HYUNDAI AUTOEVER

AUTOSAR CanCM User Manual

DOC. NO

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HYUNDAI AutoEver

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2022-08-26	1.5.21.0	Minuk Kim	4.2 4.4	Module Version Updated Change Log updated

Table of Contents

1. Overview

CanCM module is created as per HKMC communication design specification. For more detailed functional description, please refer to the reference document below.

The following terms on configuration category mean:

- Changeable (C) : Items that can be configured by users
- Fixed (F) : Items that cannot be changed by users
- NotSupported (N) : Items that are not used

2. Reference

Sl. No.	Title	Version
1	ES95480-00 (High-speed CAN design specification)	-
2	ES95400-00 (CAN DESIGN SPECIFICATION)	-
3		

3. AUTOSAR System

3.1 CAN Communication Stack

On Hyundai AutoEver AUTOSAR platform, CAN Communication Stack consists of modules shown below.

- CanIf : Sends and receives CAN messages
- PduR : Delivers PDUs between communication modules
- IpduM : Sends and receives multiplexed PDUs
- CanTp : Sends and receives transport protocol-based mass data
- CanSM : Controls the status of CAN communication channels and handles Bus-Off operations
- CanTrcv : Controls CAN transceiver hardware
- OsekNm : Handles the Sleep entry synchronization of CAN communication channel
- CanCM : Controls the activation and deactivation of CAN communication depending on the battery voltage and HKMC specifications

3.2 CanCM Module

CanCM module performs the following in order to control CAN communication under given conditions.

- Activates and deactivates the CAN communication based on the timing configurations
- Activates and deactivates the CAN communication based on the battery voltage conditions
- Activates and deactivates the Com communication based on the ComM communication mode switches

4. Product Release Notes

4.1 Overview

This chapter provides the release information of Hyundai AutoEver CanCM module, describing the features and restrictions of different release versions of the CanCM software product.

4.2 Scope of the Release

All content in this document is limited to the following Hyundai AutoEver CanCM modules.

Module name	AUTOSAR version	SWS version	Module version
CanCM	-	-	1.5.21

※ Module version refers to the SW version defined in the BswModule Description file (Bswmd) of each module.

4.3 Module Release Notes

4.3.1 Limitations

4.3.1.1 Precautions when Asw is directly using the ADC Read function of IoHwAb module

All Asw tasks that call out ADC-reading functions (IoHwAb_AnaInReadDirect, IoHwAb_AnaInDirReadDirect) shall be bound to internal resources such as CanCM tasks or enclosed by ExclusiveArea (SuspendAllInterrupt/ResumeAllInterrupt or SuspendOsInterrupt/ResumeOsInterrupt methods) so as to prevent mutual preemption from occurring.

4.3.1.2 Limitations related to missing sections of Chorus Application

In the process of Can Controller STOP, when a message is received before the interrupt (MCAL internal logic) is disabled and the controller is stopped, the wakeup is not executed due to MCAL restrictions.

4.3.2 Deviations

4.4 Change Log

4.4.1 Version 1.5.21.0

Improvement

- Code improvement to comply with the UNECE Cyber Security regulations that detected in Integration_Pm

Rationale	Needed to improve the codes to comply with the UNECE Cyber Security regulations from Integration_Pm
Impact on behavior	None
Impact on settings	None
Required ASW actions	None

4.4.2 Version 1.5.20.0

Improvement

- Code improvement to comply with the UNECE Cyber Security regulations

Rationale	Code improvement to comply with the UNECE Cyber Security regulations
Impact on behavior	None
Impact on settings	None
Required ASW actions	None

4.4.3 Version 1.5.19.0

Improvement

- Eliminated impact on Library

Rationale	Eliminated impact on Library
Impact on behavior	None
Impact on settings	None
Required ASW actions	None

4.4.4 Version 1.5.18.0

Improvement

- Code improvement to comply with the UNECE Cyber Security regulations

Rationale	Needed to improve the codes to comply with the UNECE Cyber Security regulations
Impact on behavior	None
Impact on settings	None
Required ASW actions	None

4.4.5 Version 1.5.17.1

Improvement

- Format changes of the user manual document

Rationale	Needed to update user manual document.
Impact on behavior	None
Impact on settings	None
Required ASW actions	None

4.4.6 Version 1.5.17.0

Improvement

- Actions taken based on the review results of race conditions

Rationale	Needed to review race conditions
Impact on behavior	None
Impact on settings	Need to set BswM (refer to 10.3 of this document)
Required ASW actions	None

4.4.7 Version 1.5.16.0

Improvement

- Documented the limitation concerning Chorus Application Messages missings

Rationale	Found the limitation that the wakeup is not executed when a message is received while processing MCAL internal logics for Chorus Can Controller STOP operation
Impact on behavior	None
Impact on settings	None
Required ASW actions	None

4.4.8 Version 1.5.15.1

Improvement

- Updated the guide for checking the Network Activation Timer expiration

Rationale	Received the request to allow the user to check the Network Activation Timer expiration
Impact on behavior	None
Impact on settings	None
Required ASW actions	None

4.4.9 Version 1.5.15.0

Improvement

- Added MISRA-C exception handling to the modules

Rationale	Violation against MISRA-C
Impact on behavior	None
Impact on settings	None
Required ASW actions	None

4.4.10 Version 1.5.14.0

Improvement

- Network Activation Time can be set to 0

Rationale	The specifications were revised.
Impact on behavior	When setting Network Activation Time at 0, FullCom immediately enables Tx.
Impact on settings	None
Required ASW actions	None

4.4.11 Version 1.5.13

Improvement

- Fixed Misra C violations

Rationale	Fixed Misra C violations
Impact on behavior	None
Impact on settings	None
Required ASW actions	None

4.4.12 version 1.5.12.1

Improvement

- Added fail safety logics to prepare for voltage measurement failures

Rationale	To prevent TX disabling caused by voltage measurement failure when the IoHwAb ADC Read function of ASW and the CanCM modules can preempt each other
Impact on behavior	Maintains the previous values and reports DET errors in case of voltage measurement failure
Impact on settings	None
Required ASW actions	None

4.4.13 version 1.5.12

Improvement

- Voltage-related communication controls are now optional

Rationale	Needed to selectively use voltage-related communication controls for individual channels
Impact on behavior	Able to selectively use communication control functions based on voltage values entered
Impact on settings	None
Required ASW actions	None

4.4.14 version 1.5.11

Improvement

- Parameter type changed for remote wakeup notification

Rationale	Error occurred in wakeup behaviors when the number of wakeup sources exceeds 16.
Impact on behavior	Changed the type of the parameter that conveys wakeup sources to fit the number.
Impact on settings	None
Required ASW actions	None

■ Changed the set range for ADC Default values

Rationale	It was not possible to set ADC Default values higher than 1023.
Impact on behavior	Changed the set range to 0-65535
Impact on settings	None
Required ASW actions	None

4.4.15 version 1.5.10

Improvement

■ Fixed the logics that detect remote wakeups between the beginning of CAN sleep and the entering into low power mode

Rationale	There was a possibility of failing to read the wakeup signal due to logic errors.
Impact on behavior	Fixed logic errors that caused the failure to read the wakeup signal
Impact on settings	None
Required ASW actions	None

5. Configuration Guide

5.1 CanCMGlobalConfig

Parameter Name	Value	Categor
[1] CanCMDemStatusReport	True	F
[2] CanCMDisableDMOnAbnormalVoltage	From SRS	F
[3] CanCMWakeupSupport	From SRS	F
[4] CanCMHysteresisSupport	True	F
CanCMDevErrorDetect	True	F
CanCMMainFunctionPeriod	0.005	F
[5] CanCMFilteringConstant	128	C

1) Whether to use the functionality that notifies DEM modules when the battery voltage is in critical range
2) Whether to use DM (Deadline Monitoring) deactivation functionality of Com modules when the battery voltage is in abnormal range
3) Whether to use the functionality that regularly checks remote wake-up in NO COMM status
4) In deciding if the voltage is normal when it returns from critical to non-critical level or from abnormal to normal.
5) Coefficient used for filtering Adc values entered in monitoring the battery voltage (Refer to 8.1.3 in IoHwAb Manual)

5.2 CanCMBatMonConfig

Parameter Name	Value	Categor
[1] CanCMBatAnalogInputRef	-	C
[2] CanCMAdcDefault	500	C

1) Setting the ADC port for monitoring the battery voltage: CanCM module periodically reads ADC values in designated ports,
checks voltage status and controls communication functions.
In case that 2 or more ports are designated, CanCM module reads the ADC values from all ports designated and uses the highest value.
2) Set the initial value for battery voltage (refer to 8.1.3 in IoHwAb user manual).

