tune to a NEWS station.

In any other mode (e.g. CD):

- The AHU shall continuously ensure that if the user has a NEWS station previously selected, this station is still available and if NEWS was also activated, that NEWS Announcements becomes active.
- If the vehicle drives out of range of the transmitted station, it shall not automatically change to a different NEWS program.
- If the user switches the NEWS function on while listening to another source (e.g. CD), the AHU shall tune to the previous tuned station, and switch to the NEWS behaviour if a NEWS announcement happens, but the AHU shall not automatically tune to a NEWS station.

Fine tuning shall be done cooperatively with the supplier and Ford engineering during the field test (jury evaluation).

3.18.3 Sequence Diagrams

3.18.3.1 AMFM-SD-REQ-023981/A-Select PTY News Announcement (TcSE ROIN-119442-2)

Scenario

Scenario

The user is turning the PTY News Announcement On or Off.

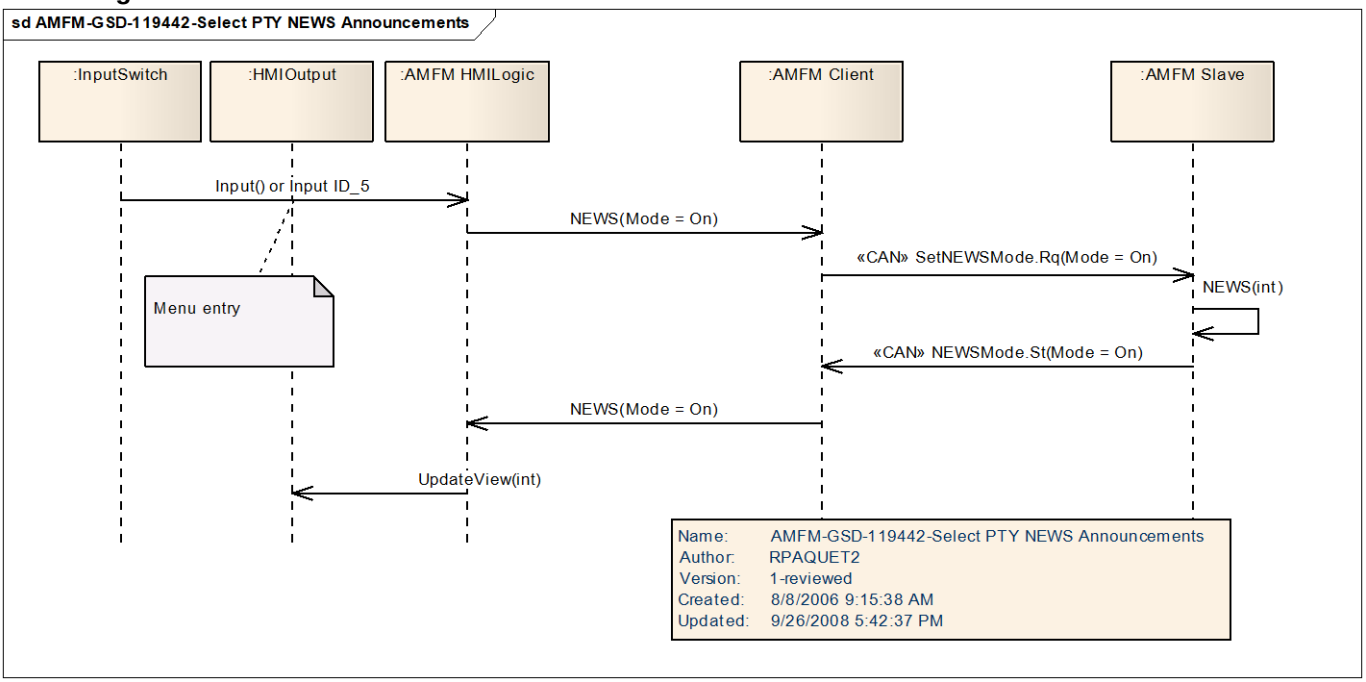
Constraints

Pre-condition

PTY News Announcement is either On or Off.

Post-condition
PTY News Announcement is set to the users selection.

Sequence Diagram



3.19 AMFM-FUN-REQ-435243/A-AF Mode

3.19.1 Use Cases

3.19.1.1 AMFM-UC-REQ-023983/A-Enable AF Mode - with RDS (TcSE ROIN-291685)

Actors	User
Pre-conditions	Infotainment System is ON. AF function is OFF. Radio is the source. Infotainment System is configured in RDS mode.
Scenario Description	The user enables <AF mode> via HMI.
Post-conditions	AF function is enabled persistently HMI displays {AF function enabled}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.19.1.2 AMFM-UC-REQ-023984/A-Disable AF Mode - with RDS (TcSE ROIN-291686)

Actors	User

Pre-conditions	Infotainment System is ON. AF function is ON. Radio is the source. Infotainment System is configured in RDS mode.
Scenario Description	The user disables <AF mode> via HMI.
Post-conditions	AF function is disabled persistently HMI displays {AF function disabled}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.19.2 Requirements

3.19.2.1 AMFM-FUR-REQ-435244/B-EU - AF Strategy

The HMI shall allow the customer to select the AF to be "ON" or "OFF" so that the customer may turn off this function. HMI shall indicate the AF status.

In the case of the AF function previously being switched off manually by the customer in the last key off state, when the AHU starts up from a key cycle the HMI shall indicate that the AF is OFF for $\mathbf{T_{\_AF\_TURNON}}$ seconds.

AF Strategy

The AF check process shall be unnoticeable to the listener. Each AF check forces the audio to be muted. This shall occur fast enough that the mute is inaudible to the customer. An AF check occurs if the frequency needs to be confirmed for a PI.

For systems with more than 1 tuner, every AF check / verification shall be inaudible.
When using RDS Method A, the tuner shall not lose the station network. With Method A and B the AF list shall be retained.

The AHU shall not provide any AF jump to the HMI.

The software of the AF strategy shall be flexible until it is confirmed in a field test (jury evaluation) and final adjustments made.

AF purge time behaviour

The overall AF strategy is dependent on the signal quality and the audio quality performance of the receiver. Due to these variables it is not possible to define a specific objective value for all proper AF purge time behavior so the AHU must judge between a complex signal quality of the frequency and the dedicated AF's. A subjective good audible feedback is the target per Ford engineering approval.

The best AF with the best quality shall be selected direct after power on each time.
The following requirements shall be fulfilled;

Dual tuner systems

- No audible AF switch
- No incorrect modulation (it shall be ensured that just a secured AF is chosen)
- Unnoticeable AF update in the background
  It is not allowed to interrupt a TA with an AF change
  (AF may quickly switch inaudibly only to verify AF's with common PI, also with Regional stations)
- Only unnoticeable actions are allowed
- No AF switch to frequencies with subjective worse Quality

Single tuner systems

- Min. audible/muted AF switch
- Incorrect modulation minimized by first performing PI code verification muted, (it shall be ensured that just a secured AF is chosen)
- Actual sampling shall be unnoticeable in the background
- It is not allowed to interrupt a TA with an AF change
- (AF may quickly switch inaudibly only to verify AF's with common PI, also with Regional stations)
- Best AF switch to frequencies with subjective best Quality

Fine tuning shall be done during development via jury evaluation (AHU field test), targeting the best in class AF strategy.

Extraction of RDS data and updating of AF lists

If during an AF check the AHU identifies a PI code different from the desired one, the AF list shall be updated accordingly. The frequency shall be purged for the desired PI code and shall be entered into the AF table as a valid AF for the new PI code.

Systematic update of AF lists during PI-SEEK

During PI-SEEK the AHU effectively checks every single frequency point of the FM band until the desired PI code has been found with a reasonable audible quality.
Every seek stop on a frequency carrying an undesired PI code shall be used to update the AF table as described under Extraction of RDS data and updating of AF lists for all receivable PI codes and AF's.

Systematic update of AF lists during non-FM mode (AM, CD, Aux etc.) and VOL=0 (or mute condition)

- Single tuner

A strategy shall be applied to reflect the currently receivable stations as entries in the AF table – as much as this is possible with a single tuner AHU.
This does NOT mean a continuous sweep through the FM band.

- Dual tuner

Additional to the single tuner behavior, the AHU shall update the FM PI/AF list continuously during AM mode.

Systematic update of AF lists during power OFF (ignition ON)

See Systematic update of AF lists during non-FM mode for overall performance with the following exception. As the AHU is switched off here, there are no limitations imposed by single tuner or TA standby operation.

Systematic update of AF lists once after power OFF (ignition OFF)

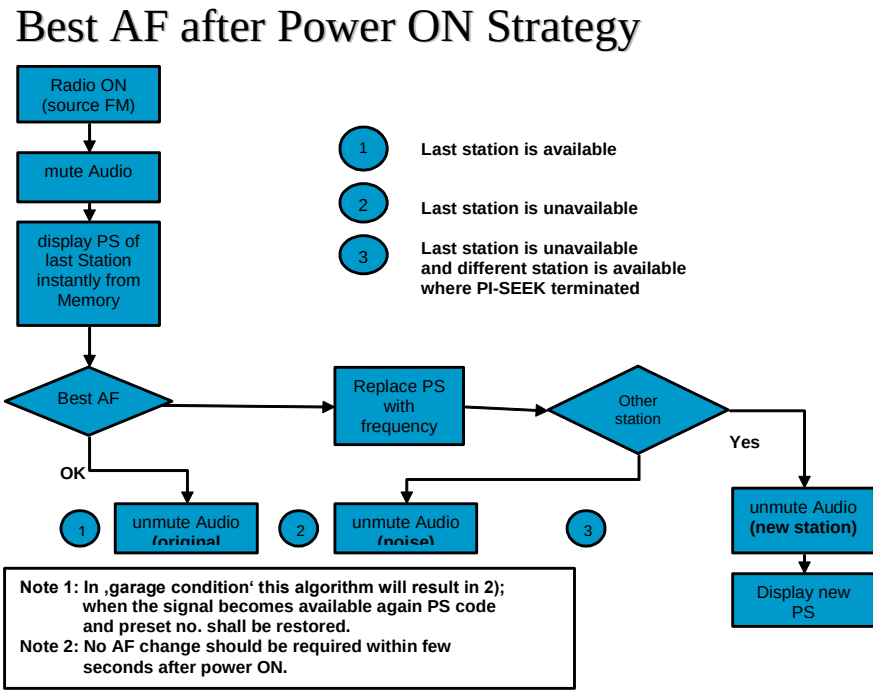
After power off, the AHU shall scan one complete cycle through the entire FM band. The AF table shall be updated as described under Extraction of RDS data and updating of AF lists.
While this operation is carried out the active antenna on the vehicle shall be ON (controlled by the AHU).
Garage detection is required (to avoid purging all AF if no station can be received at all). If a garage condition is detected, the AF lists shall not be updated. Garage detection strategy needs to be agreed upon by the supplier and Ford engineering. E.g. loss of signal strength on the whole frequency band.

Best AF @ power ON

After power on (use the first available trigger, first door unlock then power on by the user) the AHU must update the AF list to find the best frequency.

When no AHU station is found after checking the stored AF's, the AHU must stay on the last used frequency.

If Garage detection becomes valid, the AHU must stay on the Frequency when the AHU was powered off.



AHU wake up with CAN wake up or 10 min. mode after run

The AHU must wake up as soon as the CAN is awake, for example, upon receipt of a CAN message stating that the door is open or unlocking the door. The HMI display must stay off. The AHU must check AF table. With power on and key on, the HMI must come up and the AF check needs to be aborted. If no frequency was detected with better reception quality, the AHU must come back with the last used frequency.

Priority: Latest used Station
Preset
PI table

AF switch hold off

To avoid unnecessary AF switches, which can cause a bad AF or a mute, the AHU must stay on the current valid frequency until an AF with better audible quality is available. The complex reception quality measurement shall be used to evaluate the best AF.

AF Quality threshold

To avoid inaudible AHU stations with bad quality rating, the AHU should not have a threshold parameter specified, which denies the tuner to switch to a better quality rated AF

AF sound quality

A strong station is not necessarily a good one. The AHU must choose the best AF with the best complex reception quality; frequency noise, adjacent channel, co-channel and Multipath.

RDS data availability for name display

PS name needs to be made available to the HMI via the CAN bus.

3.19.2.2 AMFM-FUR-REQ-023986/A-EU - PI Strategy (TcSE ROIN-27902-1)

PI Behavior

PI seek

The PI seek shall be initiated after the AF scan for the last used Station failed. A PI seek shall be initiated from the initial stored Frequency of the Preset.

During PI Seek all available information shall be used to update the FM Learn Memory.

PI detection

When the AHU can't detect a PI code during an AF check on a strong signal, the AHU must check this AF again after **$T_{\_AF}$** seconds.

Fine tuning shall be done during field test (jury evaluation).

