M4G Group (1)
Application Note
Consumer Electronics Control Circuit
(CEC-A)

Outlines

This application note is a reference material for developing products using the Consumer Electronics Control Circuit (CEC) function of M4G group (1).
This document helps the user check operation of the product and develop its program.

Target sample program: CEC_CH_TO_CH

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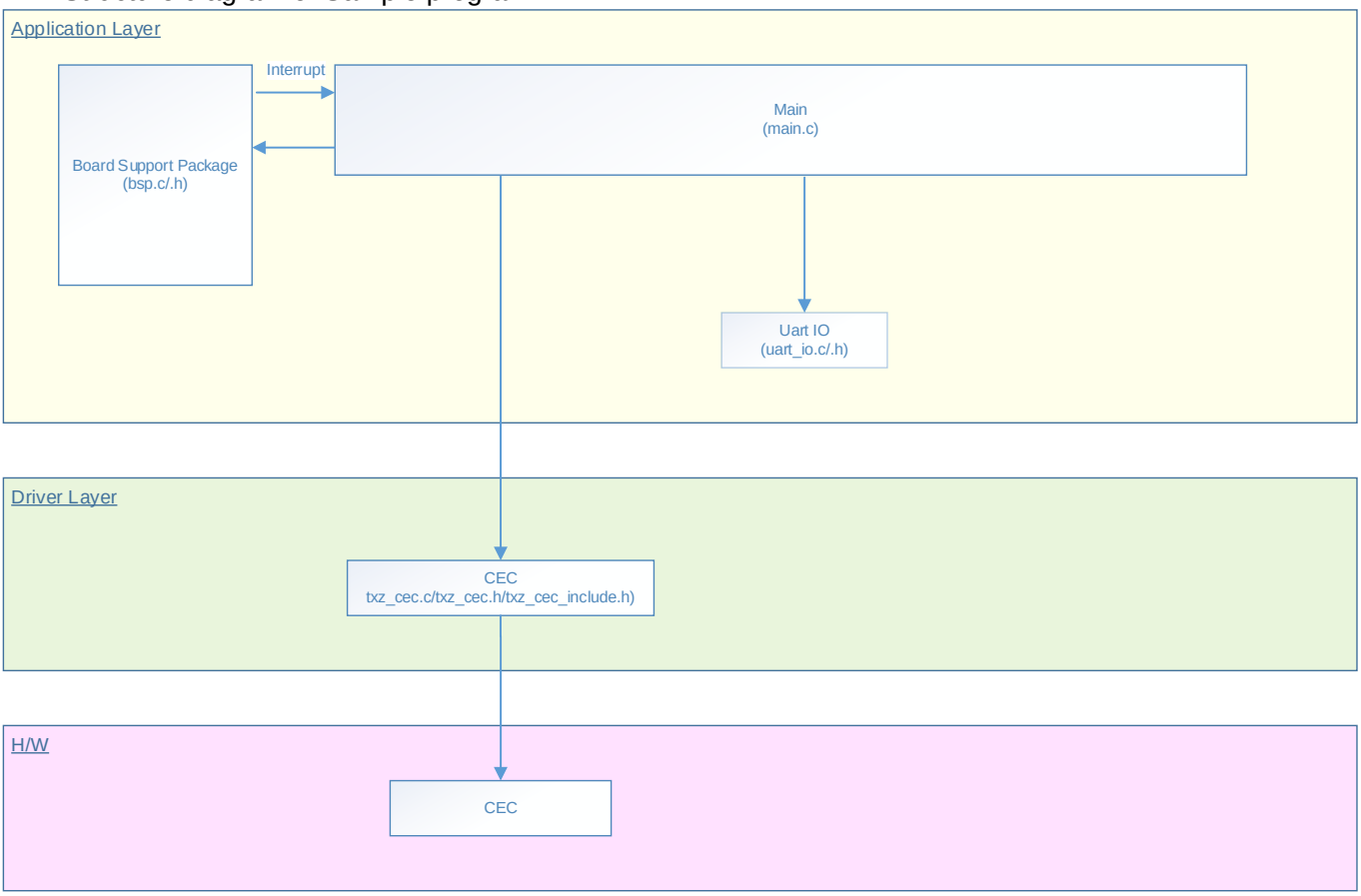
Table of Contents

Outlines....1
Table of Contents....2
1. Preface....3
2. Reference Document....4
3. Function to Use....4
4. Target Device....4
5. Operation Confirmation Condition....5
6. Evaluation Board Setting....6
7. Operation of Evaluation Board....6
8. Outline of CEC Control Circuit Function....7
9. Sample Program....8
9.1. Initialization....8
9.2. Sample Program Main Operation....8
9.3. Output Example of Sample Program....9
9.3.1. Setting Example of Terminal Software....9
9.4. Operating Flow of Sample Program....10
10. Precaution....17
11. Revision History....17
RESTRICTIONS ON PRODUCT USE....18

1. Preface

This sample program is used to check the operation of CEC circuit function.

Structure diagram of Sample program



2. Reference Document

- Datasheet
  TMPM4G group (1) datasheet Rev1.0 (Japanese edition)
- Reference manual
  Consumer Electronics Control Circuit (CEC-A) Rev1.0 (Japanese edition)
  Asynchronous Serial Communication Circuit (UART-C) Rev3.0 (Japanese edition)
- Application note
  M4G Group (1) Application Note Startup (CMSIS System & Clock Configuration) Rev1.0
- Other reference document
  TMPM4G (1) Group Peripheral Driver User Manual (Doxygen)

3. Function to Use

IP	Channel	Port	Operation / Function mode
CEC	-	PT2 (CEC0)	-
Asynchronous Serial Communication Circuit	ch0	PE2 (UT0RXD)	UART mode
		PE3 (UT0TXDA)	

4. Target Device

The target devices of this application note are as follows;