5.3 CanCMChannelConfig

Parameter Name	Value	Categor
CanCMChannelId	Automated	F
[1]CanCMNetworkActivationTime	0.1	C
[2]CanCMVoltageErrorDelayTime	0.12	C
[3]CanCMTimeoutMonitoringStartTime	1	C
[4]CanCMVoltageAbnormalUpper	-	C
[4]CanCMVoltageAbnormalLower	-	C
[5]CanCMVoltageCriticalUpper	-	C
[5]CanCMVoltageCriticalLower	-	C
[6]CanCMVoltageHysteresis	-	C
CanCMComMChannelId	Automated	F

1) Time taken for the functionality that sends CAN messages (except NM messages) to be activated after the communication mode of the given channel is switched to FULL COMMUNICATION
2) Time taken for the voltage error status to be cleared after the battery voltage returns from the critical to the non-critical range (the CAN message sending functionality is activated immediately after the error status is cleared)
3) Standby time until the Rx Deadline monitoring functionality of the Com module is activated, after the communication mode of the given channel is switched to FULL COMMUNICATION
4) Setting the range for abnormal voltage
When the battery voltage is in the specified abnormal range, Rx Deadline monitoring functionality of the Com module is deactivated to prevent DTC from recording the received signal timeout. When the battery voltage returns to the normal range, the functionality is reactivated.
When the values of both CanCMVoltageAbnormalUpper and CanCMVoltageAbnormalLower are 0, the foregoing functionality that monitors Rx Deadline is not executed.
5) Setting the range for critical voltage
When the battery voltage is in the critical range, CAN messages are prohibited from being sent. When the current status returns to the normal voltage, CAN messages are allowed to be sent again.
When the values of both CanCMVoltageCriticalUpper and CanCMVoltageCriticalLower are 0, the foregoing functionality that controls the transmission of messages is not executed.

6) Setting hysteresis values
Hysteresis values are applied when deciding whether the voltage has returned to non-critical from critical.

- Criteria for critical voltage range
BatVol <= CanCMVoltageCriticalLower or BatVol >= CanCMVoltageCriticalUpper

- Criteria for non-critical voltage range (hysteresis values are applied when returning to non-critical from critical).
CanCMVoltageCriticalLower + CanCMVoltageHysteresis < BatVol < CanCMVoltageCriticalUpper – CanCMVoltageHysteresis

- Criteria for abnormal voltage
BatVol <= CanCMVoltageAbnormalLower or BatVol >= CanCMVoltageAbnormalUpper

- Criteria for normal voltage (Hysteresis values are applied when returning to normal from abnormal).
CanCMVoltageAbnormalLower + CanCMVoltageHysteresis < BatVol < CanCMVoltageAbnormalUpper – CanCMVoltageHysteresis

(BatVol : voltage ADC value)

The entire communication control time is calculated by the cycle task of the CanCM module, errors may occur depending on the cycle of the task.
The values from 4) to 6) above are based on the voltage ADC values from the port designated as the monitoring input.
The unit of time for 1) to 3) above is second.
Refer to the corresponding parameters in the HKMC CAN ES design specification when configuring all values.

5.4 CanCMDemEventParameterRefs

Parameter Name	Value	Categor
[1)]CANCM_E_BAT_FAIL	-	F

1) Designates an event ID to notify the Dem module when the battery voltage changes from normal to critical range.

5.5 CanCMWakeupParameterRefs

Parameter Name	Value	Categor
[1)]CanCMEcuMWakeupSourceRef	-	F
[2)]CanCMIoHwAbWakeupPinNameRef	-	F

1) Designates the wake-up source as defined in EcuM.
When the CanCM module detects a remote wake-up at a corresponding CAN channel, it calls EcuM interface, using the designated wakeup source as the parameter.
2) Designates the IO pin where the wake-up signal comes in.
When ComM is switched to NO COMM status, the CanCM module periodically reads the designated pin and detects a remote wake-up. For this reason,**when the wake-up frame is**

detected on the bus in a Sleep or Stand-By status, the transceiver shall maintain the voltage level of the designated pin as LOW.

6. Application Programming Interface (API)

6.1 Type Definitions

None

6.2 Macro Constants

None

6.3 Functions

None

7. Generator

7.1 Generator Option

Option	Description
-V	Displays the version of module in use.
-O	Designates the location where the output is generated.

7.2 Generator Message

7.2.1 Error Messages

None

7.2.2 Warning Messages

None

7.2.3 Information Messages

None

8. Det Error

Detected development errors shall be reported to the Det_ReportError(uint16 ModuleId, uint8 InstanceId, uint8 ApiId, uint8 ErrorId) service of the Development Error Tracer (DET) if the pre-processor switch CANCM_DEV_ERROR_DETECT is set “on”.

8.1 Error Classification

Type of error	Relevance	Related error code	Value
CanCM module is uninitialized	Development	CANCM_E_UNINIT	0x1F
Error code for reading battery	Development	CANCM_E_READBATTERYFAIL	0x20
Invalid request	Development	CANCM_E_INVALID_REQUEST	0x21

8.1.1 Service ID

CanCM function name	Service ID[hex]
CanCM_MainFunction	0x02
CanCM_ComModeIndication	0x03
CanCM_GetCurrentVoltageMode	0x04
CanCM_GetCurrentNetworkState	0x05

9. Dem Error

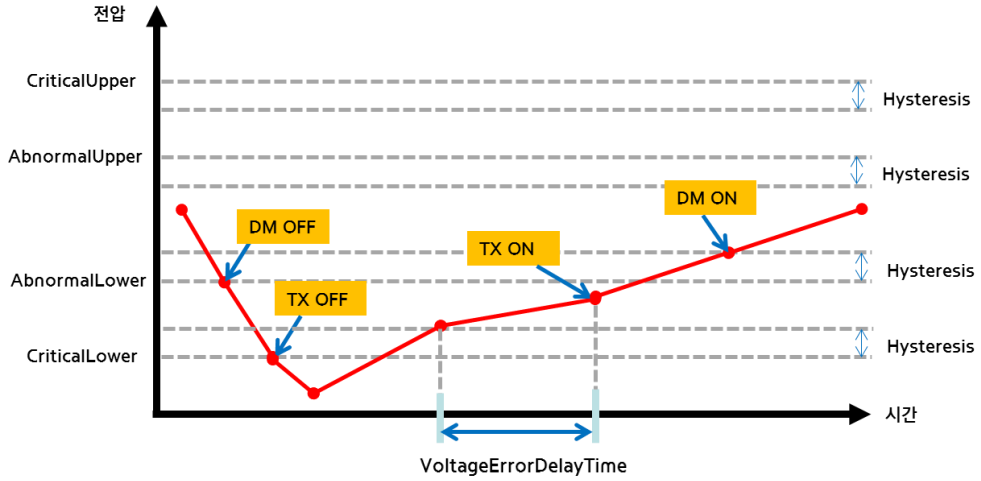
Bsw module errors shall be reported to the Dem_ReportErrorStatus () when the errors occur.

9.1 CANCM_E_BAT_FAIL

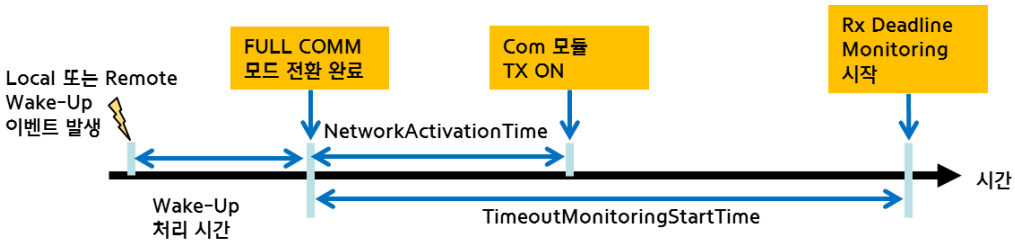
ErrorId Symbol	CANCM_E_BAT_FAIL
Description	This occurs when there are voltage errors.
Cause	H/W
Platform default Action	Wait (depending on H/W conditions)
Functional impact	When the current battery voltage is not suitable for communication, CanCM stops the transmission functionality of CAN and notifies DEM.
Related module(s)	IoHwAb
MCU	Common
Error type	Configuration, code
Possible fixes in application	When the voltage returns to the normal level, the transmission functionality can be resumed. Application can recognize this via a setting of BswM.