3.19.3 Sequence Diagrams

3.19.3.1 AMFM-SD-REQ-023987/A-Select AF Mode (TcSE ROIN-119449-2)

Scenario

Scenario

The user wants to turn AF Mode On or Off.

Constraints

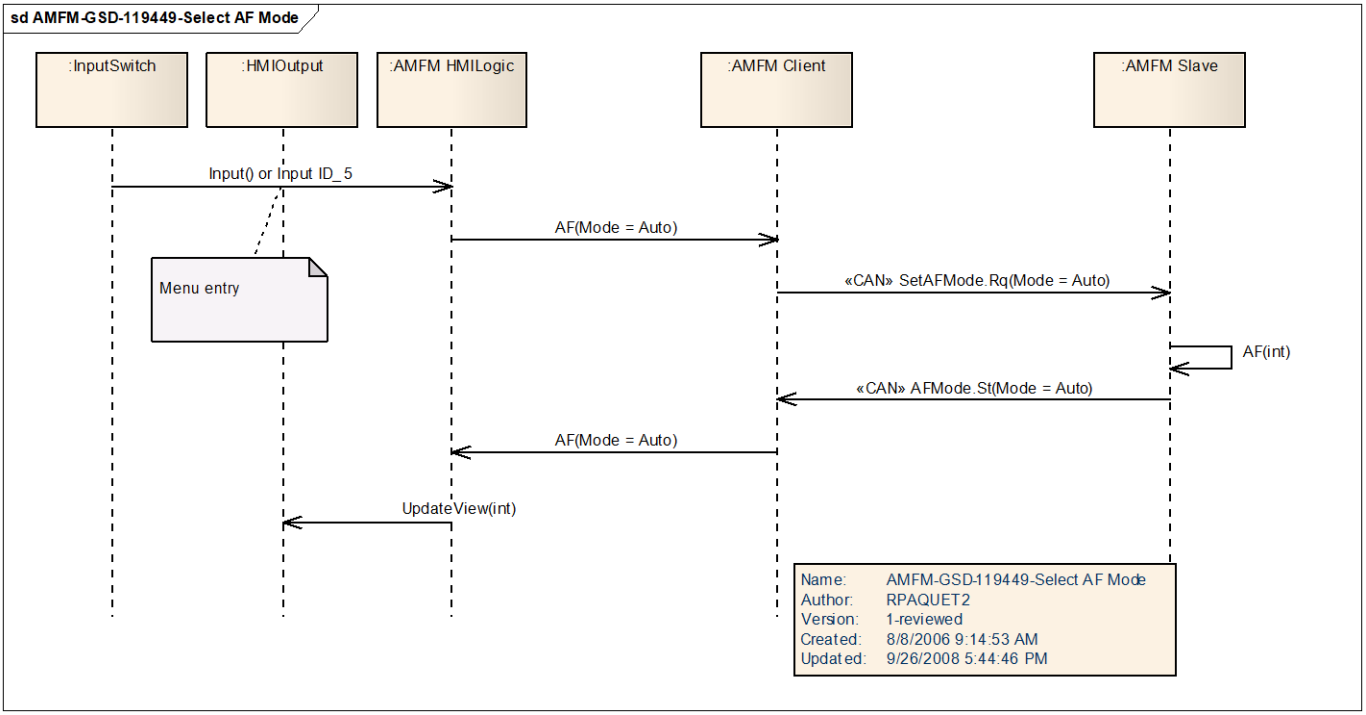
Pre-condition

AF Mode is either On or Off.

Post-condition

AF Mode is set based on the user input.

Sequence Diagram



3.20 AMFM-FUN-REQ-023988/B-Regional Mode (TcSE ROIN-293299)

3.20.1 Use Cases

3.20.1.1 AMFM-UC-REQ-023989/C-Enable Regional Mode (TcSE ROIN-291687)

Actors	User
Pre-conditions	Infotainment System is ON. Regional Mode function is OFF. Radio is the source. Infotainment System is configured in RDS mode.
Scenario Description	The enables <regional mode> via HMI. This setting is a used globally for FM and DAB if DAB is equipped.
Post-conditions	Regional Mode function is disabled persistently HMI displays {Regional Mode function disabled}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.20.1.2 AMFM-UC-REQ-023990/C-Disable Regional Mode (TcSE ROIN-291688)

Actors	User
Pre-conditions	Infotainment System is ON. Regional Mode function is ON. Radio is the source. Infotainment System is configured in RDS mode.
Scenario Description	The user disables <Regional mode> via HMI. This setting is a used globally for FM and DAB if DAB is equipped.
Post-conditions	Regional Mode function is disabled persistently HMI displays {Regional Mode function disabled}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.20.2 Requirements

3.20.2.1 AMFM-FUR-REQ-024114/B-EU - Regional Mode (TcSE ROIN-27900-2)

AHU default is to have the Regional mode ON.

Regional Mode shall be designed to meet IEC 62106:2015 Specification of the radio data system (RDS).
Reference this externally controlled specification (not owned by Ford Motor Company).

Regional Mode On
Regional switching is disabled; assume programming is different - No switching between regions.
One exception is if the AHU has done a modulation comparison and the result is that both stations have the same modulation.

Regional Mode Off
Regional switching is possible assume programming is the same - Allow AF switching.

In order to cut down on confusion, since it is unlikely that most users are unaware of how all this works, the REGIONAL MODE ON state is normally the default setting. In this case the AHU shall not appear to randomly switch to another station at various times.

Regional Mode Preset
The Regional Mode status shall be selected via HMI. It stays either on or off. The Regional mode shall not be stored on a dedicated Preset.
If the radio station was stored as a Regional Program on a Preset, the PS name needs to be updated as soon as the Regional information disappears. The AHU is allowed to change the Preset Number when the Regional information in the PI code changes.

Fine tuning shall be done during field test (jury evaluation).

3.20.3 Sequence Diagrams

3.20.3.1 AMFM-SD-REQ-023991/A-Select Regional Mode (TcSE ROIN-119463-2)

Scenario

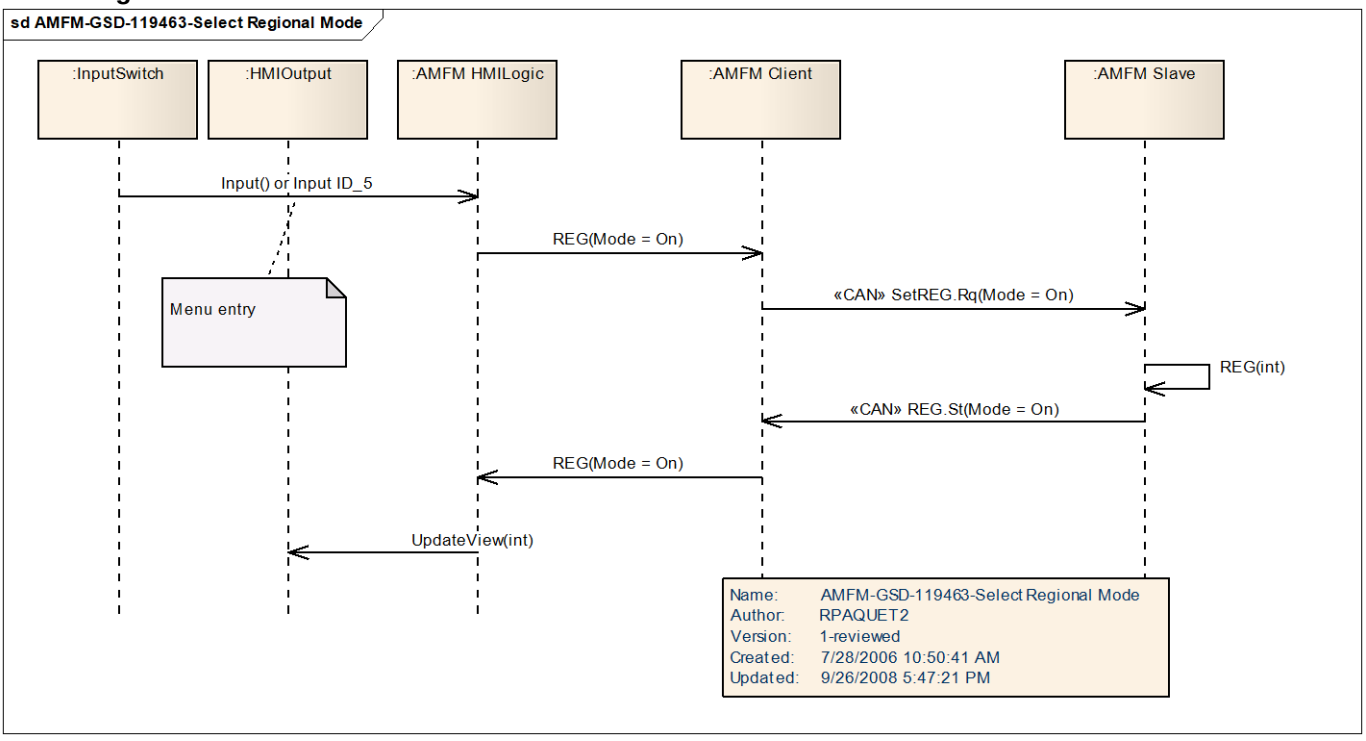
Scenario
The Regional Mode is set to either On or Off.

Constraints

Pre-condition
Regional Mode is either On or Off.

Post-condition
Regional Mode is set to the user input.

Sequence Diagram



3.21 AMFM-FUN-REQ-111070/A-Alternative frequency jump

3.21.1 Use Cases

3.21.1.1 AMFM-UC-REQ-107186/B-Activate AF Jump

Actors	AMFM System
Pre-conditions	Multimedia system is On. AMFM radio is the active audio source. AFJump is deactivated.
Scenario Description	The AMFM system activates the alternative frequency jump.
Post-conditions	AFJump is activated.
List of Exception Use Cases	
Interfaces	G-HMI, CAN

3.21.1.2 AMFM-UC-REQ-107187/B-Deactivate AF Jump

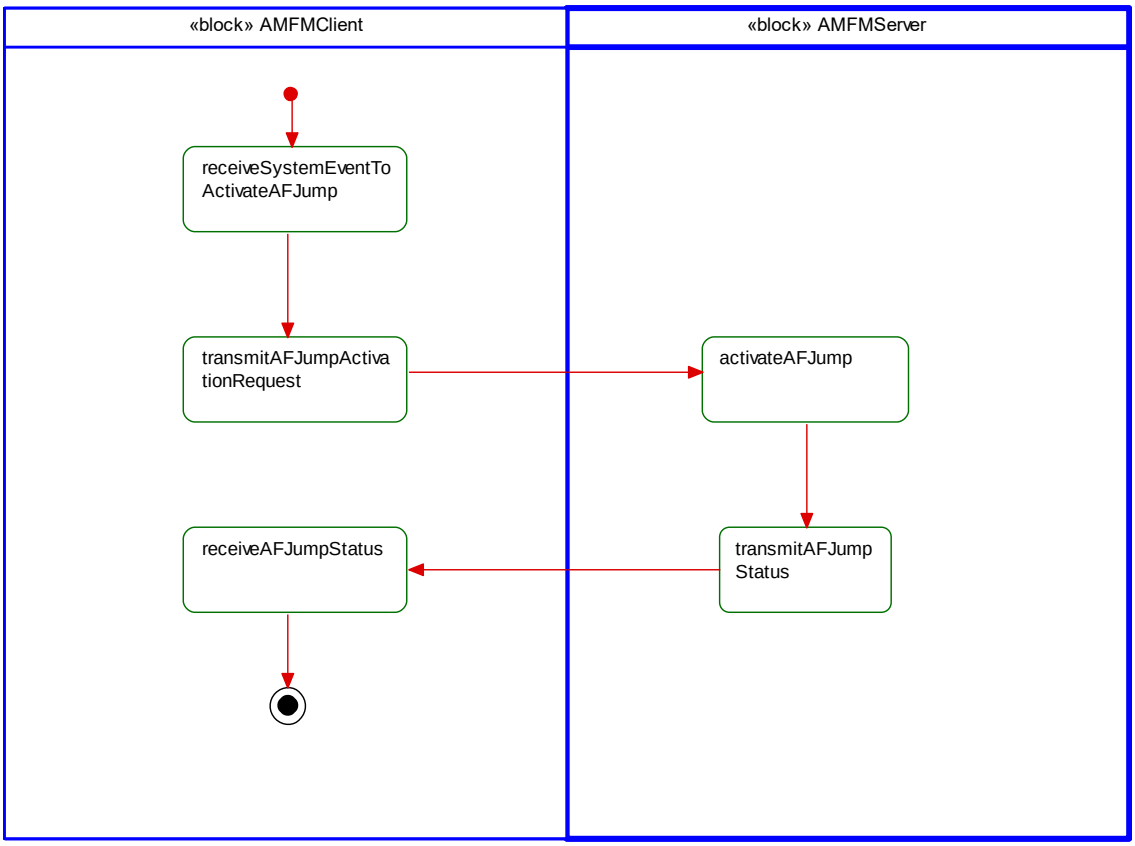
Actors	AMFM System
Pre-conditions	Multimedia system is On. AMFM radio is the active audio source. AFJump is activated.
Scenario Description	The AMFM system deactivates the alternative frequency jump.
Post-conditions	AFJump is deactivated.
List of Exception Use Cases	
Interfaces	G-HMI, CAN