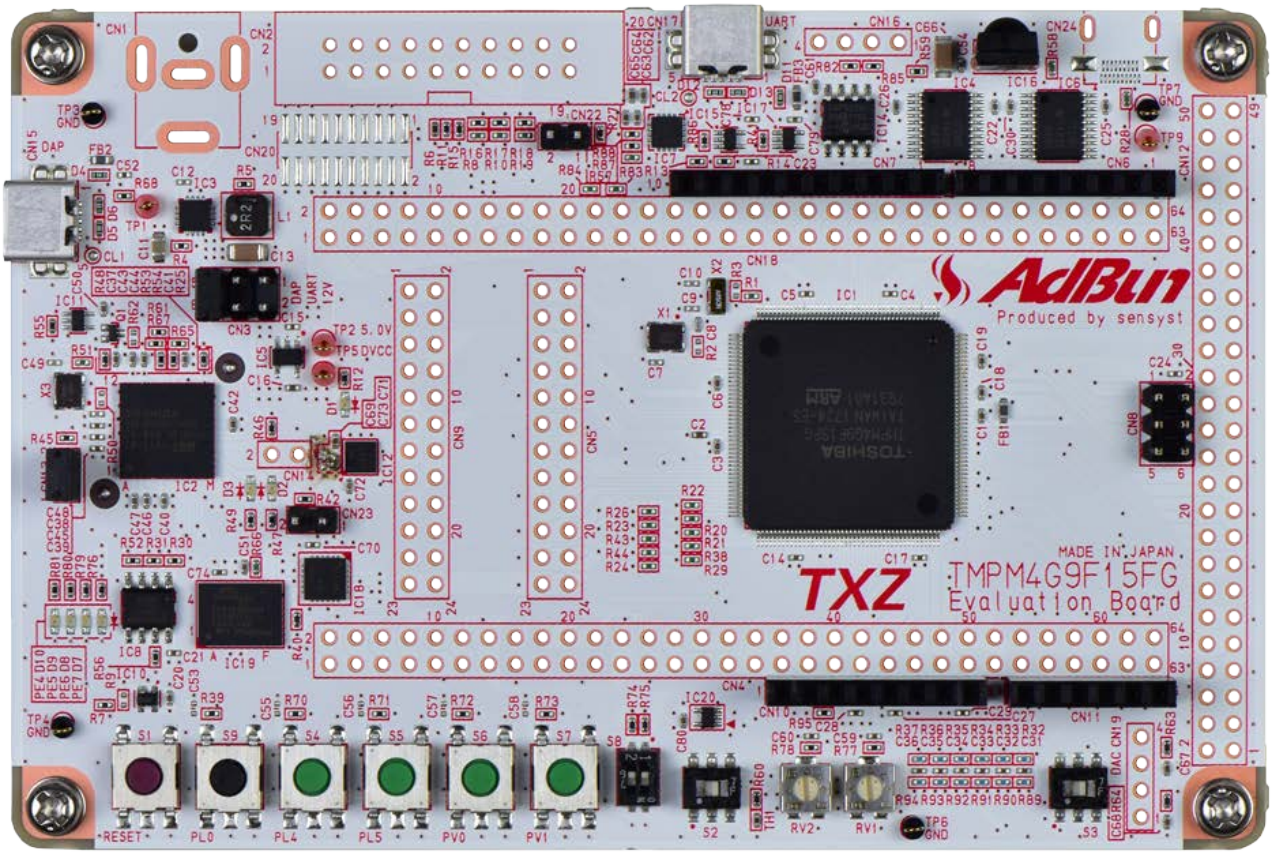
TMPM4G9F15FG	TMPM4G9F10FG	TMPM4G9FEFG	TMPM4G9FDFG
TMPM4G9F15XBG	TMPM4G9F10XBG	TMPM4G9FEXBG	TMPM4G9FDXBG
TMPM4G8F15FG	TMPM4G8F10FG	TMPM4G8FEFG	TMPM4G8FDFG
TMPM4G8F15XBG	TMPM4G8F10XBG	TMPM4G8FEXBG	TMPM4G8FDXBG
	TMPM4G7F10FG	TMPM4G7FEFG	TMPM4G7FDFG
	TMPM4G6F10FG	TMPM4G6FEFG	TMPM4G6FDFG

*This sample program operates on the evaluation board of TMPM4G9F15FG.
If other function than the TMPM4G9F15 one is checked, it is necessary that CMSIS Core related files (C startup file and I/O header file) should be changed properly.
The BSP related file is dedicated to the evaluation board (TMPM4G9F15). If other function than the TMPM4G9F15 one is checked, the BSP related file should be changed properly.

5. Operation Confirmation Condition

Used microcontroller	TMPM4G9F15FG
Used board	TMPM4G9F15FG Evaluation Board by Sensyst
Unified development environment	IAR Embedded Workbench for ARM 8.11.2.13606
Unified development environment	µVision MDK Version 5.24.2.0
Terminal software	Tera Term V4.96
Sample program	V1000