10. Appendix

10.1 Configuration guides per feature



[Figure 1] Example of communication control by voltages measured

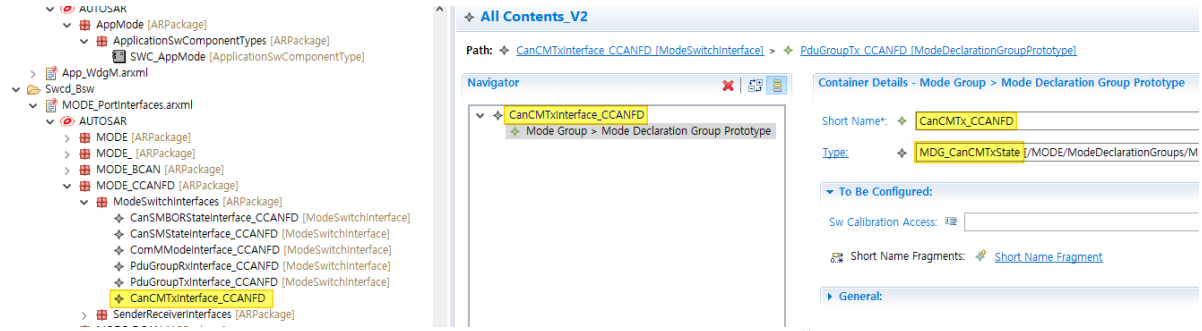


[Figure 2] CAN communication control timing

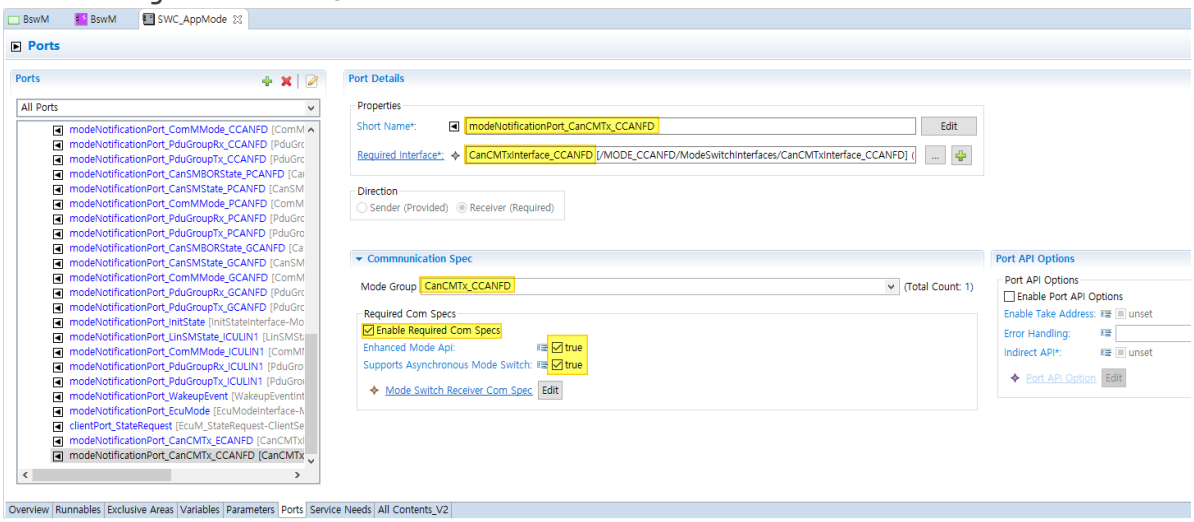
10.2 Guide for checking when Network Activation Timer expires

Expiration of Network Activation Timer can be detected with the Rte_Switch rule that is configured in BswM. Since the existing per-channel TX enabling rules include not only the TX enabling conditions of CanCM but ComM and Dcm, it's impossible to specifically check when the Network Activation Timer of CanCM has expired. Following the guide below, therefore, the user can check the expiration time of Network Activation Timer in the CanCM, for each channel. (This functions at the exact time of expiration only when the voltage is in normal range.)

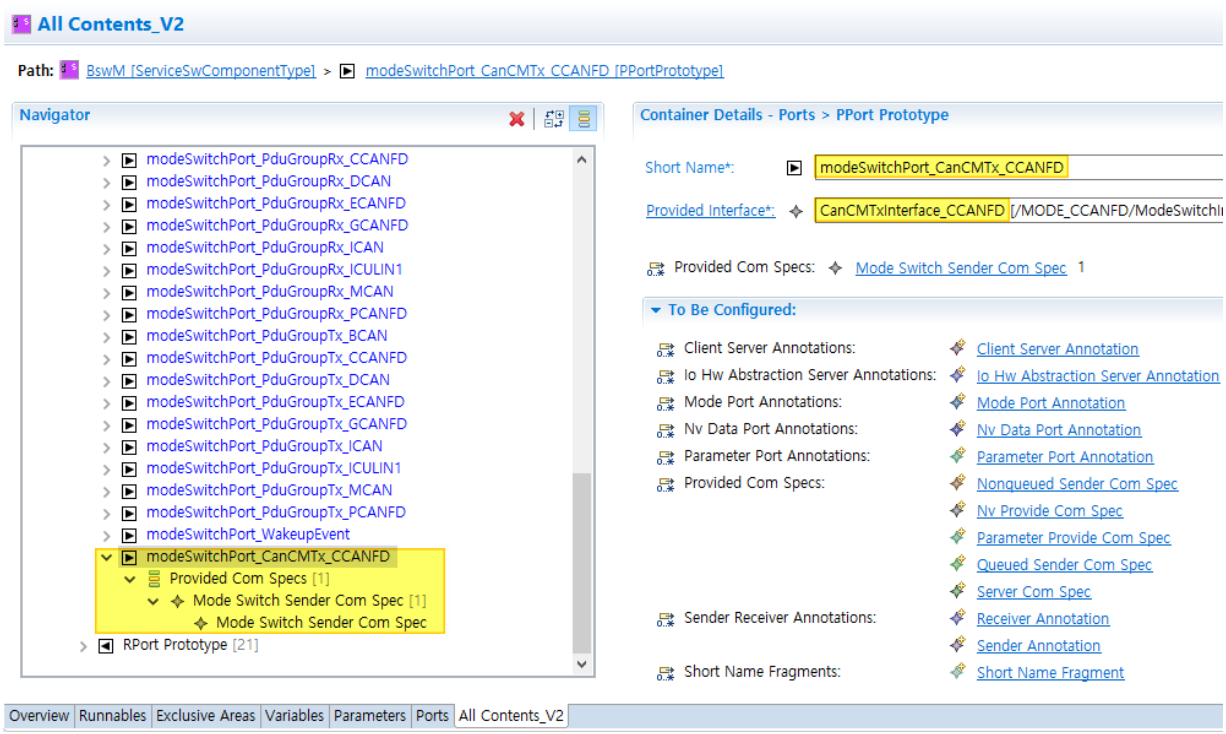
1) In order to generate a switch port, create ModeSwitchInterfaces of the channel to register and connect it to the SwitchPort of BswM. (See Step 9 for setting the type.)