3.21.2 Requirements

3.21.3 Activity Diagrams

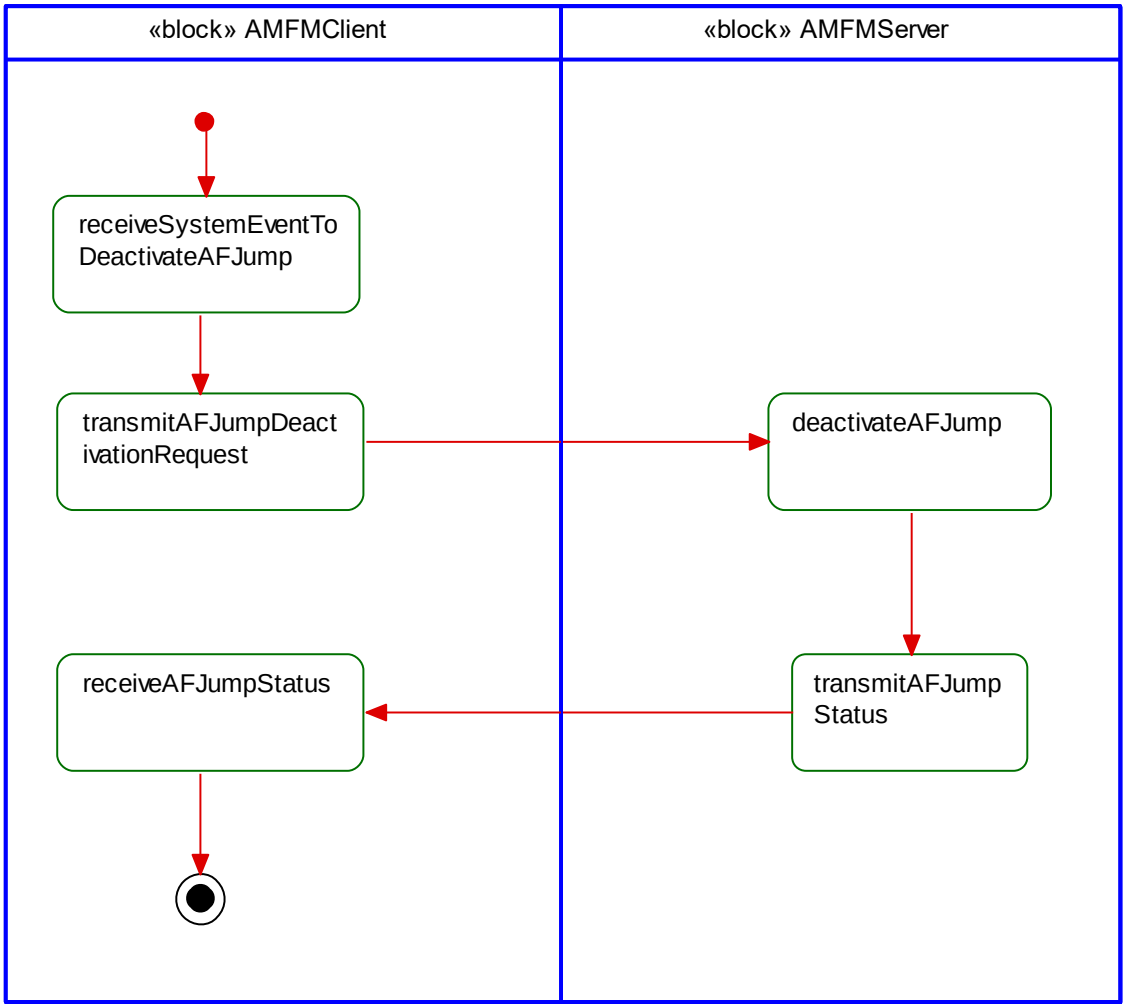
3.21.3.1 AMFM-ACT-REQ-111015/A-Activate AF Jump

Activity Diagram



3.21.3.2 AMFM-ACT-REQ-111016/A-Deactivate AF Jump

Activity Diagram



3.21.4 Sequence Diagrams

3.21.4.1 AMFM-SD-REQ-107190/A-Activate AFJump

Scenario

The AMFM System activates the alternative frequency jump function.

Constraints

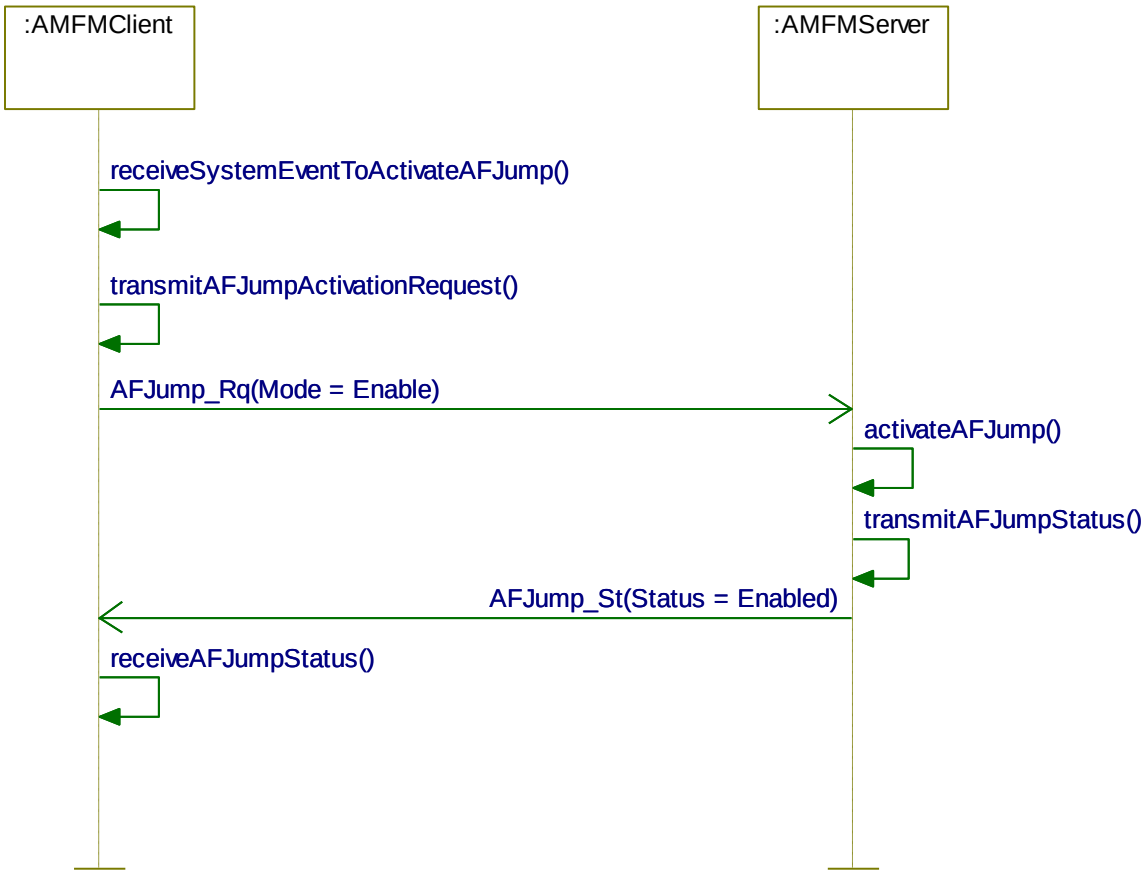
Pre-condition

AFJump is deactivated.

Post-condition

AFJump is activated.

Sequence Diagram



3.21.4.2 AMFM-SD-REQ-107191/A-Deactivate AFJump

Scenario

The AMFM System deactivates the alternative frequency jump function.

Constraints

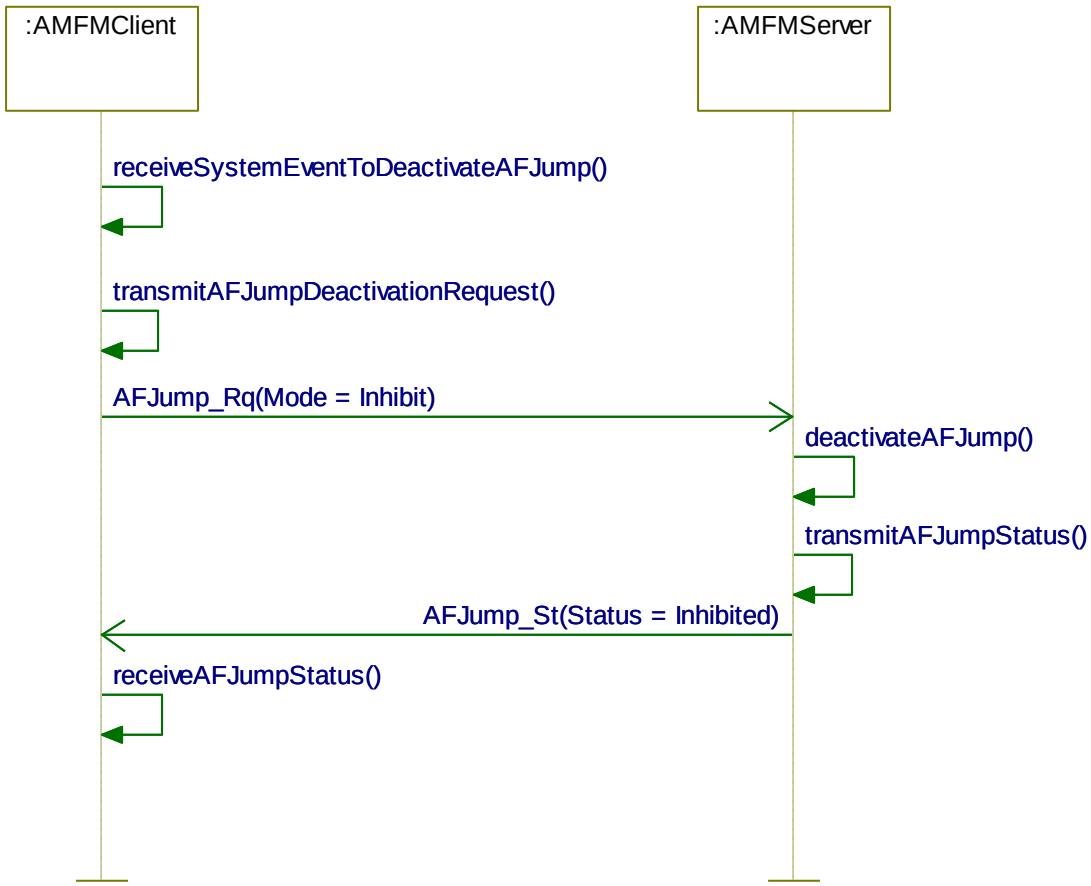
Pre-condition

AFJump is activated.

Post-condition

AFJump is deactivated.

Sequence Diagram



3.22 AMFM-FUN-REQ-326113/A-RDS RadioText

3.22.1 Use Cases

3.22.1.1 AMFM-UC-REQ-326114/A-Enable RDS RadioText

Actors	User
Pre-conditions	Infotainment System is ON. RadioText is OFF. Radio is the source. Infotainment System is configured in RDS mode.
Scenario Description	The user enables <RadioText> via HMI. This setting is independently used for FM and DAB; if DAB is equipped.
Post-conditions	RadioText is enabled persistently HMI displays {RDS RadioText content}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.22.1.2 AMFM-UC-REQ-326115/A-Disable RDS RadioText

Actors	User
Pre-conditions	Infotainment System is ON. RadioText is ON. Radio is the source. Infotainment System is configured in RDS mode.
Scenario Description	The user disables <RadioText> via HMI. This setting is independently used for FM and DAB; if DAB is equipped.
Post-conditions	RadioText is disabled persistently HMI displays {Regional Mode function disabled}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.22.2 Requirements

3.22.2.1 AMFM-FUR-REQ-326116/A-RDS RadioText

The AHU shall provide the RDS/RBDS RadioText (RT) data of the currently tuned station to the HMI.

RDS/RBDS RadioText (RT) content will be displayed according HMI specification.

RDS/RBDS RadioText (RT) content will be supported only for the currently tuned station.
The setting for RDS/RBDS RadioText (RT) must be independent from other data supporting settings like e.g. DLplus, EPG, SlideShow, etc.