Evaluation board (TMPM4G9F15FG Evaluation Board) Top view



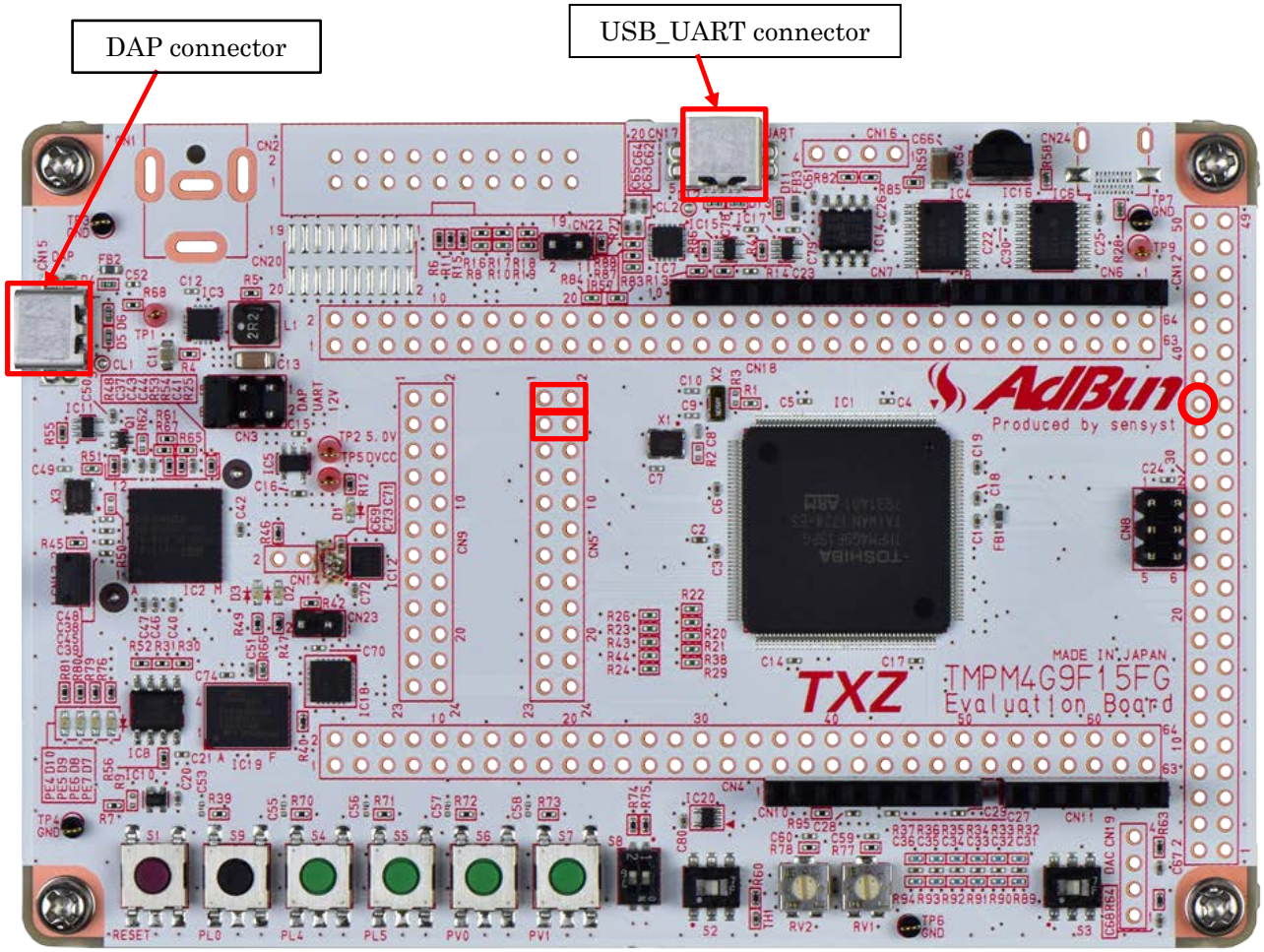
6. Evaluation Board Setting

Two evaluation boards are used.
The way of connection is the same.

The following through-holes should be connected on the evaluation board. (Common with board A and board B)

CN5		
Board function	Through-hole No.	Through-hole No.
USB to UART conversion	1: USB_UT_RX	2: PE2
USB to UART conversion	3: USB_UT_TX	4: PE3

The following parts of the board A and board B are connected.
Board A: CN12 36 (PT2) - Board B: CN12 36 (PT2)



7. Operation of Evaluation Board

PC and the USB_UART are connected for communication with the terminal software.
Executes the setting of communication after the terminal software (Tera Term) starts up.
Push down the reset button on the evaluation board.
The communication starts with the command input.
For details of command input operations, refer to Sample program main operation.

8. Outline of CEC Control Circuit Function

The brief outline of CEC Control Circuit (CEC) function is shown as follows.

Function Classification	Function	Operation
HDMI standard	-	Compliant with Version 1.3a.
Reception control	Sampling clock	Selected from the followings: - fs (Low speed clock) - CECxCLKTRG (Timer trigger for Clock source)
	Noise reduction	Noise canceling time is adjustable. -"High" detection time Sampling clock selected from 1 to 4 consecutive observations. - "Low" detection time Sampling clock selected from 1 to 4 consecutive observations.
	Data reception	Data reception per Byte - Flexible data sampling point - Data reception is available even when a Destination address does not match.
	Error detection	- Cycle error (Max/Min) - ACK collision - Waveform error
Transmission control	Data transmission	Data transmission per Byte - Triggered by auto-detection of bus free state
	Waveform adjustment	Transmission waveform adjustment - The timing of a rising edge and the cycle time are adjustable.
	Error detection	- Arbitration lost - ACK response error
Interrupt	Transmission interrupt	- Start transmission - Transmission end - Arbitration lost - ACK Error - Underrun
	Reception interrupt	- Reception completed - Start bit - Max cycle error - Min cycle error - ACK collision - Overrun - Waveform error

9. Sample Program

Two addresses, address 5 and address 7 are set as the CEC address.
When the header and Data are input on the Tera Term, you can check the transmission and receiving of Data by sample program.

9.1. Initialization

The following initialization is done after power is supplied.
The initialization of each clock setting and the setting of the watchdog timer are done.

9.2. Sample Program Main Operation

After the initialization operation, shift to the main function and do the following initialization.
(1) Initialization of BSP (Board Support Package)
(2) Initialization of variables
(3) Initialization of application

The header and Data are input following “Input =”.
The header and Data are displayed following “CEC Snd =”, and are transmitted.
When the data are received, the header and received data are displayed following “CEC Rcv =”.