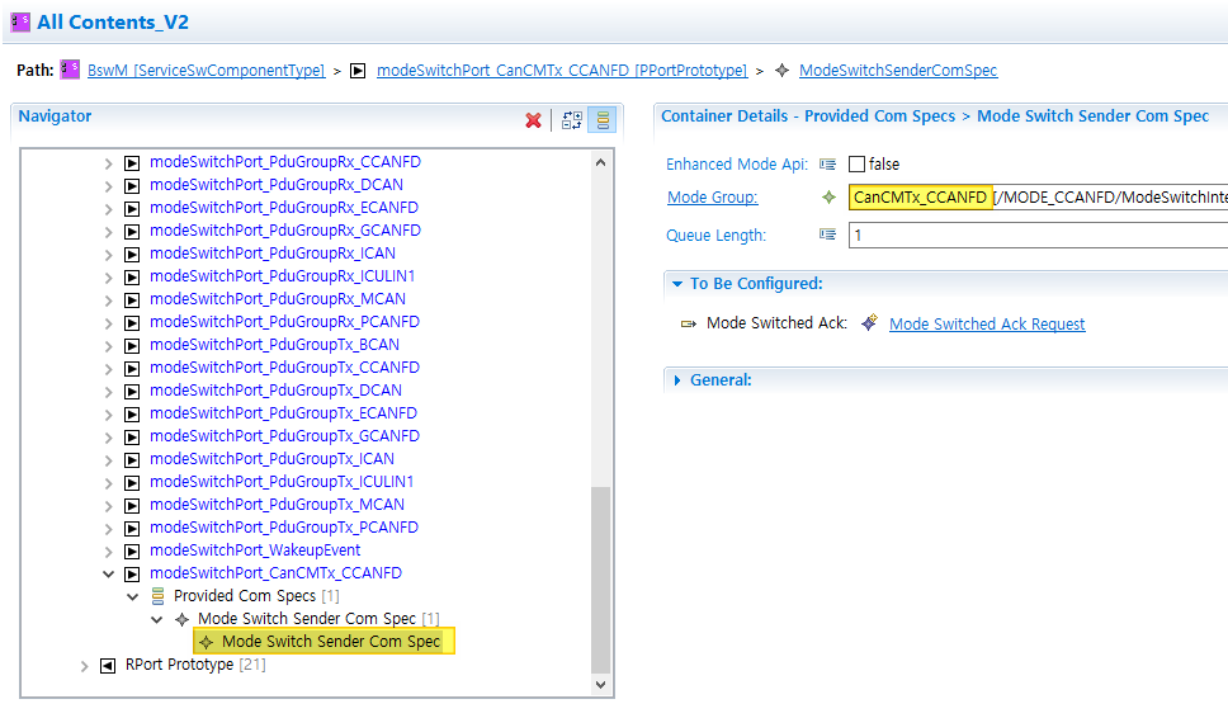


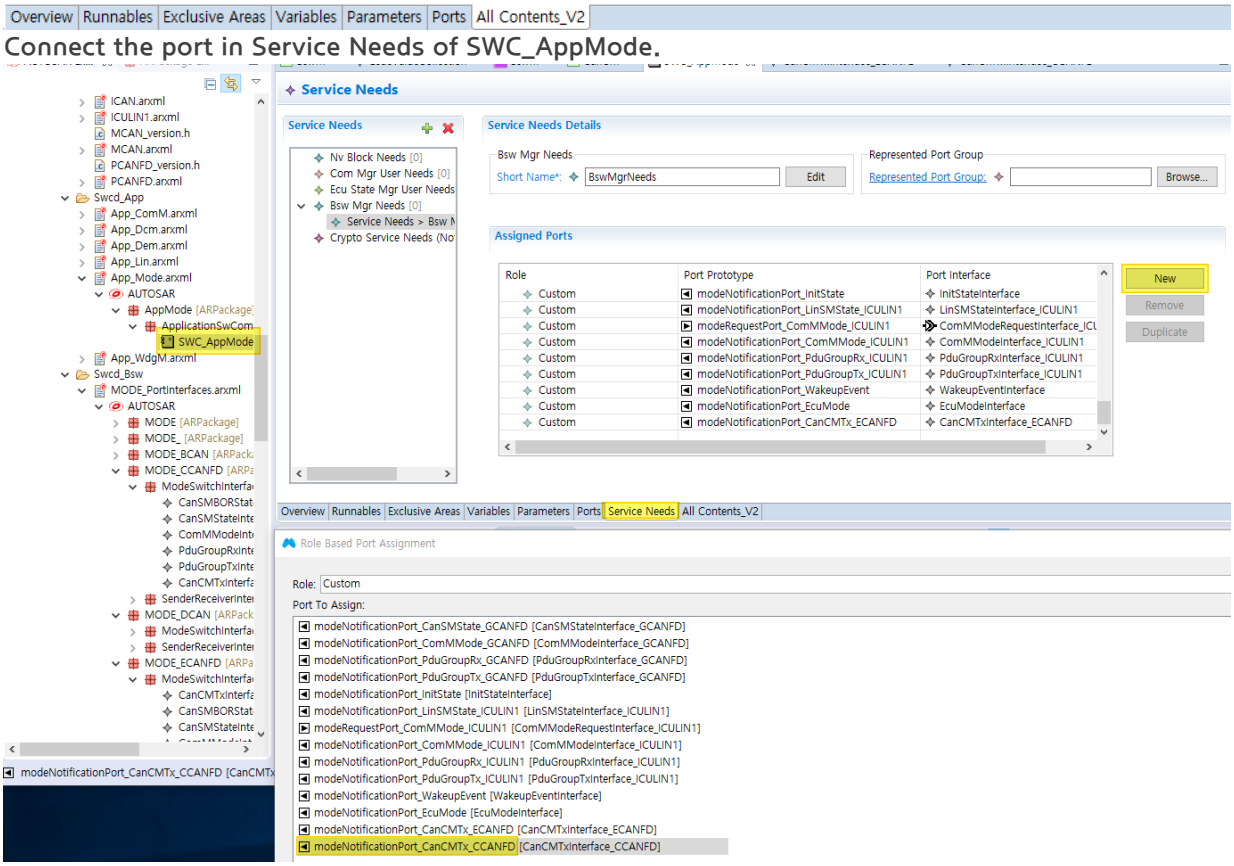
2) In SWC_AppMode tab, go to Ports > RPort Prototype > Click "+" > Mode Swtich Interface > Mode Receiver to generate RPort.



3) Generate PPort in Swcd_Bsw_BswM.arxml.







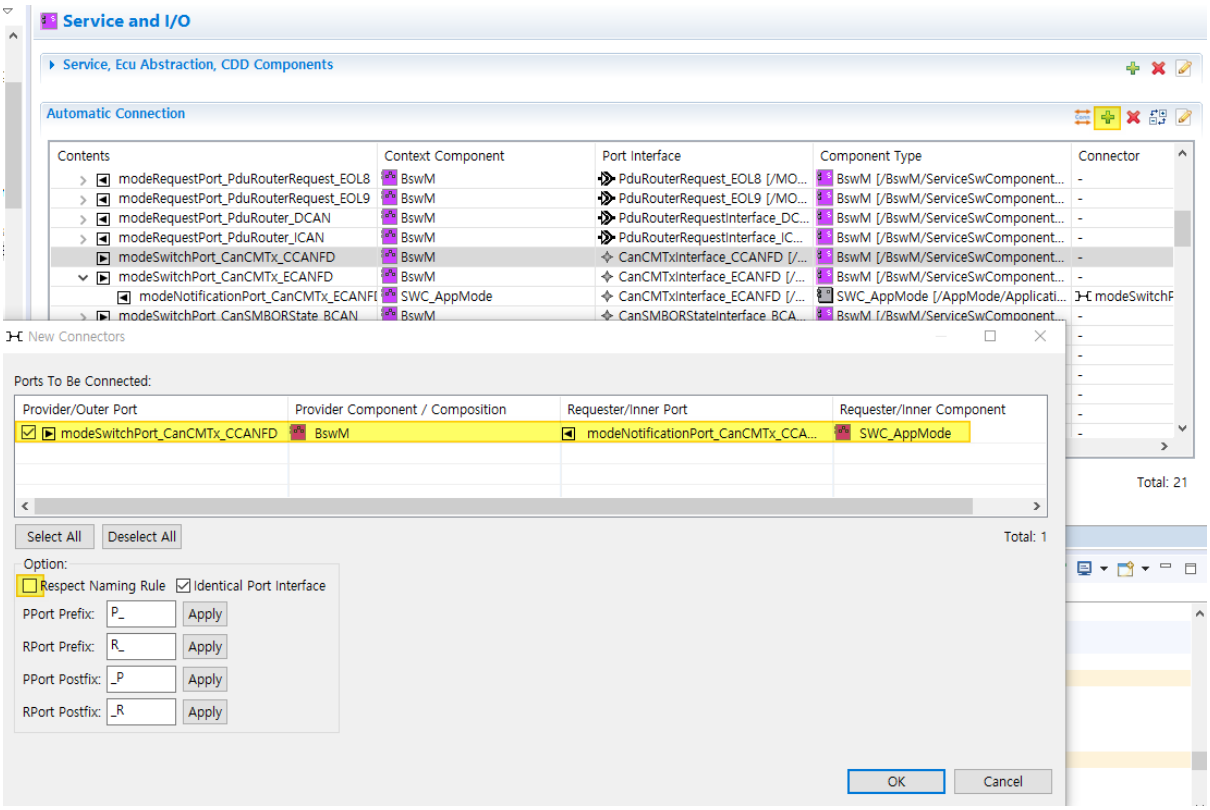
4) Connect the port in Service Needs of SWC_AppMode.