3.22.3 Sequence Diagrams

3.22.3.1 AMFM-SD-REQ-321591/A-Display Radio Text

Scenario

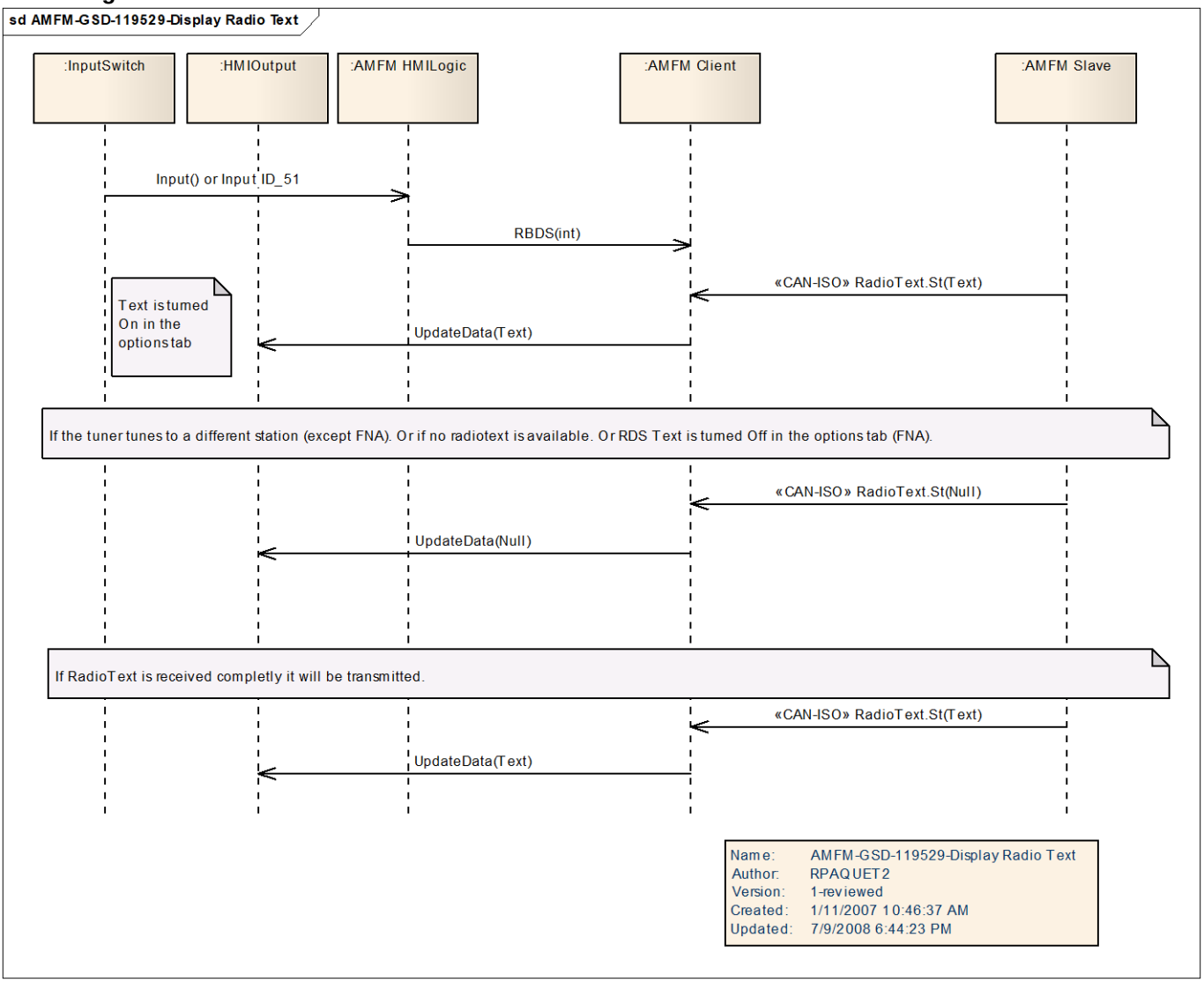
Scenario
The user is listening to FM station.

Constraints

Pre-condition
The tuned station supports RDS/RBDS.

Post-condition
Radio Text is displayed.

Sequence Diagram



3.23 AMFM-FUN-REQ-111071/A-Skip station list entries

3.23.1 Use Cases

3.23.1.1 AMFM-UC-REQ-107201/B-Skip station from station list

Actors	User
Pre-conditions	Multimedia system is On. FM radio is the active audio source. Tune setting is set to “Station List” Station 1 from the station list is active.
Scenario Description	The user skips to the next station from the station list via <<HMI input>>
Post-conditions	Station 2 from the station list is active.

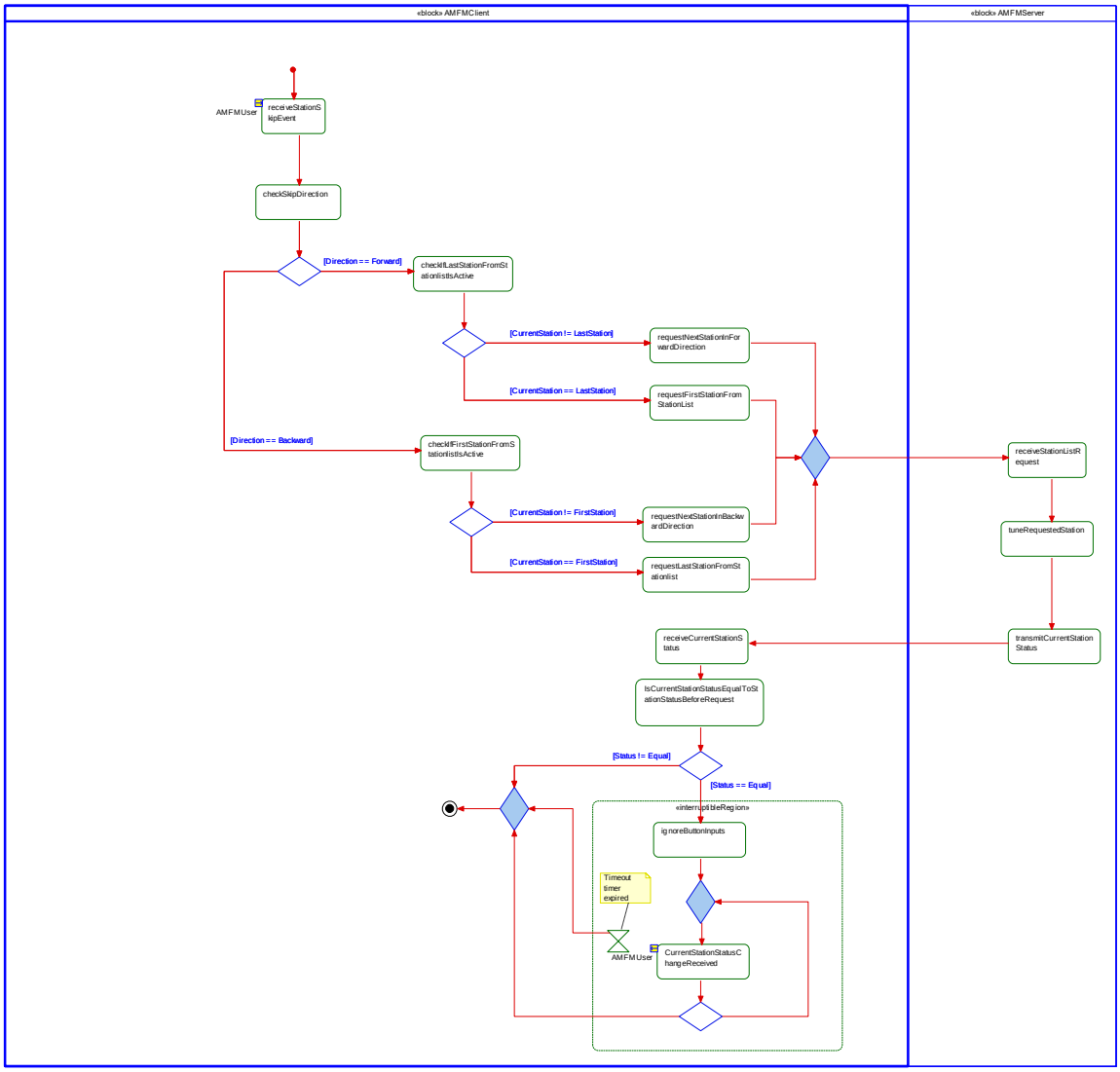
List of Exception Use Cases	E1: Last station from station list is active: If the last station from the station list is the active radio station then the first station from the station list shall be requested. Post-condition: Station 1 from the station list is active E2: The user skips backward: If the user skips backward then the next station in backward direction shall be requested. E3: The user skips backward and first station from station list is active: If the user skips backward and the first station of the station list is the active radio station then the last station from the station list shall be requested. Post-condition: The last station from the station list is active. E4: User requests to skip to Next or previous station before a status update of the current station is received: If the user requests to skip to the next or previous station before a status update of the current station is received then all incoming skip events shall be ignored. A request for the next or previous station shall be transmitted again with reception of the status update of the current station. E5: Status update of the current station is not changed after reception of a request for the next or previous station: If the status update of the current station is not changed after reception of a request for the next or previous station then a request for the next or previous station shall be transmitted again after a predefined timeout.
Interfaces	CBI-HMI, G-HMI,

3.23.2 Requirements

3.23.3 Activity Diagrams

3.23.3.1 AMFM-ACT-REQ-111017/A-Skip station from station list

Activity Diagram



3.23.4 Sequence Diagrams

3.23.4.1 AMFM-SD-REQ-107278/A-SkipStationFromStationList_ForwardDirection_OtherThanLastStationIsActive

Scenarios

Normal Usage

The user skips to the next station in the station list in forward direction.

Constraints

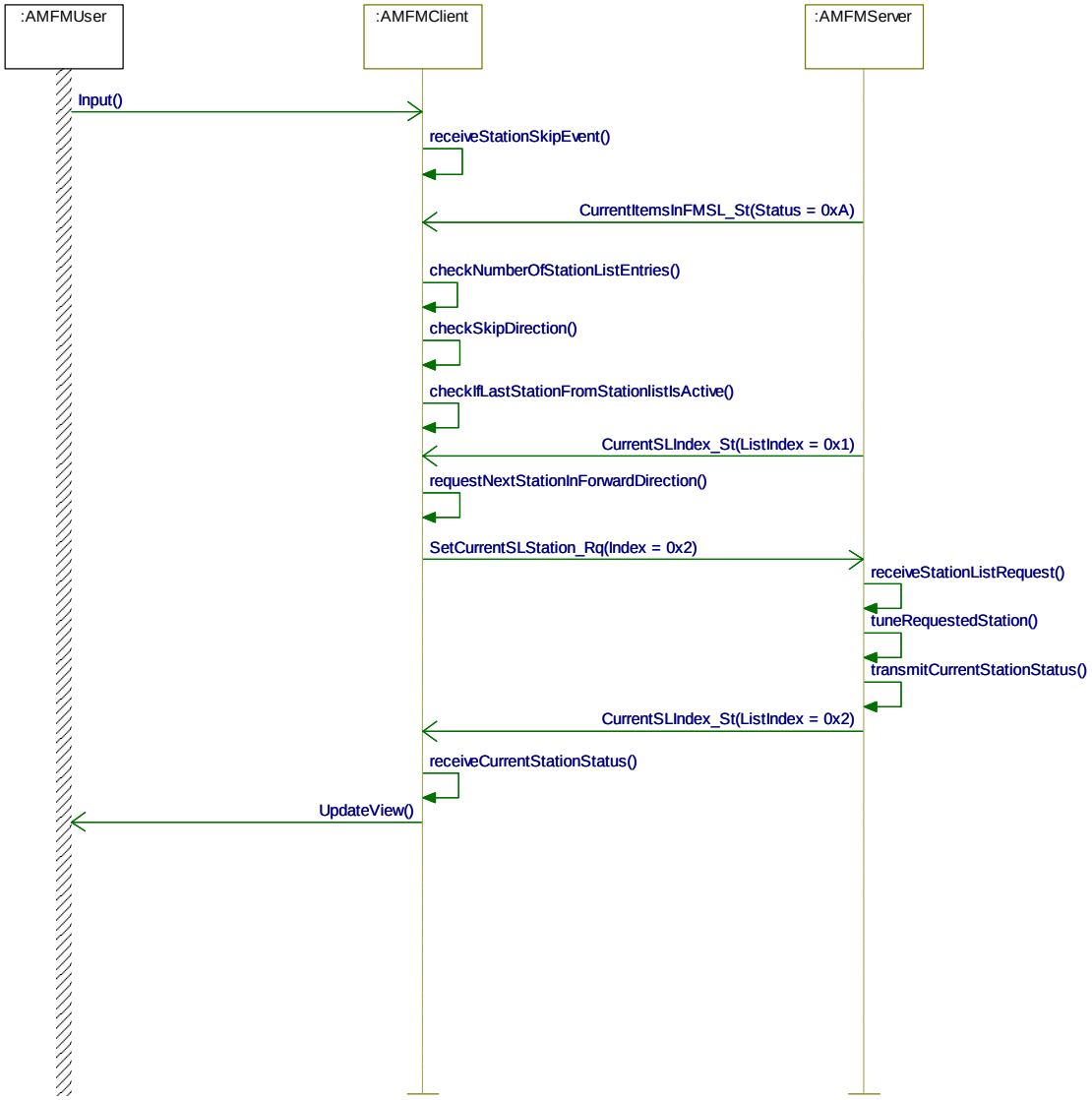
Pre-condition

Station 1 from the station list is active.