9.3. Output Example of Sample Program

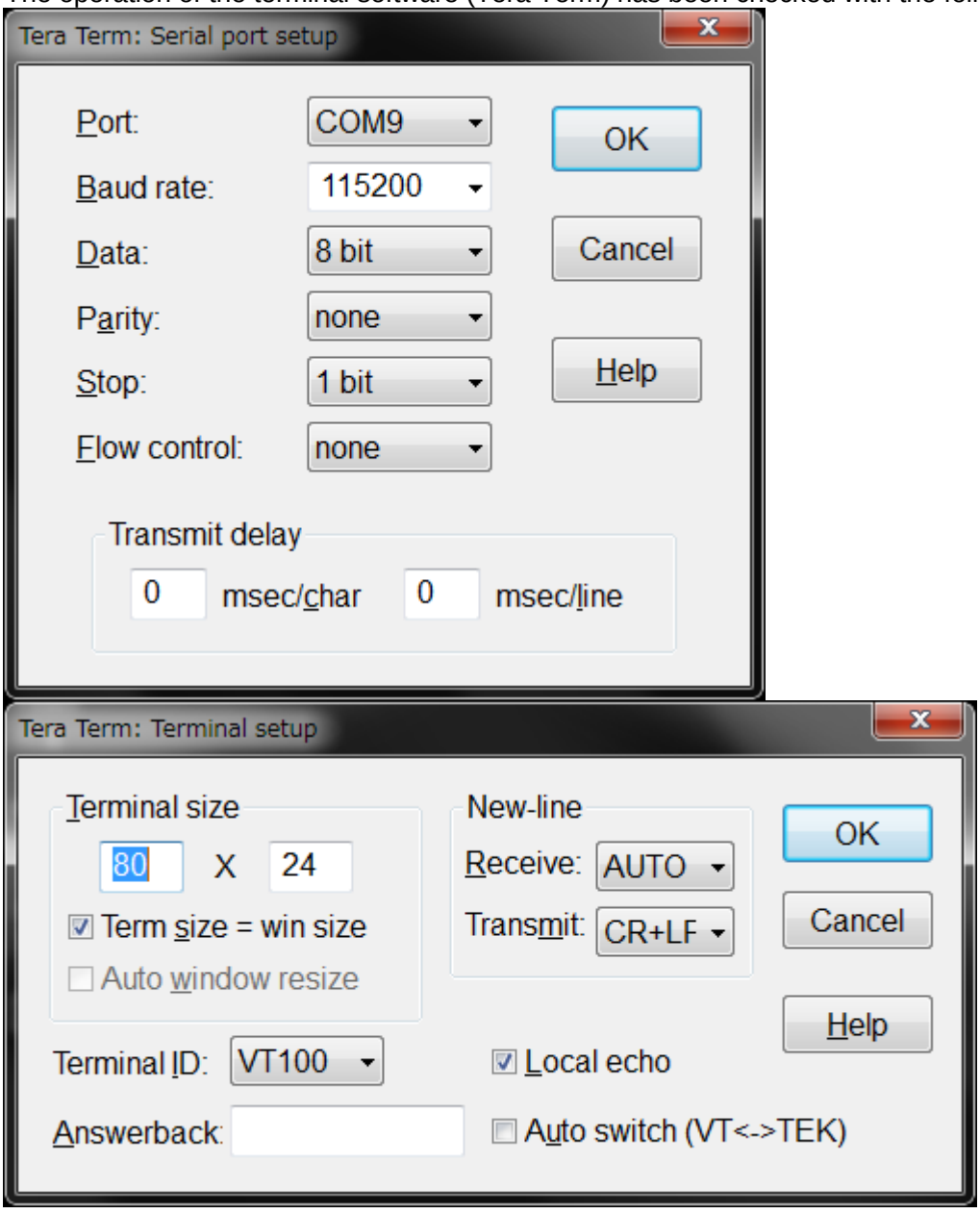
After the sample program starts to operate, the command results are displayed as shown in the following.

"u" shows header, and "abcdef" shows Data in the following example.

```
CEC Address = 5
CEC Address = 7
Input = uabcdef
CEC Snd = uabcdef
Input =
CEC Rcv = W012345
```

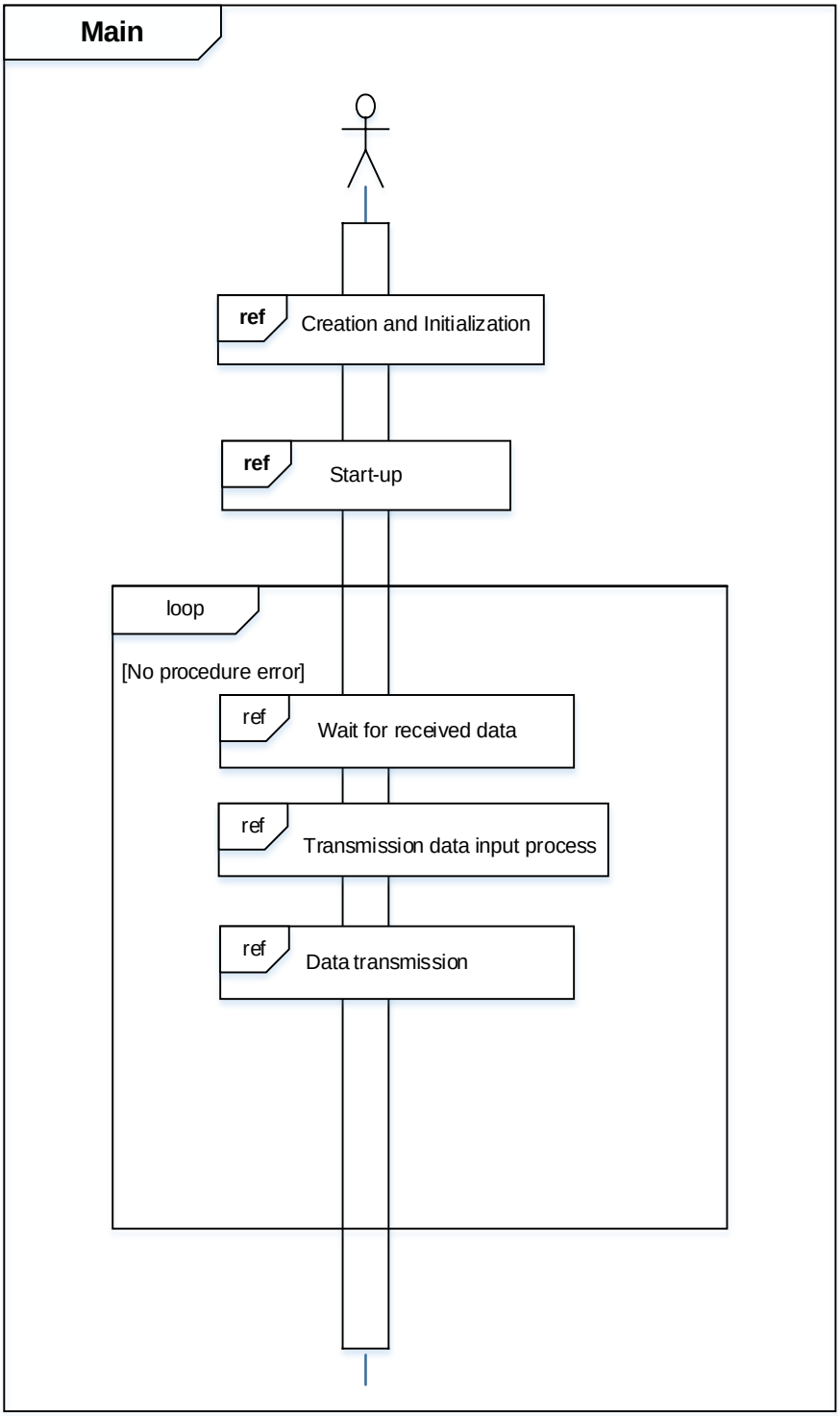
9.3.1. Setting Example of Terminal Software