Ports assigned to Service Needs

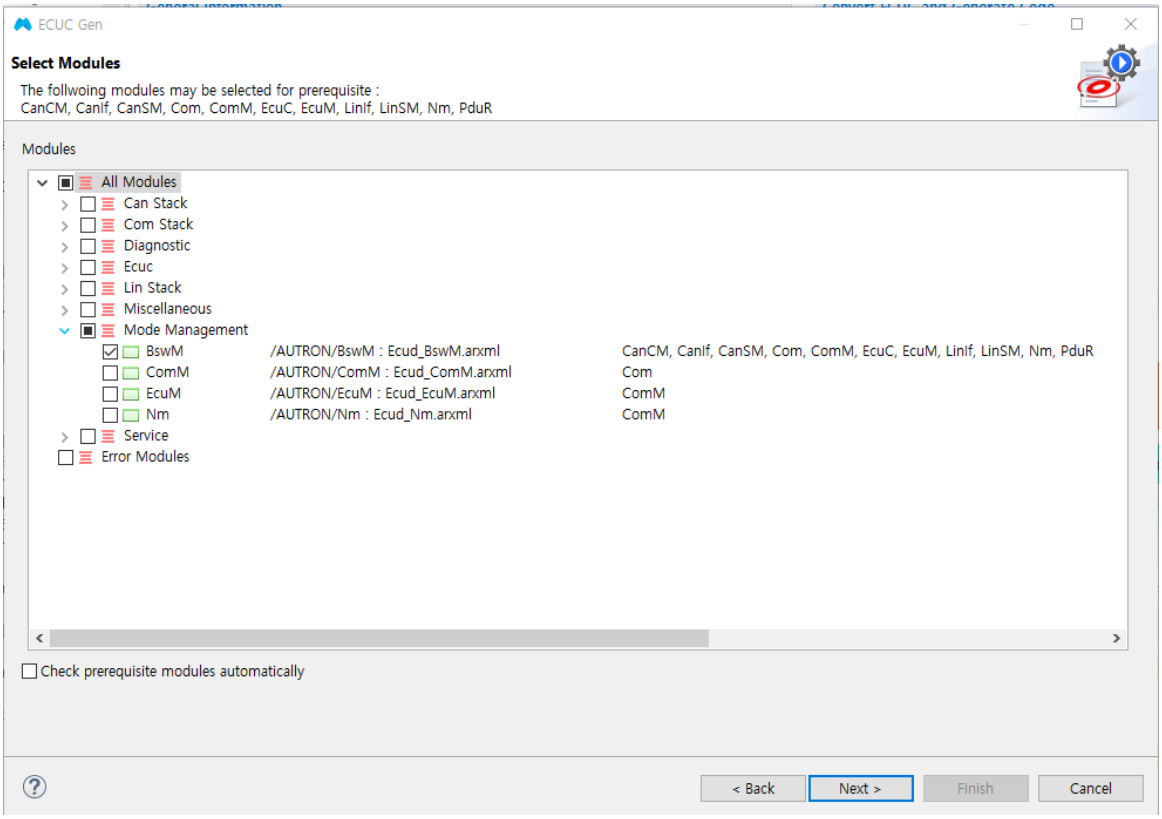
Assigned Ports

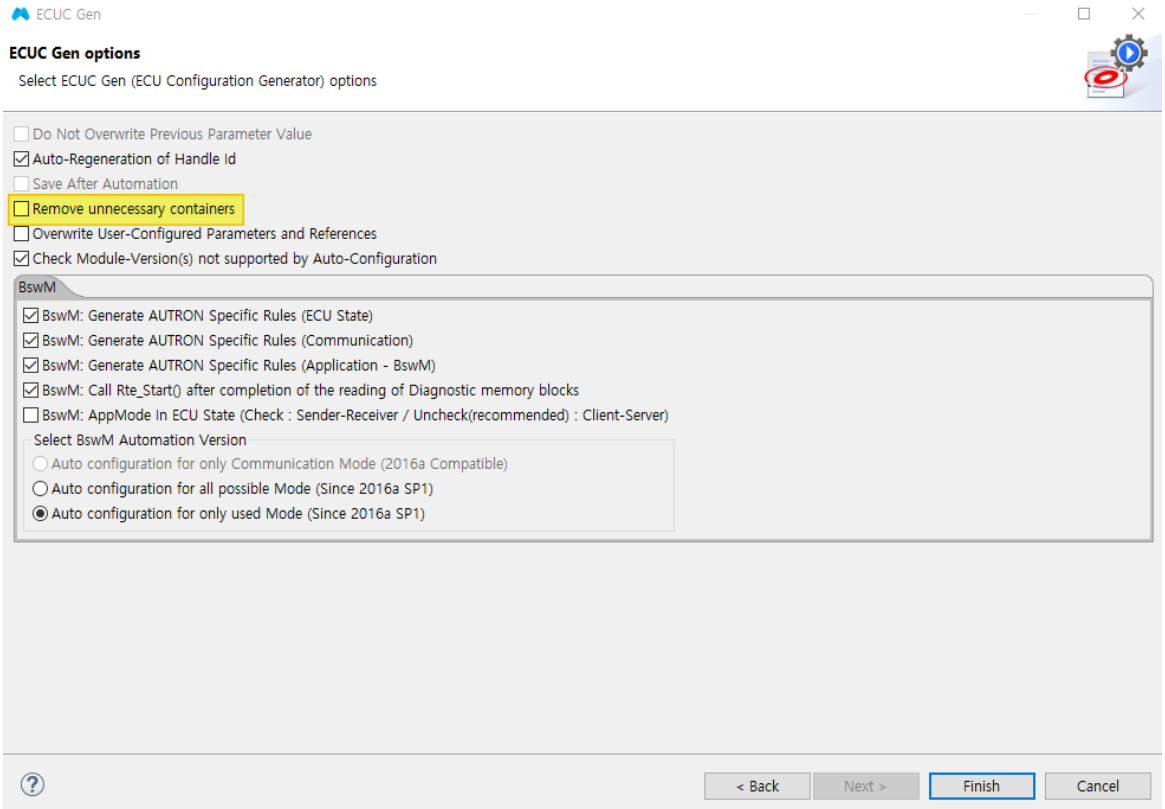
Role	Port Prototype	Port Interface
Custom	modeNotificationPort_CanSMBORState_GCA...	CanSMBORStateInterface_GCA...
Custom	modeNotificationPort_CanSMState_GCANFD	CanSMStateInterface_GCANFD
Custom	modeNotificationPort_ComMMode_GCANFD	ComMModeInterface_GCANFD
Custom	modeNotificationPort_PduGroupRx_GCANFD	PduGroupRxInterface_GCANFD
Custom	modeNotificationPort_PduGroupTx_GCANFD	PduGroupTxInterface_GCANFD
Custom	modeNotificationPort_InitState	InitStateInterface
Custom	modeNotificationPort_LinSMState_ICULIN1	LinSMStateInterface_ICULIN1
Custom	modeRequestPort_ComMMode_ICULIN1	ComMModeRequestInterface_I...
Custom	modeNotificationPort_ComMMode_ICULIN1	ComMModeInterface_ICULIN1
Custom	modeNotificationPort_PduGroupRx_ICULIN1	PduGroupRxInterface_ICULIN1
Custom	modeNotificationPort_PduGroupTx_ICULIN1	PduGroupTxInterface_ICULIN1
Custom	modeNotificationPort_WakeupEvent	WakeupEventInterface
Custom	modeNotificationPort_EcuMode	EcuModeInterface
Custom	modeNotificationPort_CanCMTx_ECANFD	CanCMTxInterface_ECANFD
Custom	modeNotificationPort_CanCMTx_CCANFD	CanCMTxInterface_CCANFD

5) Go to Service and I/O of EcucValueCollection and add connections.

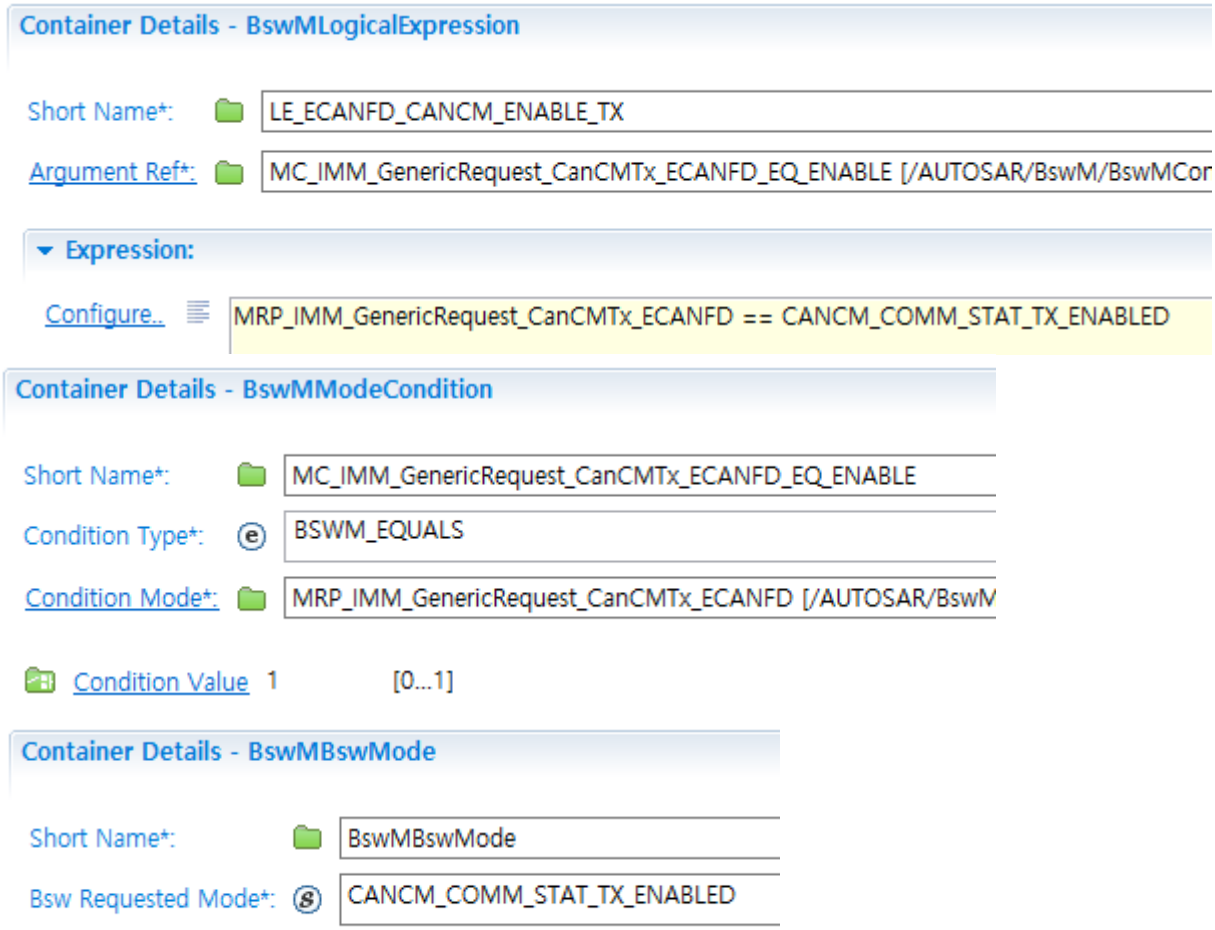


6) Harmonize BswM in ECUC Gen Configuration: harmonize after unchecking “Remove unnecessary containers” in order to harmonize without altering manually-set BswM items (when adding channels, etc.).