Post-condition

Station 2 from the station list is active.

Sequence Diagram



3.23.4.2 AMFM-SD-REQ-107287/A-SkipStationFromStationList_ForwardDirection_LastStationIsActive

Scenarios

3.23.4.2.1.1 REQ-107281/B-Normal Usage

The user skips to the next station in the station list in forward direction.

Constraints

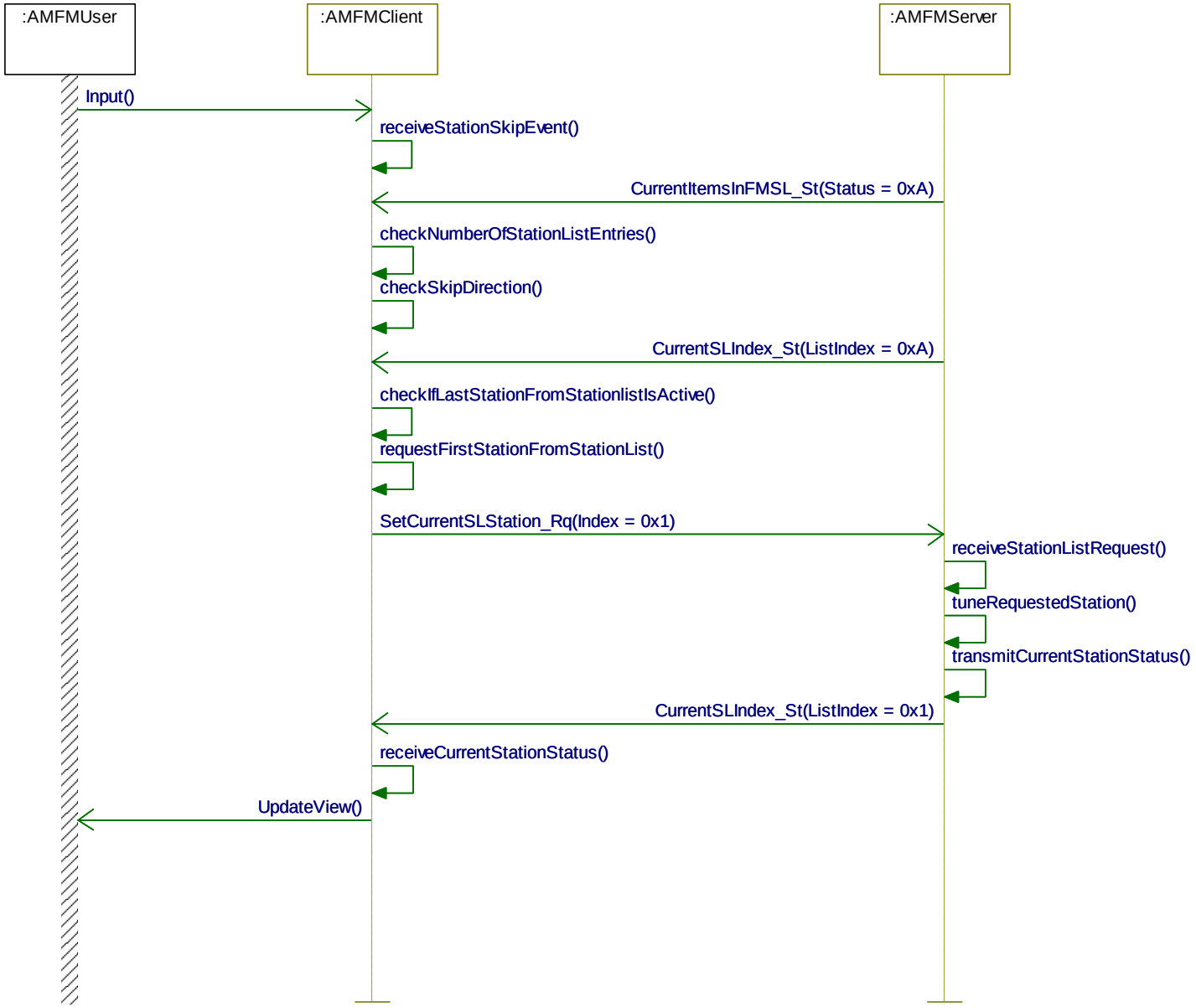
Pre-condition

Station 10 from the station list is active.

Post-condition

Station 1 from the station list is active.

Sequence Diagram



3.23.4.3 AMFM-SD-REQ-107288/A-SkipStationFromStationList_BackwardDirection_OtherThanFirstStationIsActive

Scenarios

Normal Usage

The user skips to the next station in the station list in backward direction.

Constraints

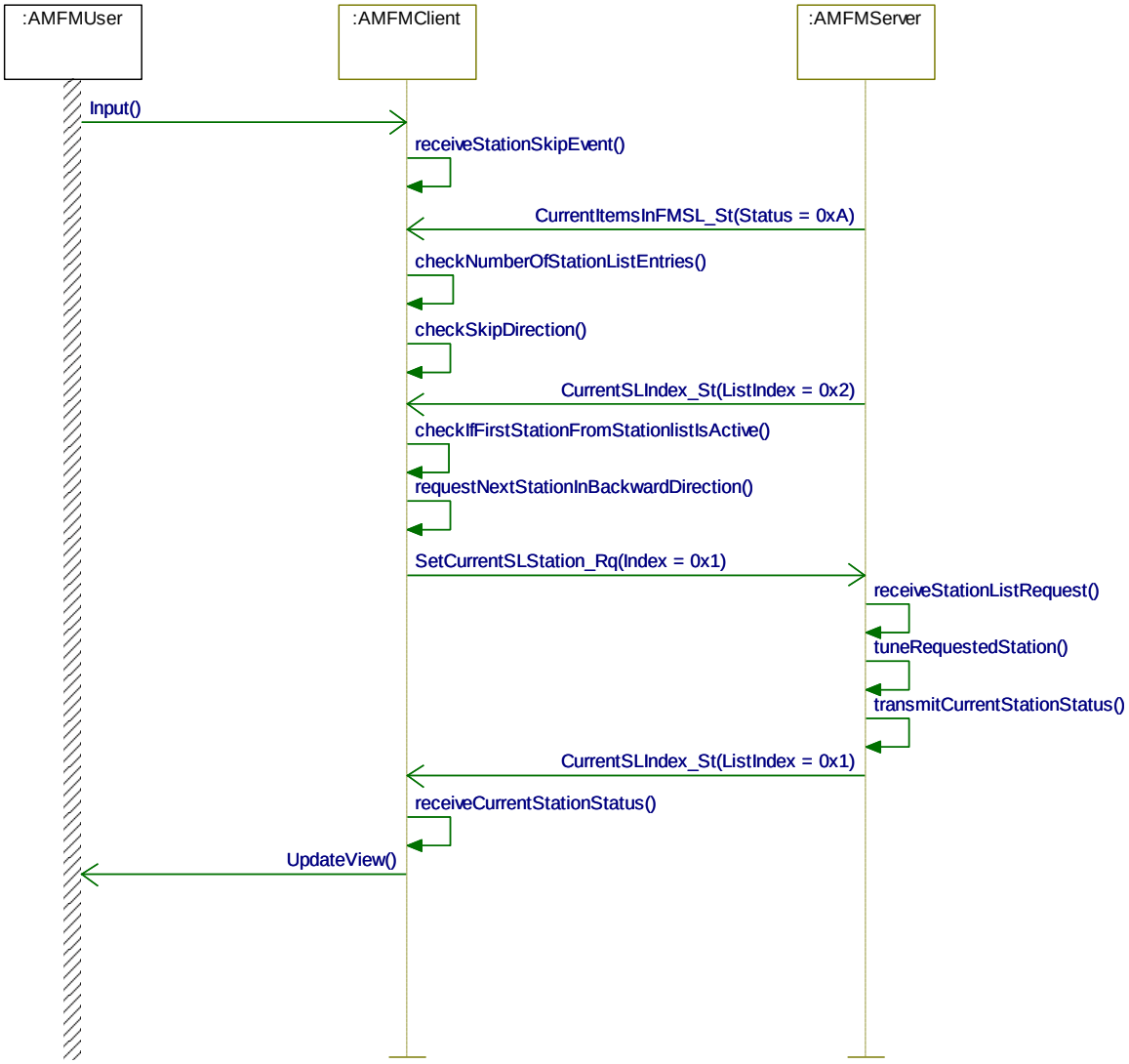
Pre-condition

Station 2 from the station list is active.

Post-condition

Station 1 from the station list is active.

Sequence Diagram



3.23.4.4 AMFM-SD-REQ-107289/A-SkipStationFromStationList_BackwardDirection_FirstStationIsActive

Scenarios

Normal Usage

The user skips to the next station in the station list in backward direction.

Constraints

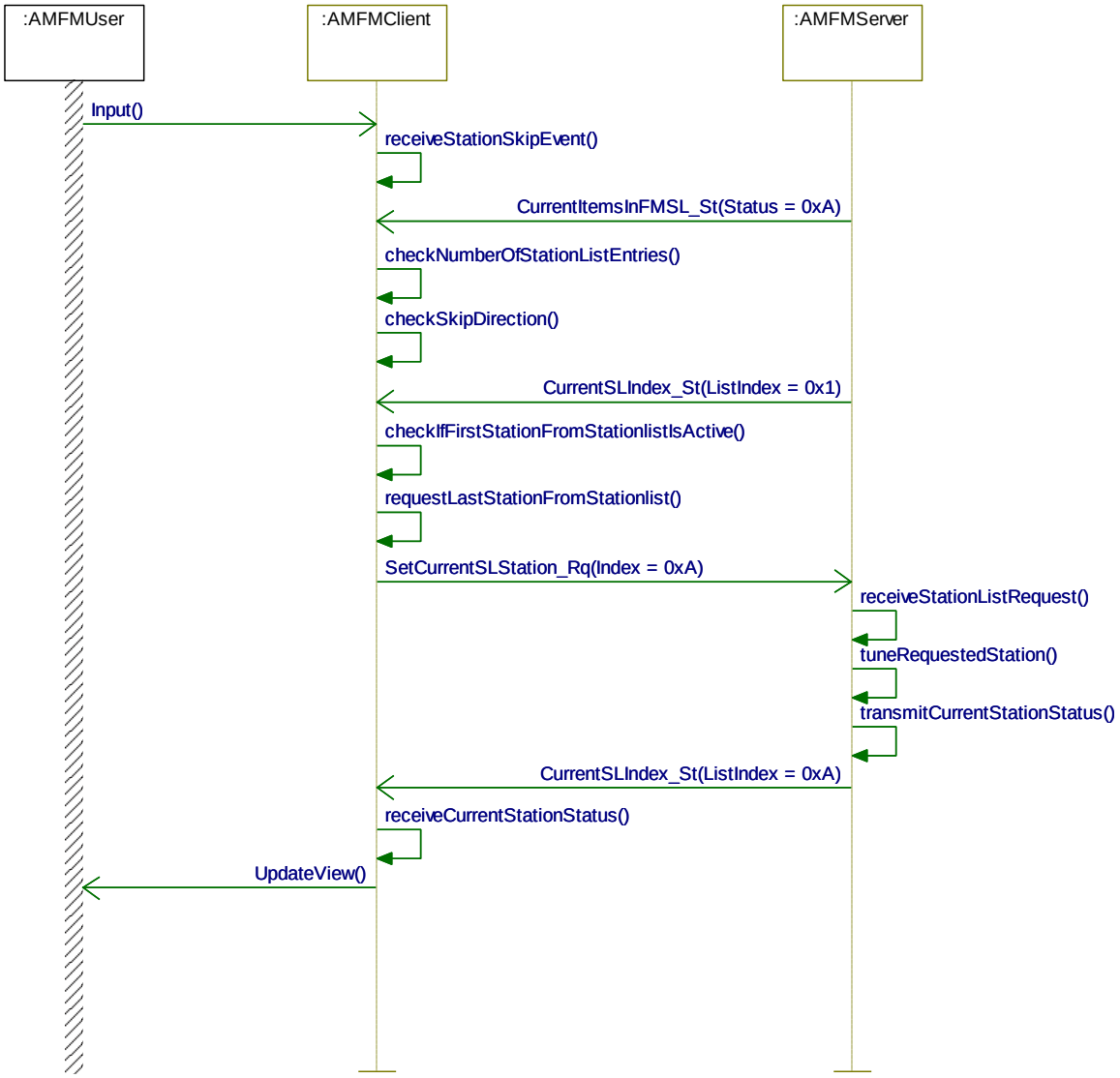
Pre-condition

Station 1 from the station list is active.