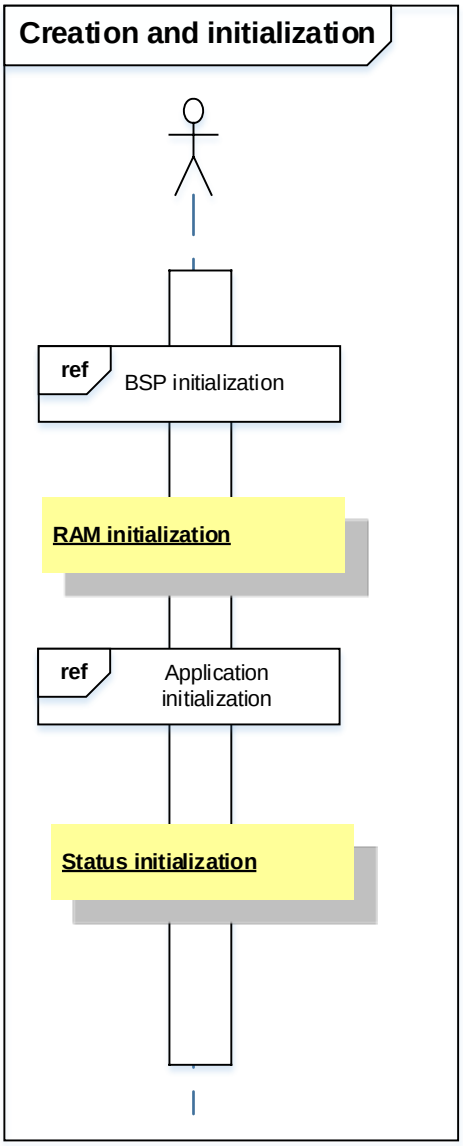
The operation of the terminal software (Tera Term) has been checked with the following settings.