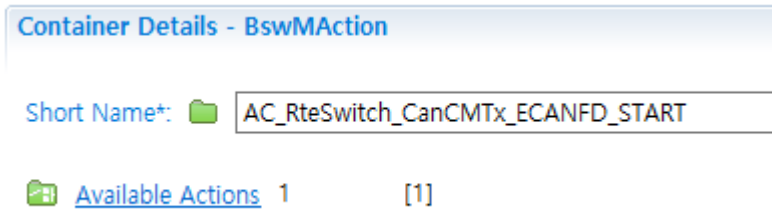


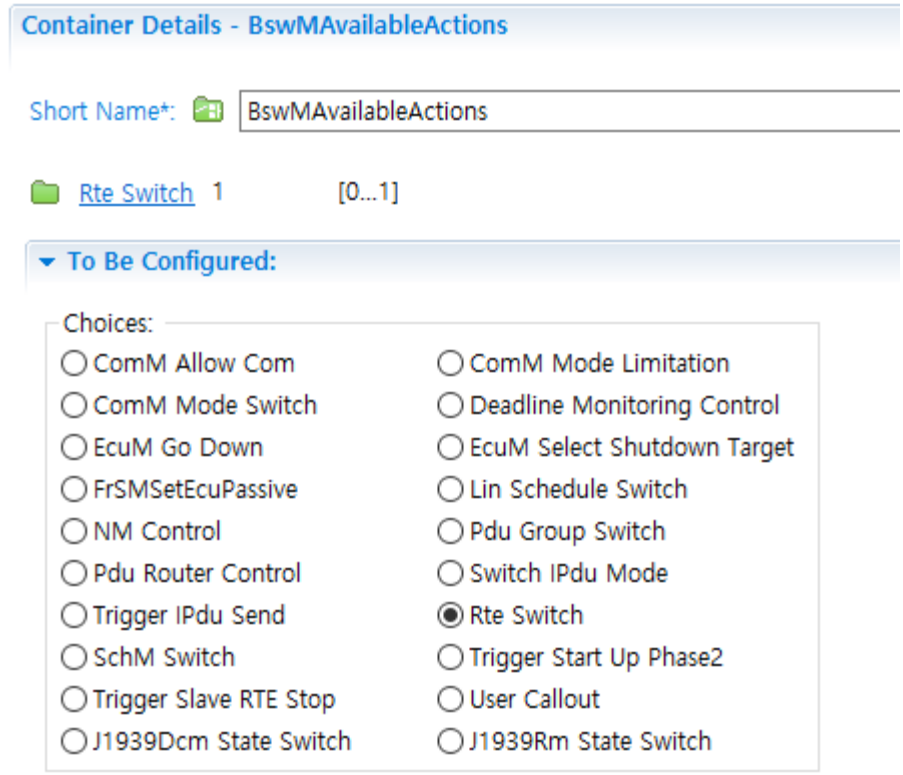


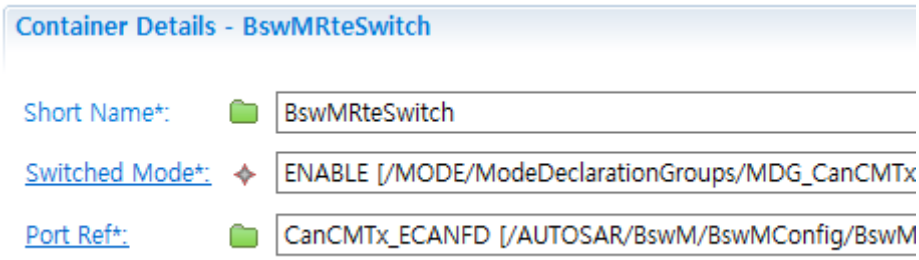
7) Now rules, actions, etc. need to be set up for BswM. For BswM's logical expressions, use LE_{channel}_CANCM_ENABLE_TX which is generated per channel. If you can't find the correct one, create one as shown below. For BswModeCondition, CanCM channel is connected as shown below.



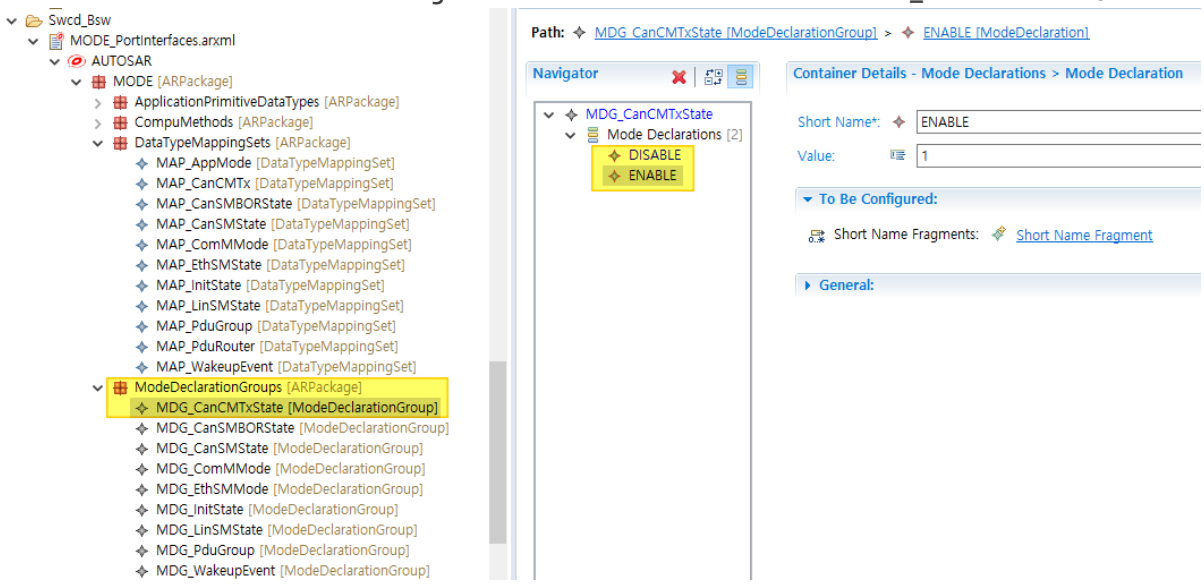
8) Generate Action as Rte Switch. (BswMAction, BswMAvailableActions, BswMRteSwitch)