Post-condition

Station 10 from the station list is active.

Sequence Diagram



3.23.4.5 AMFM-SD-REQ-179495/A-SkipStationFromStationList_NewInputForStationChangeReceivedWhileStatusUpdateOfCurrentStationIsMissing

Scenarios

Normal Usage

The user skips to the next station in the station list in forward direction. All incoming station skip events shall be ignored until the station status is changed or the timeout timer is expired.

Constraints

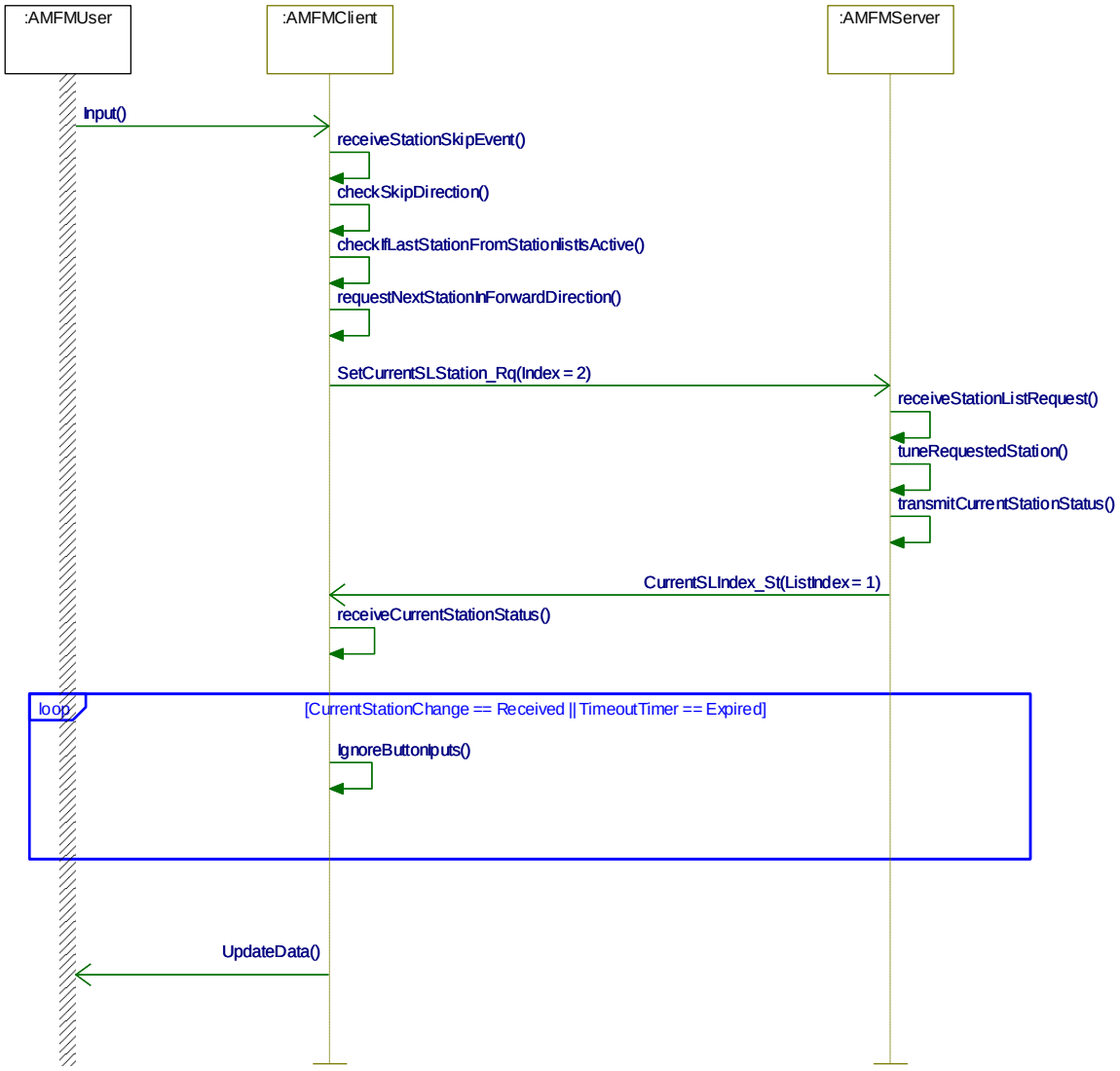
Pre-condition

Station 1 from the station list is active.

Post-condition

Station status change is received or timeout timer is expired.

Sequence Diagram



3.24 AMFM-FUN-REQ-111069/A-Manual tune view

3.24.1 Use Cases

3.24.1.1 AMFM-UC-REQ-094984/A-Open manual tune view

Linked Elements
DAB-SD-REQ-114655/A-Open manual tune view

Actors	User
Pre-conditions	Multimedia system is on AMFM radio is the active audio source
Scenario Description	The user selects to open the manual tune view to select a frequency on the presented frequency scale.
Post-conditions	The manual tune view is shown via <<HMI output>>
List of Exception Use Cases	
Interfaces	CBI-HMI, G-HMI

3.24.1.2 AMFM-UC-REQ-094985/A-Close manual tune view

Linked Elements
DAB-SD-REQ-114656/A-Close manual tune view

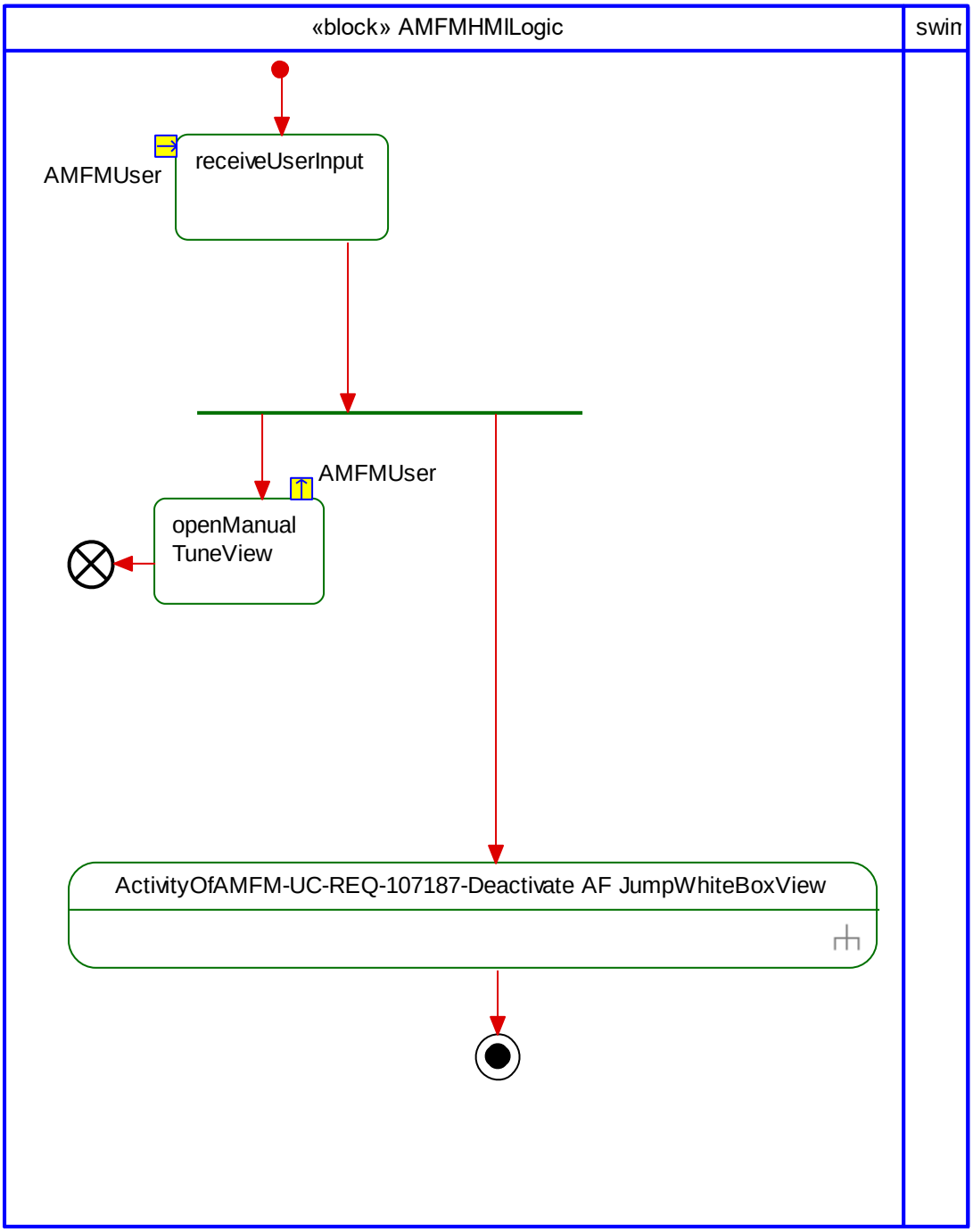
Actors	User
Pre-conditions	Multimedia System is on AMFM radio is the active audio source
Scenario Description	The user confirms to close the manual tune view presented via <<HMI output>>
Post-conditions	Manual tune view is closed
List of Exception Use Cases	E1: Manual tune view timeout timer expires: If the manual tune view timeout timer expires then the manual tune view, presented via <<HMI output>>, will be closed automatically. Post-Condition: Manual tune view is closed
Interfaces	CBI-HMI, G-HMI

3.24.2 Requirements

3.24.3 Activity Diagrams

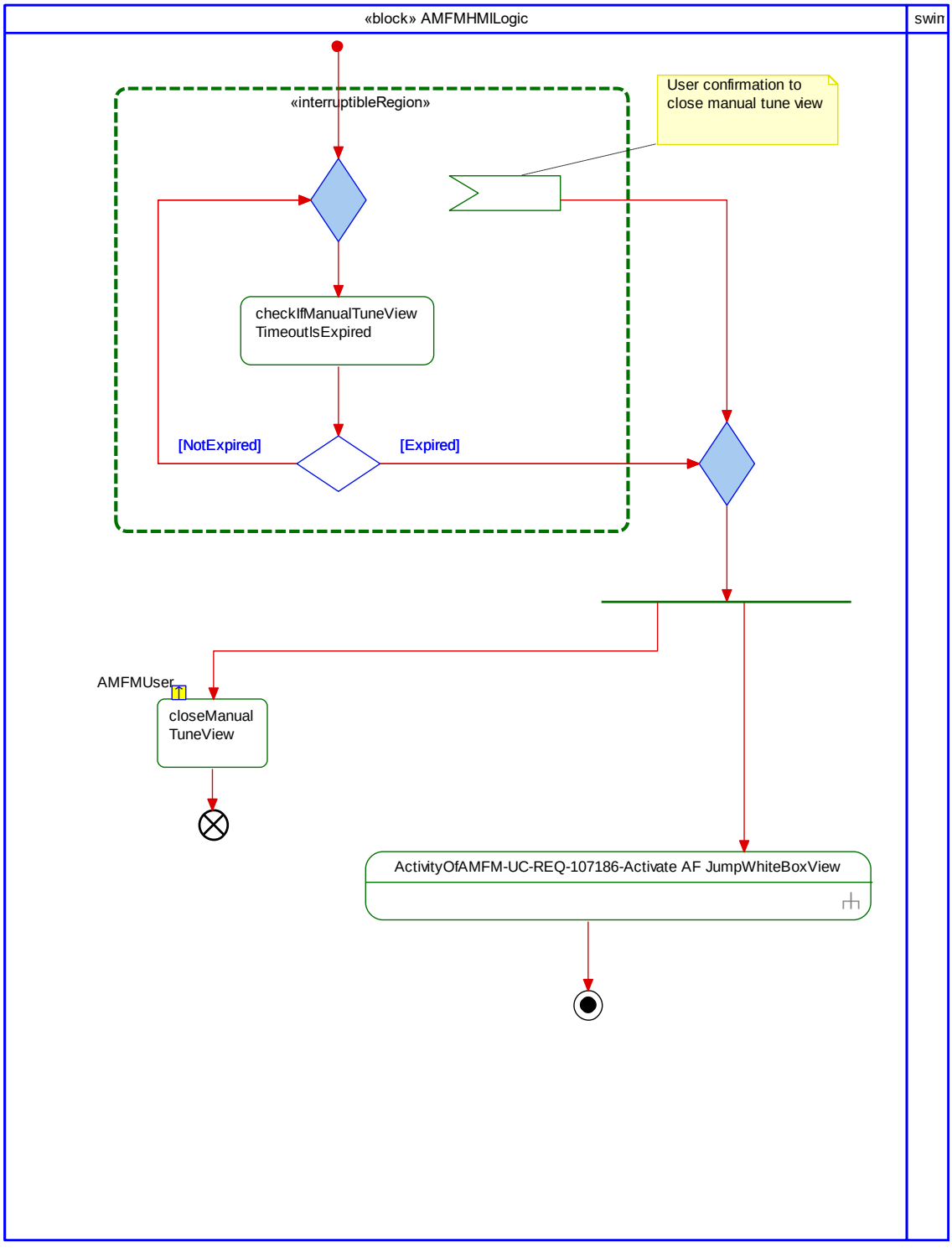
3.24.3.1 AMFM-ACT-REQ-111013/A-Open manual tune view