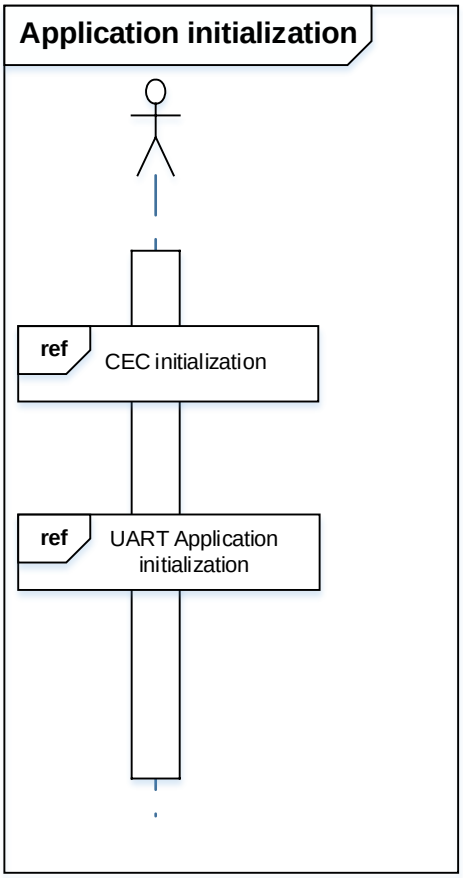


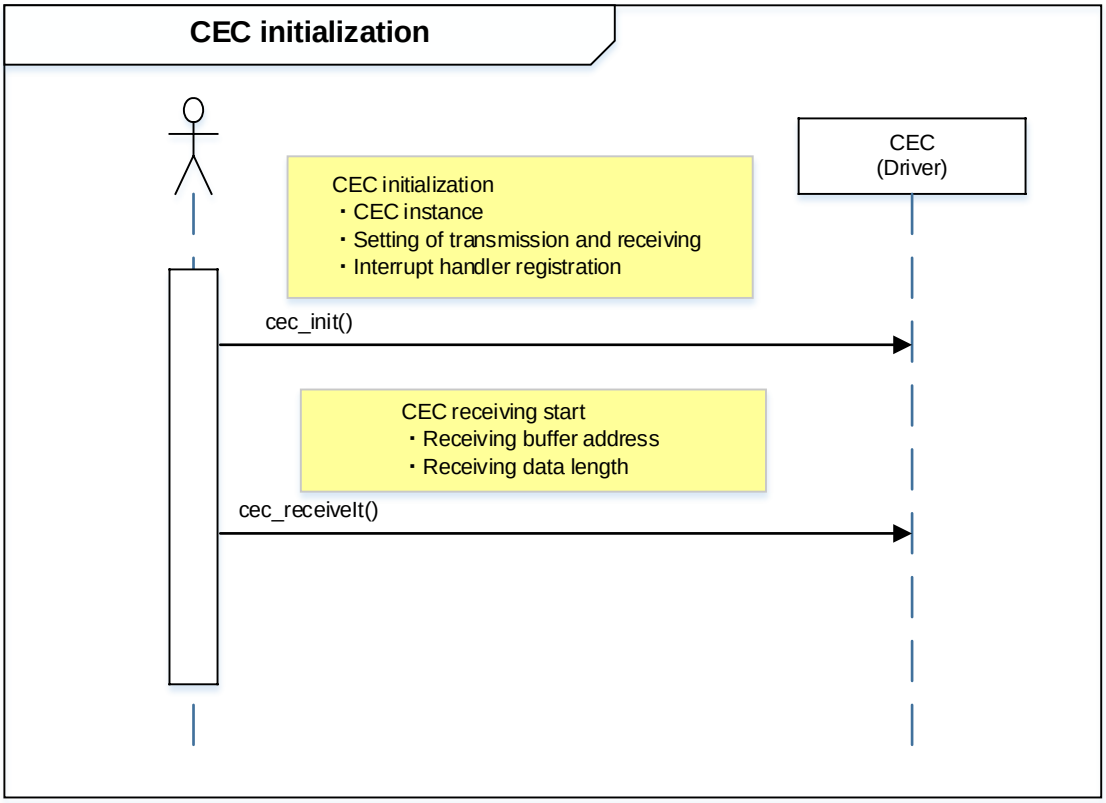
9.4. Operating Flow of Sample Program

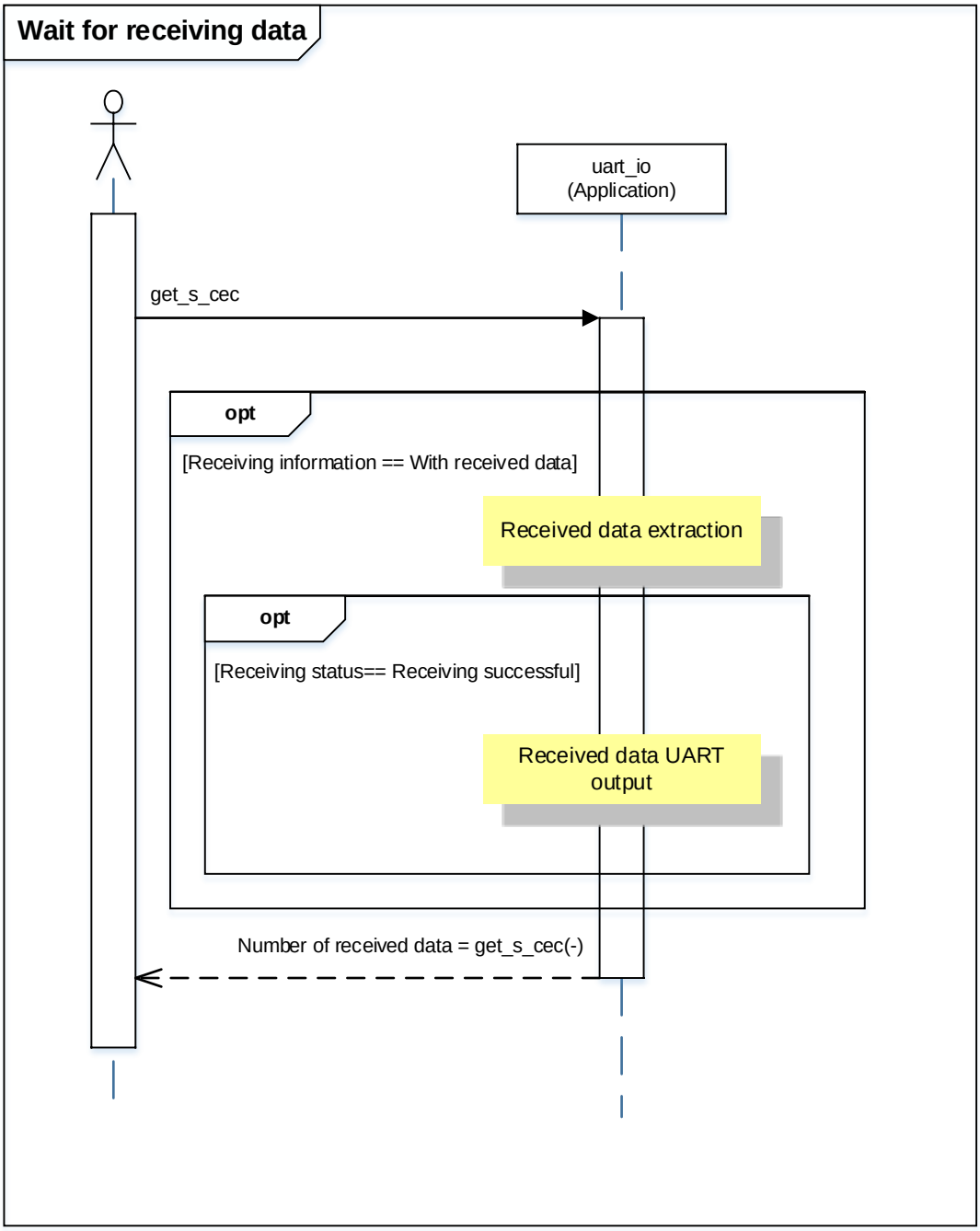
The basic operating flows of the sample program are shown in the following;