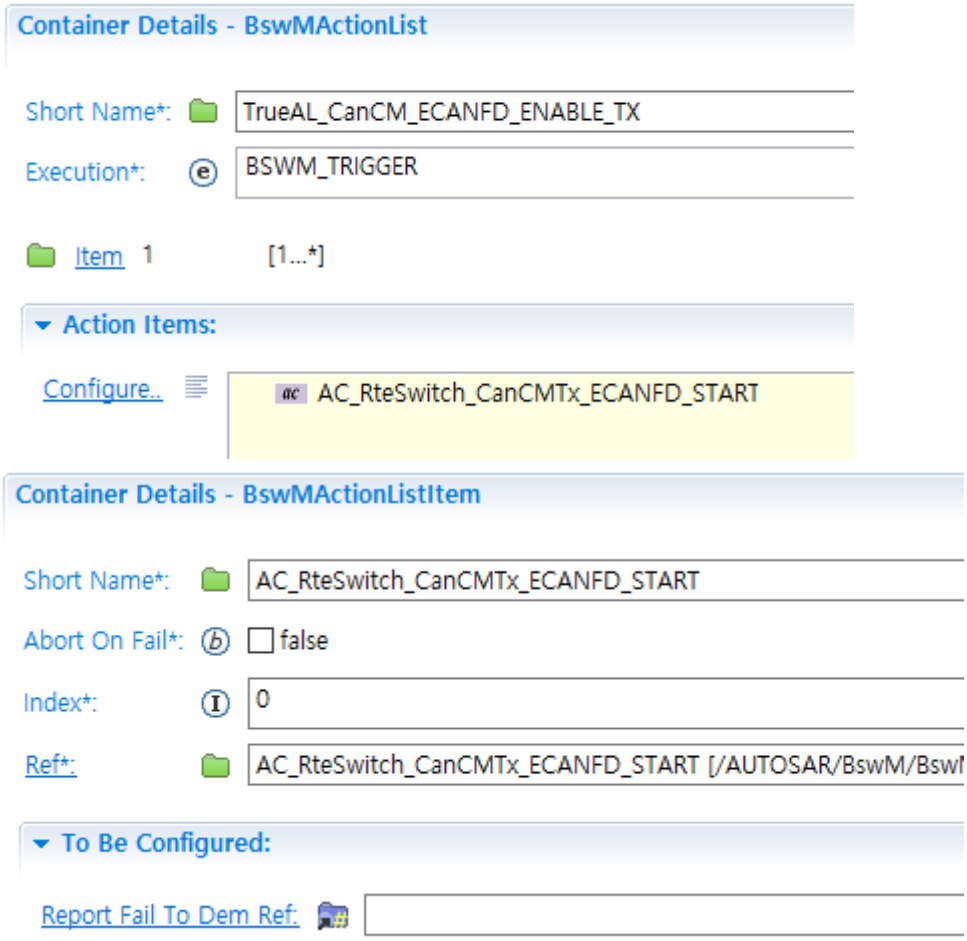




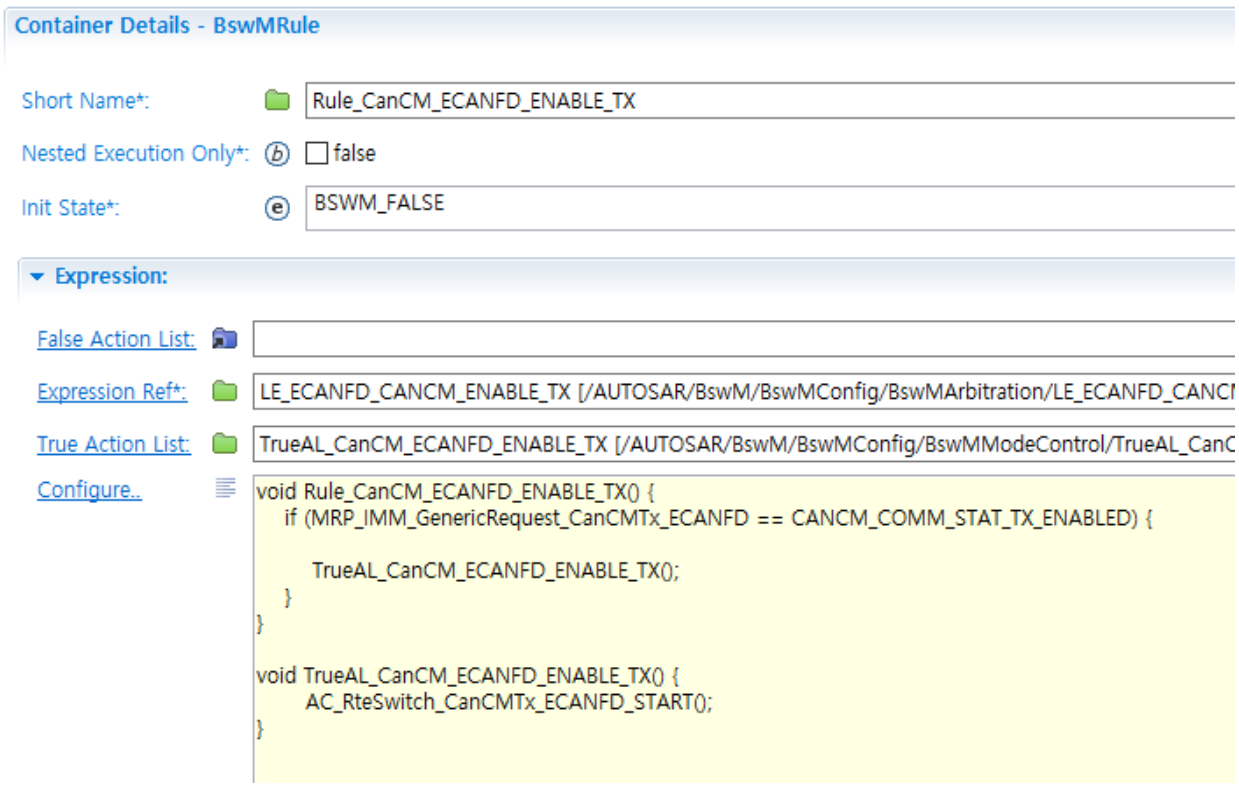
9) Add the definitions for values configured in BswMSwitchedMode to MODE_PortInterfaces.arxml



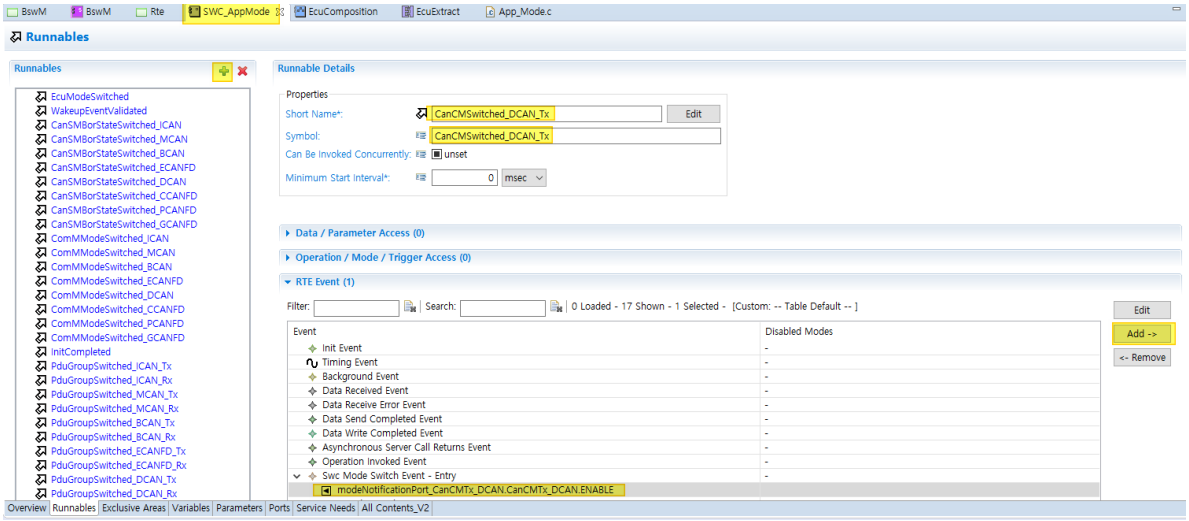
10) Create an Action List and connect the actions defined above. (BswMActionList, BswMActionListItem)



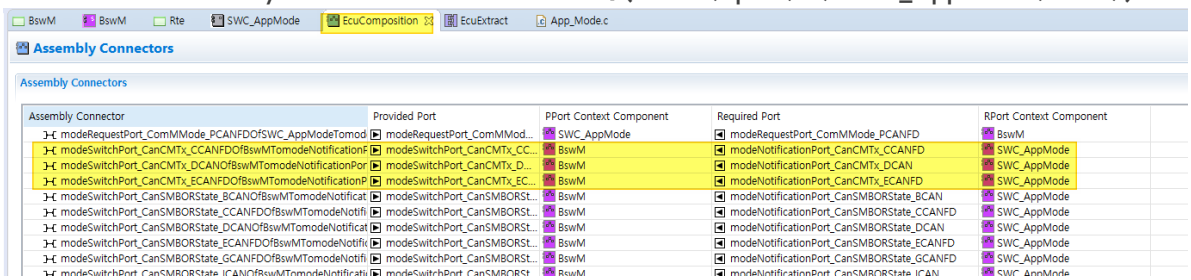
11) Generate the Rule. Ensure only CanCM conditions are checked as shown below.



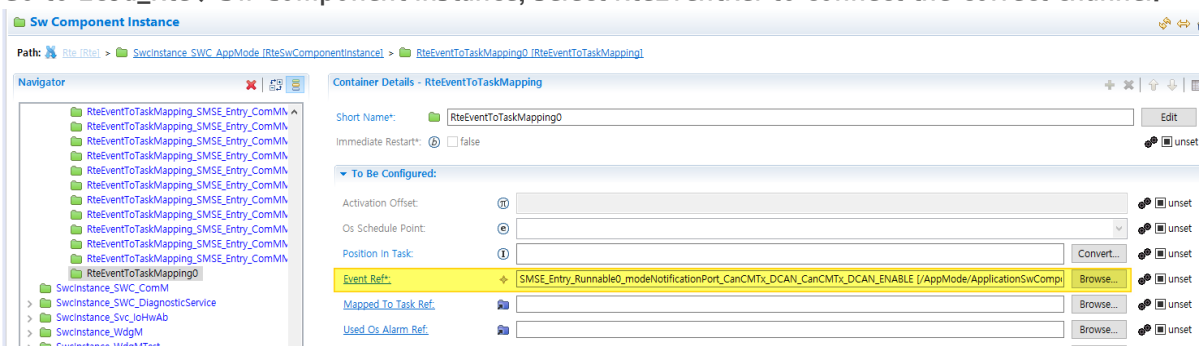
12) Create the runnables for the connection to AppMode. (SWC_AppMode) Connect modeNotificationPort created in RTE Event (under enable condition) as shown below.



13) Assembly Connectors of EcuComposition should show that connectors have been generated as below. Add them if necessary connections are not made. (BswM<Pport> -> SWC_AppMode<RPort>)



14) Go to Ecud_Rte > Sw Component Instance, select RteEventRef to connect the correct channel.



15) The runnable of SWC_AppMode created in Step 12 is called when the Network Activation Timer of the channel expires. Implement any behavior as required by declaring the prototype in Reference_code/App_Mode.c.