Activity Diagram



3.24.3.2 AMFM-ACT-REQ-111014/A-Close manual tune view

Activity Diagram



3.24.4 Sequence Diagrams

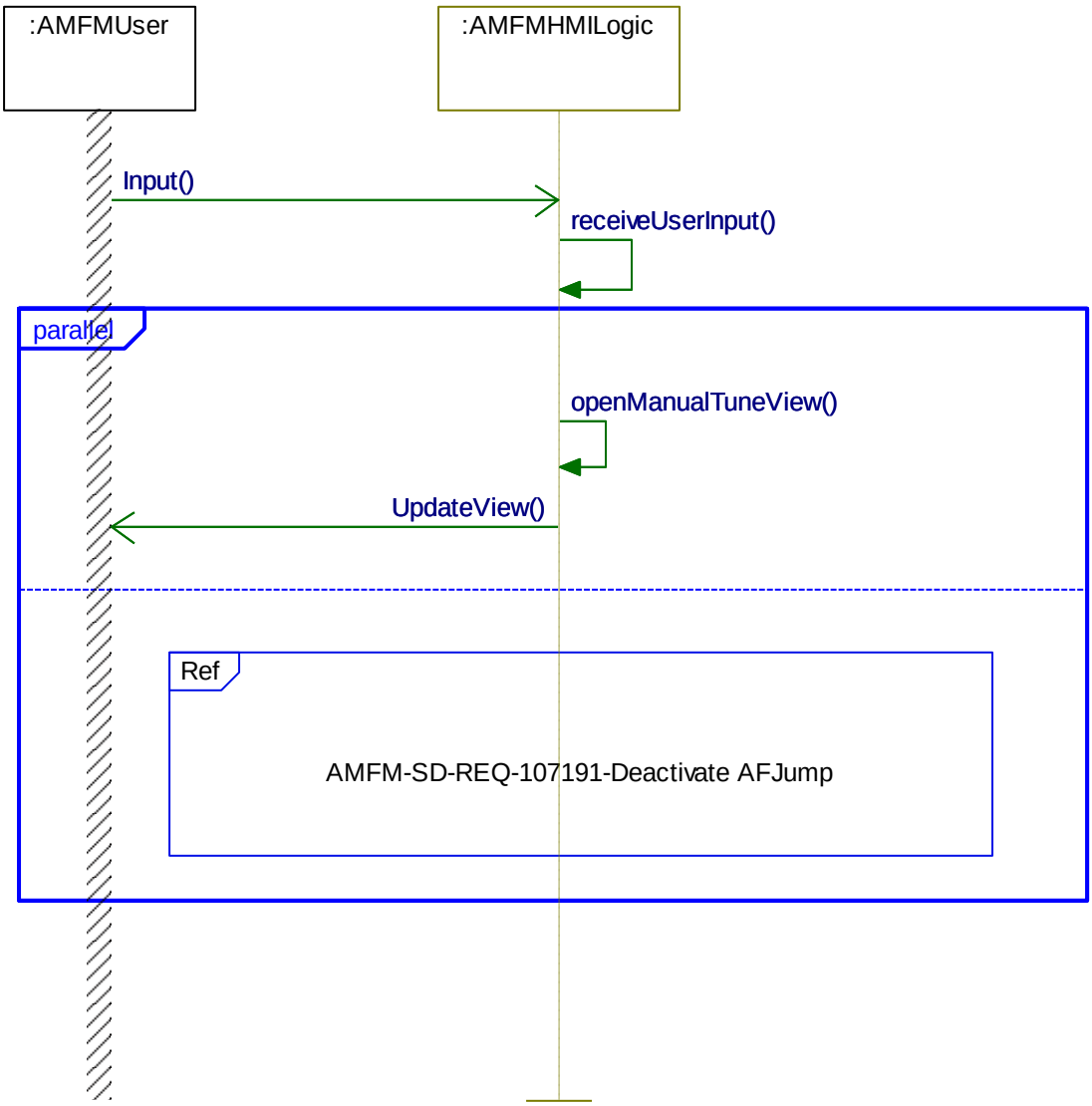
3.24.4.1 AMFM-SD-REQ-107192/A-Open manual tune view

Scenario

The user selects to open the manual tune view.

Constraints
Pre-condition
Manual tune view is closed.
Post-condition
Manual tune view is opened.

Sequence Diagram

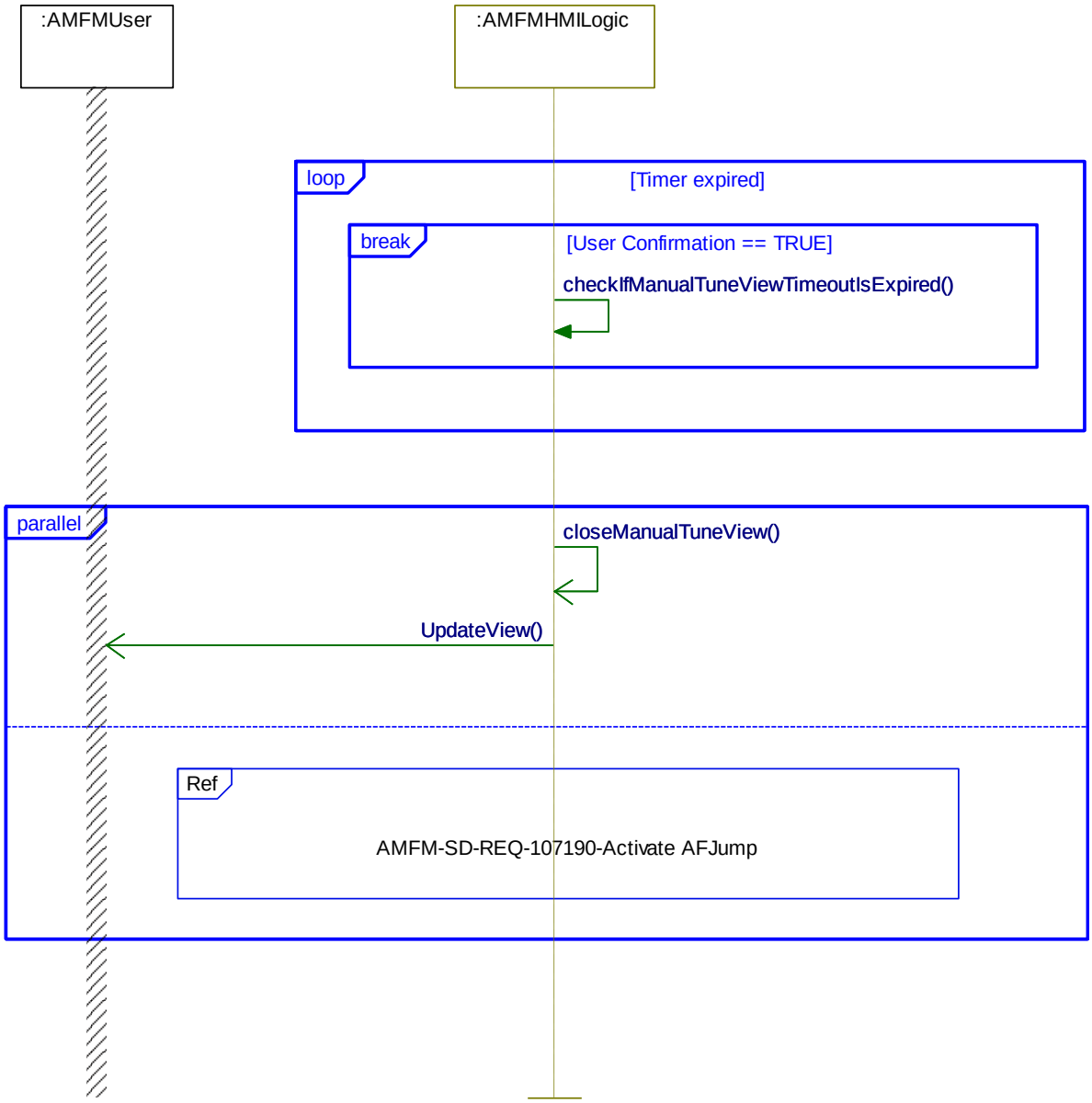


3.24.4.2 AMFM-SD-REQ-107193/A-Close manual tune view

Scenario
The manual tune view gets closed either by user confirmation or by timeout.

Constraints
Pre-condition
Manual tune view is opened.
Post-condition
Manual tune view is closed.

Sequence Diagram



3.25 TU-FUN-REQ-268693/B-Station List Selection

3.25.1 Requirements

3.25.1.1 TU-SR-REQ-266642/A-Providing Mixed Station List

The Tuner System shall provide a Mixed Station List containing all available Stations from FM reception and all Stations from the available DAB Ensembles (Live List from Learn Memory).

The Tuner System shall remove a FM Station from the Mixed Station List as long as the Station is available via DAB reception (Example: WDR2 is available on DAB and FM then only the DAB Station shall be contained in the Mixed Station List. If DAB Station WDR2 is not available any more, then the FM Station shall be contained in the Mixed Station List).

3.25.1.2 TU-SR-REQ-271047/A-Station Name for Mixed Station List

The Tuner System shall store the station name of the available radio stations to the mixed station list based on following conditions:

IF the long and short name information are equal (e.g. long: WDR2; short: WDR2) OR the long name information is not available THEN store the short name information to the mixed station list. ELSE store both, long and short name to mixed station list.

3.25.1.3 TU-SR-REQ-273584/C-List Server Radio Data Service4

Mixed Station List Root								
ListServerID =	Radio Data Service4 (0x0C)							
ActiveListID =	Radio Mixed Station List Root (0x0000)							
ParentListID =	Radio Mixed Station List Root (0x0000)							
NbrItemsInSelection =	up to 500							
ItemIndex	DataType	ActivationEvent	ObjectType	ObjectState	ItemDescriptor	getItem(ItemIndex) Behavior	setItem(ItemIndex) Behavior	static list entry
0x0000	Generic Text (0x02)	Not Supported (0x0)	List Label (0x0)	Inactive (0x0)	Mixed Station List	Invalid	Invalid	-
0x0001	Radio Mixed Station (0xA5)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{SourceIcon}{StationNameLong}{StationNameShort}{PI-Code}{SCID}{SID}{ECC}{TPFlag}	Invalid	Invalid	No
…	…	…	…	…	…	…	…	…
0x01F4	Radio Mixed Station (0xA5)	Supported (0x1)	Entry Object (0x1)	Inactive (0x0) || active (0x1) *	{SourceIcon}{StationNameLong}{StationNameShort}{PI-Code}{SCID}{SID}{ECC}{TPFlag}	Invalid	Invalid	No
				* ObjectState shall reflect the current active station.				