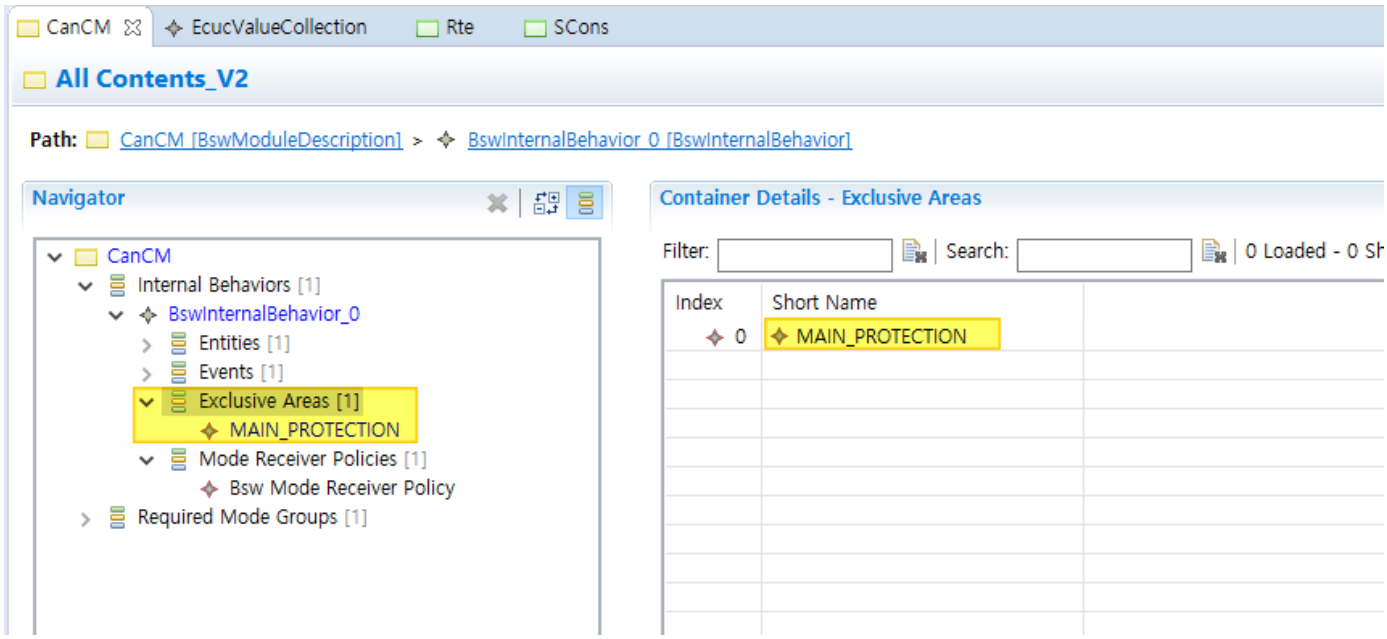
```
FUNC(void,AppMode_CODE) CanCMSwitched_DCAN_Tx(void)
{

}
```

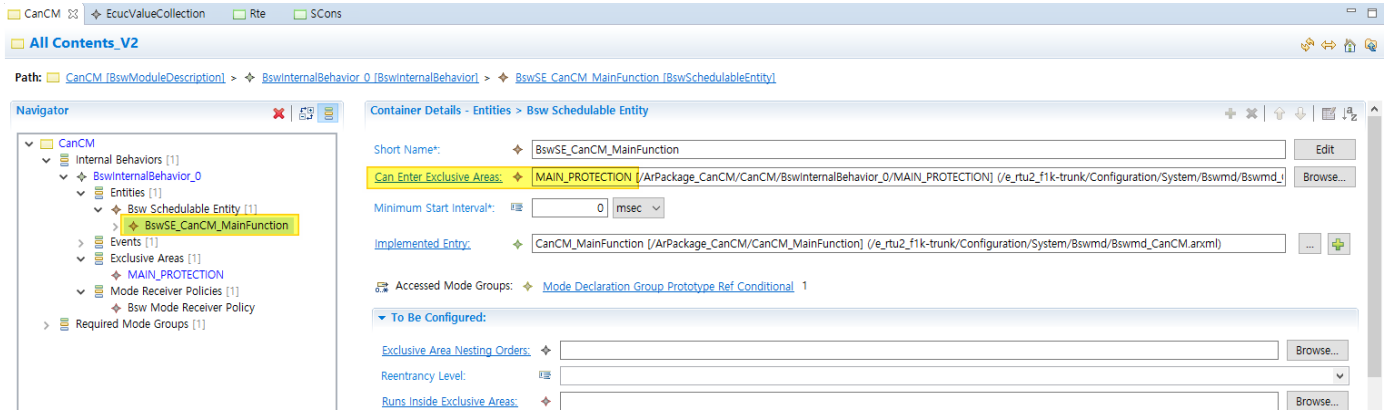
10.3 Exclusive areas added (for versions 1.5.17.0 and higher)

Version 1.5.17.0 and higher have newly-added Exclusive Areas. BswM_CanCM.arxml and Ecud_Rte.arxml shall be fixed according to the guide below.

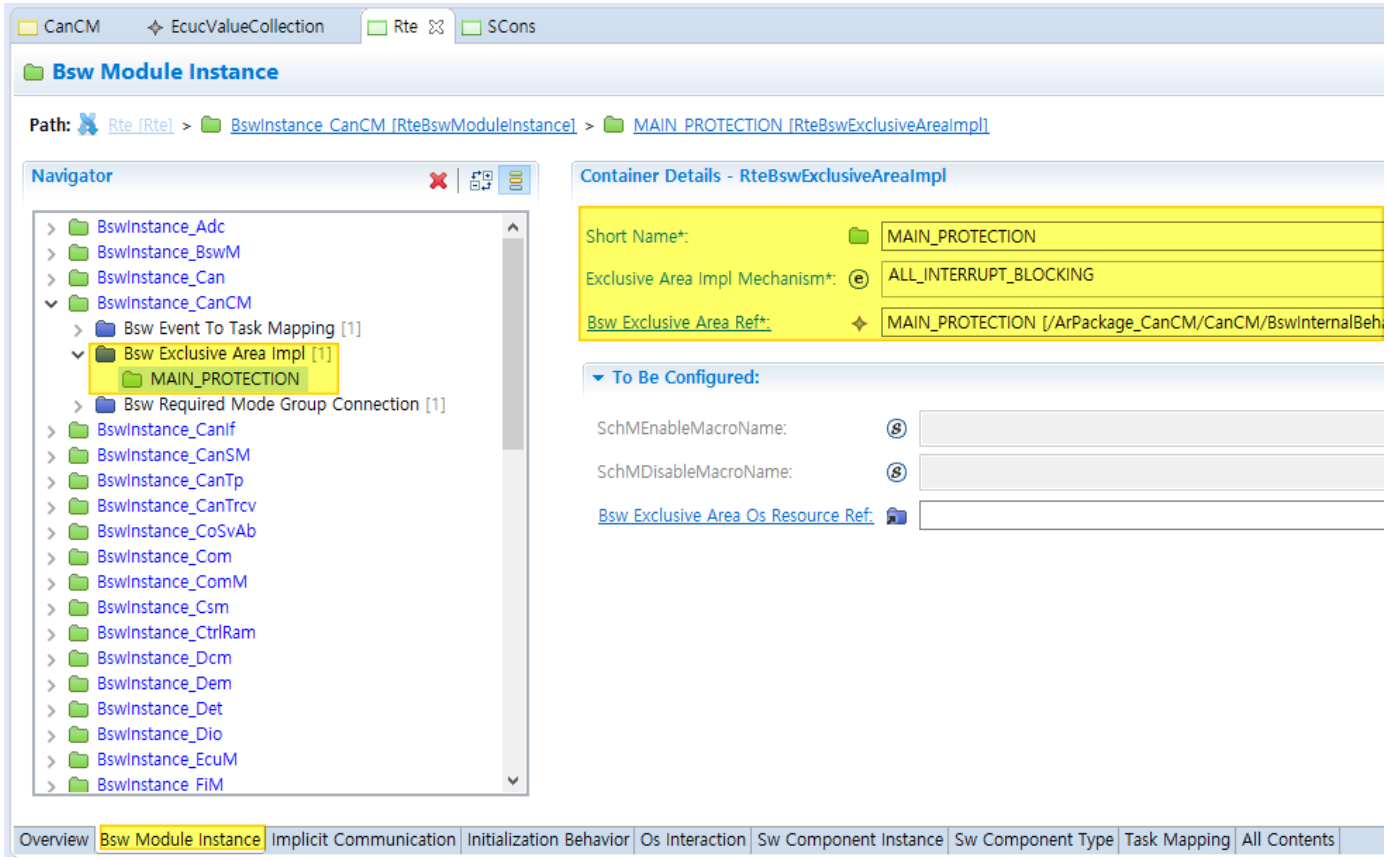
Go to Configuration/System/Bswmd/Bswmd_CanCM.arxml and add Exclusive Areas/MAIN_PROTECTION to CanCM/Internal Behaviors/BswInternalBehavior_0.



Go to Entities > Bsw Schedulable Entity > BswSE_CanCM_MainFunction. Add the aforementioned MAIN_PROTECTION to Can Enter Exclusive Areas.



Create BswInstance_CanCM/Bsw Exclusive Area Impl in Ecud_Rte.arxml and configure as shown below.



After building, SchM_Enter_CanCM_MAIN_PROTECTION and SchM_Exit_CanCM_MAIN_PROTECTION are generated in Rte.c.