3.25.2 Use Cases

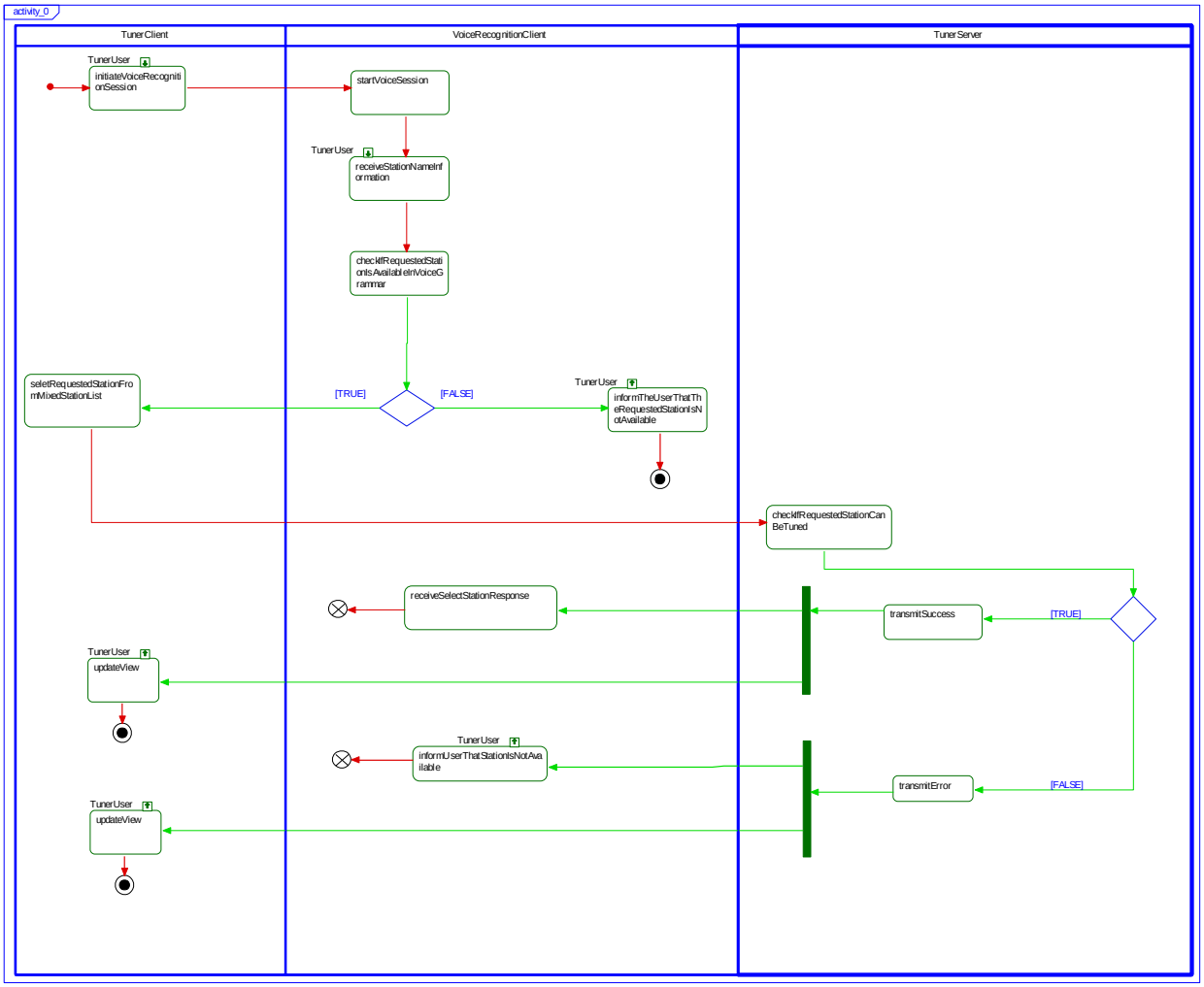
3.25.2.1 TU-UC-REQ-266620/B-Select Station from Mixed Station List

Actors	User
Pre-conditions	Multimedia System is On. Any audio source is active. Mixed Station List is available in the Voice Recognition System.
Scenario Description	The user starts a voice session to select a station from a mixed station list via <<HMI Input>>.
Post-conditions	The user selected station is active.
List of Exception Use Cases	E1 – The user selected Station is not available: If the user selectable station is not available in the mixed station list then the voice recognition system shall inform the user that the station is not available via <<HMI Output>> Post-Condition: The user selected station is not being activated; The user is informed that the selected station is not available via <<HMI Output>>
Interfaces	V-HMI Button Input Audio

3.25.3 Activity Diagrams

3.25.3.1 TU-ACT-REQ-268691/B-Select Station from Mixed Station List

Activity Diagram



3.25.4 Sequence Diagrams

3.25.4.1 TU-SD-REQ-268244/C-Select Station From Station List Via Voice Command

Scenarios

Normal Usage

The user initiates a voice recognition session via <<HMI input>> and requests to select a radio station. The selected Station will be activated.

Constraints

Pre-Condition

Multimedia System is On.

Pre-Condition

Any audio source is active.

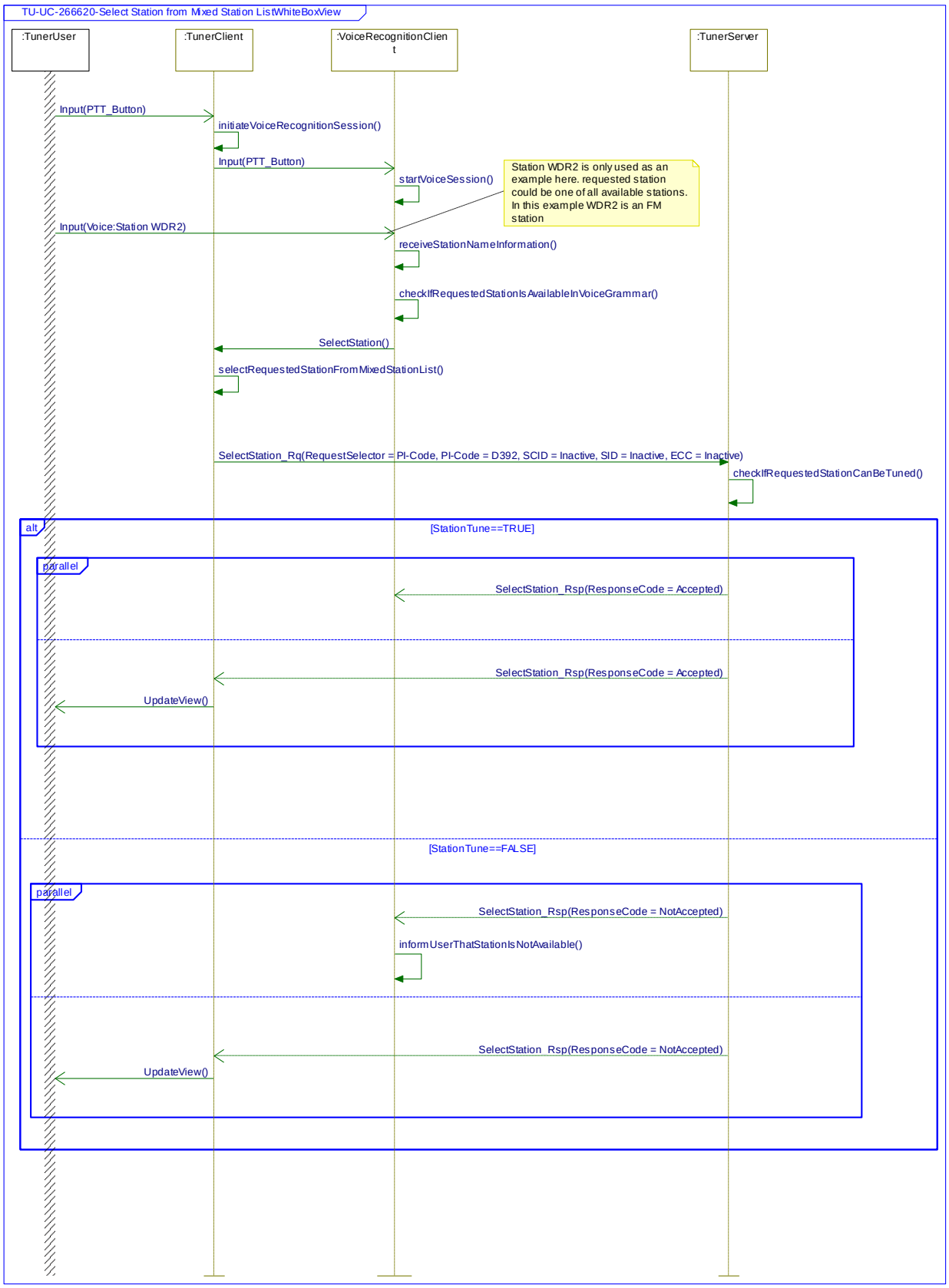
Pre-Condition

User requested radio station is available in the grammar of the Voice recognition system.

Post-Condition

The user selected station is active.

Sequence Diagram



3.25.4.2 TU-SD-REQ-271046/A-Select Station from Mixed StationList-E1-RequestedStationNotAvailable

Scenarios

Normal Usage

The user initiates a voice recognition session via <<HMI input>> and requests to select a radio station. The radio station is not available (tunable) and the user will be informed.

Constraints

Pre-Condition

Multimedia System is On.

Pre-Condition

Any audio source is active.

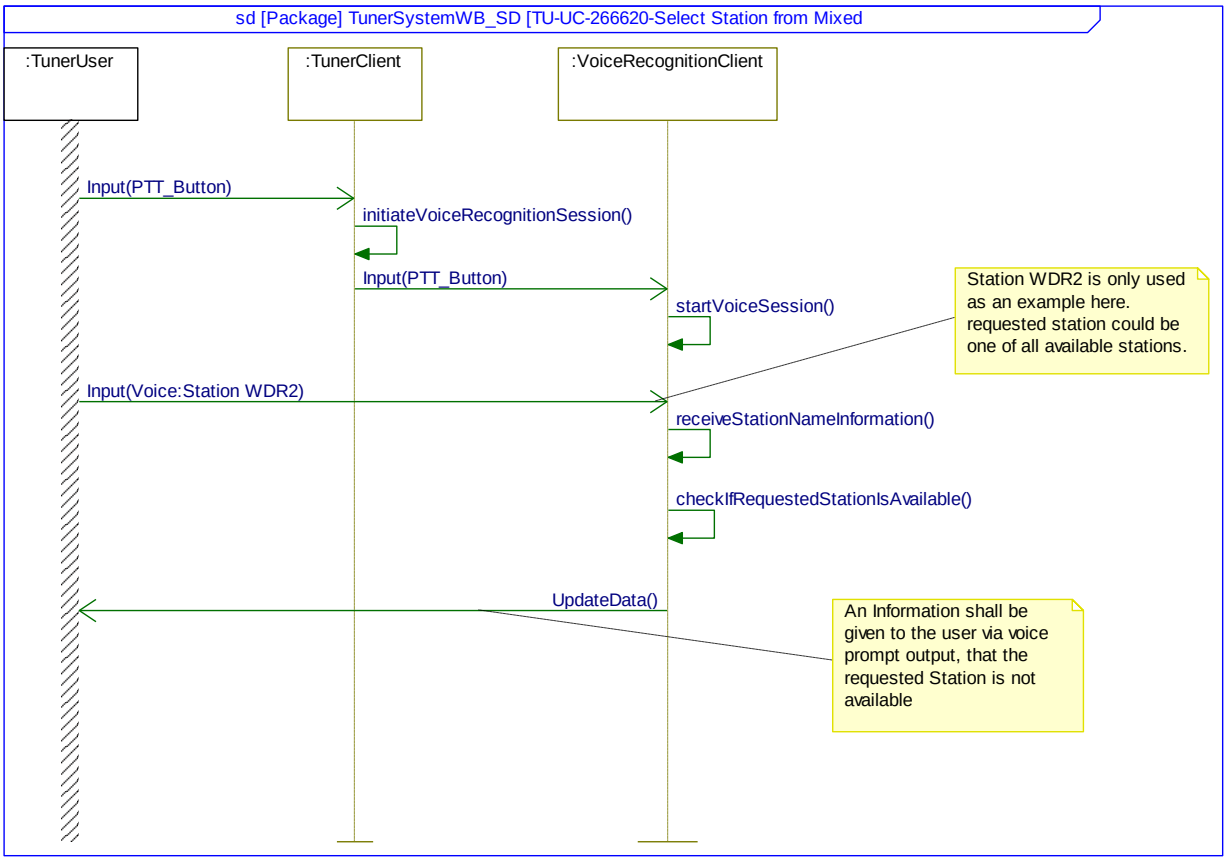
Pre-Condition

User requested radio station is available in the grammar of the Voice recognition system but not tunable.

Post-Condition

The user is informed via voice prompt that the requested station is not available

Sequence Diagram



3.26 AMFM-FUN-REQ-326149/A-AM deactivation

3.26.1 Use Cases

3.26.1.1 AMFM-UC-REQ-326150/A-Enable AM

Actors	User
Pre-conditions	Infotainment System is ON. AM is OFF.

	Radio is the source. Infotainment System is configured for RDS mode.
Scenario Description	The user enables <AM> via HMI.
Post-conditions	AM is enabled persistently HMI displays {AM source content}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.26.1.2 AMFM-UC-REQ-326151/A-Disable AM

Actors	User
Pre-conditions	Infotainment System is ON. AM is ON. Radio is the source. Infotainment System is configured in RDS mode.
Scenario Description	The user disables <AM> via HMI.
Post-conditions	AM is disabled persistently HMI displays {AM source disabled}
List of Exception Use Cases	NA
Interfaces	G-HMI, CBI-HMI, CAN, Audio out, AM/FM

3.26.2 Requirements

3.26.2.1 AMFM-FUR-REQ-326152/A-AM deactivation

The AHU shall offer the possibility to deactivate the source “AM” via HMI and also via component configuration.

AM source content will be available according HMI specification. In case of deactivation via HMI the user setting is defined in the HMI specification,

3.26.3 Sequence Diagrams

4 Appendix: Reference Documents

Reference #	Document Title
1	
2	
3	
4	
5	