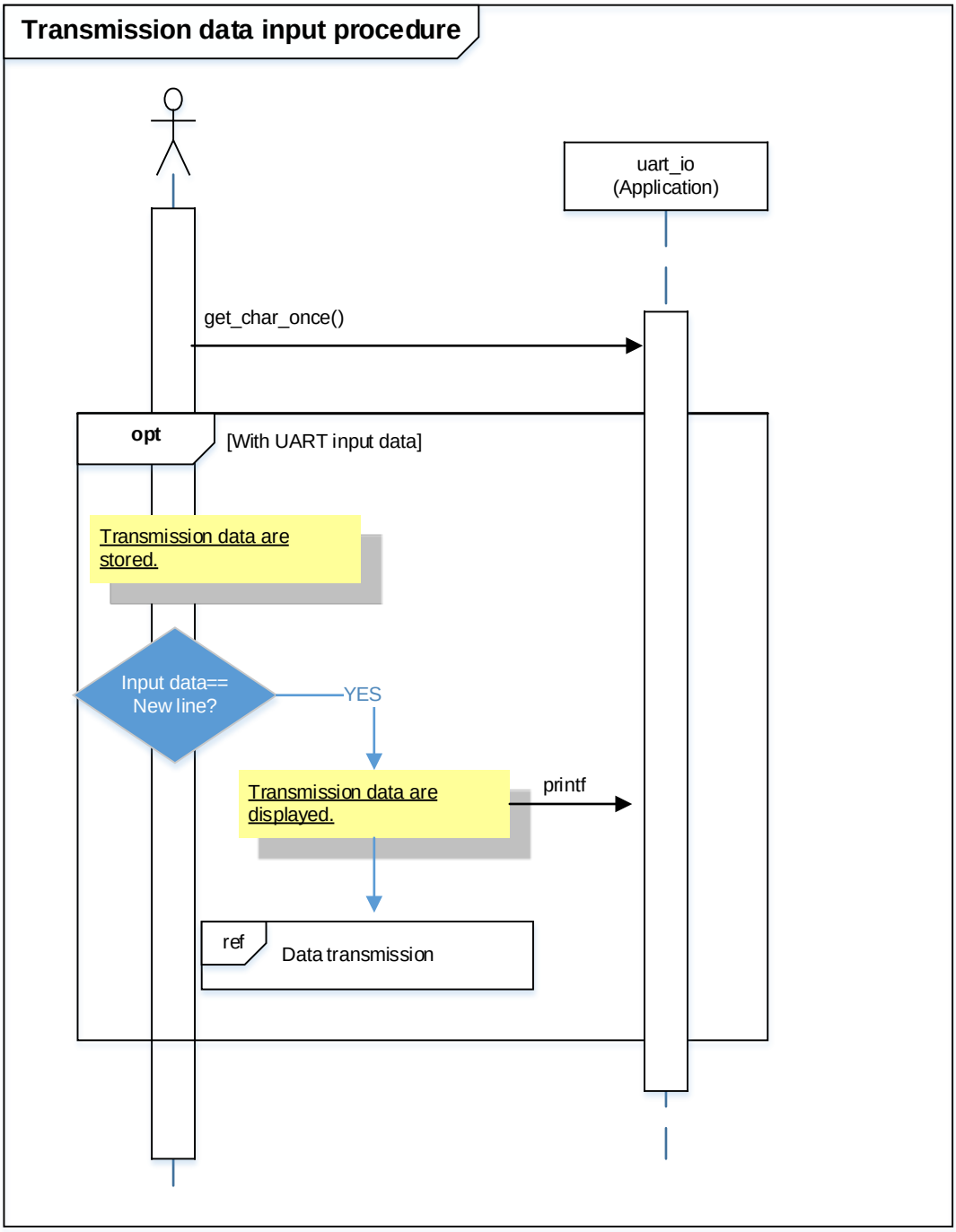


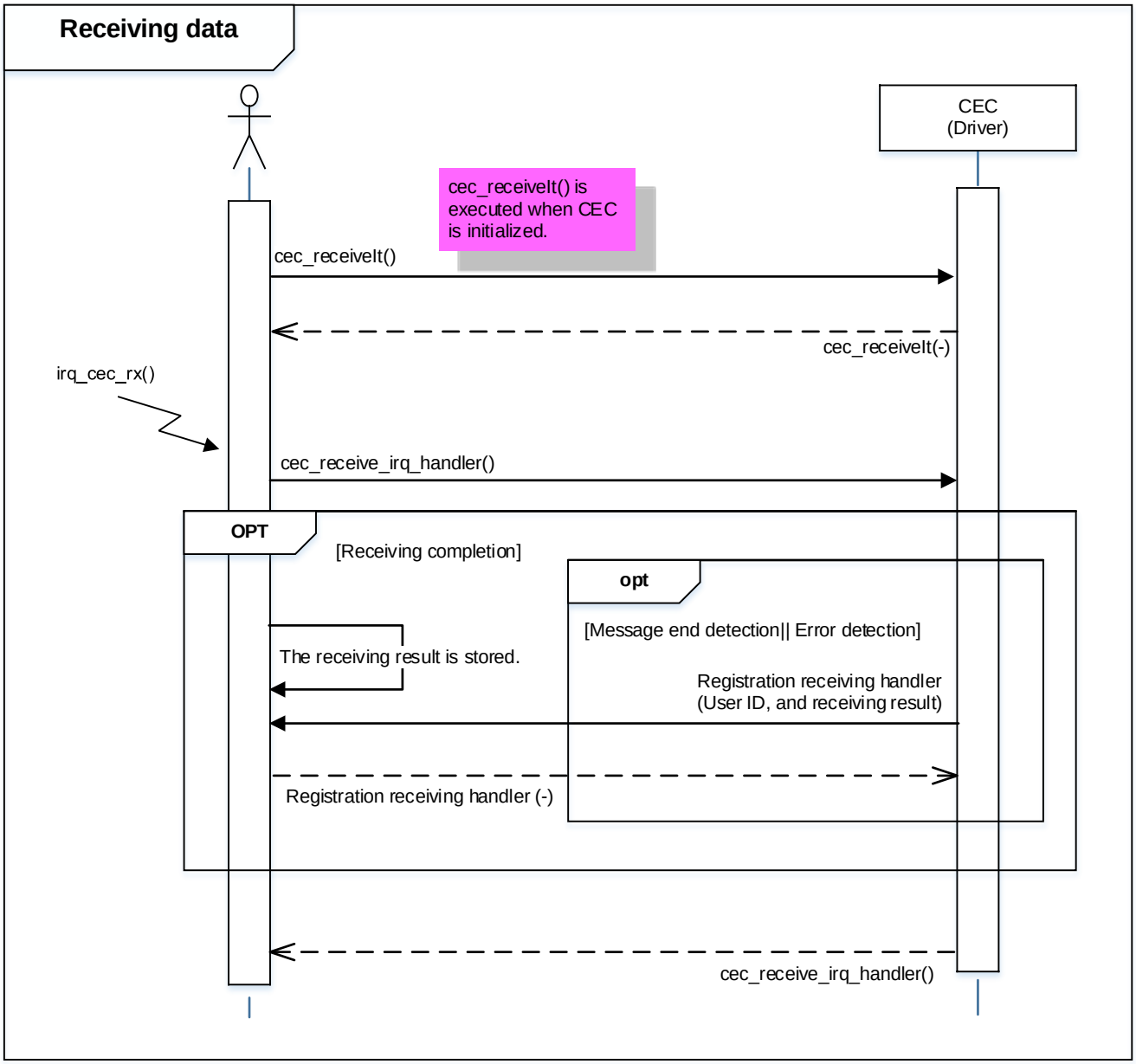

Creation and initialization
ref
BSP initialization
RAM initialization
ref
Application initialization
Status initialization

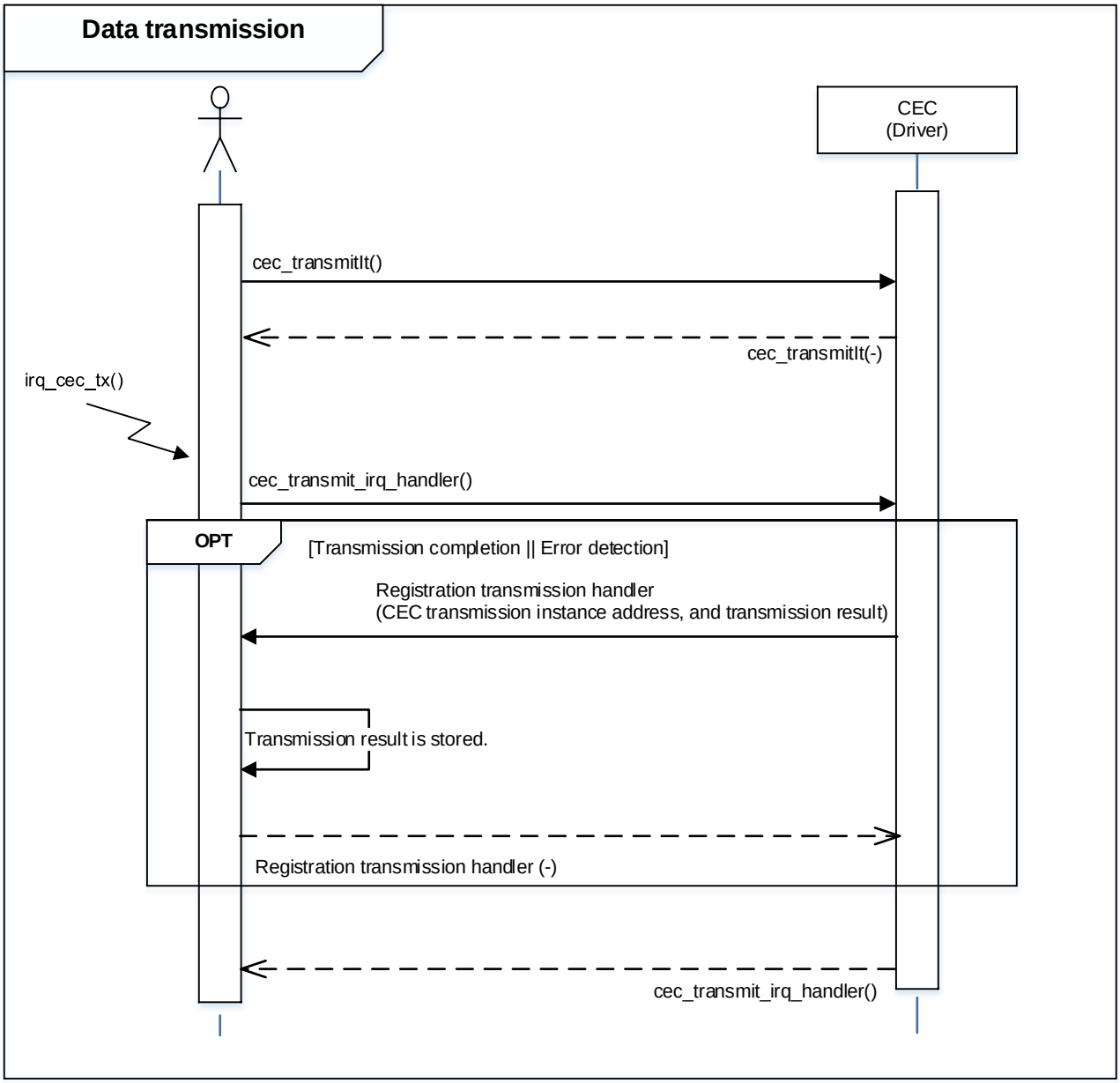

Application initialization
ref
CEC initialization
ref
UART Application initialization


CEC initialization
CEC
(Driver)
CEC initialization
・CEC instance
・Setting of transmission and receiving
・Interrupt handler registration
cec_init()
CEC receiving start
・Receiving buffer address
・Receiving data length
cec_receiveIt()


Wait for receiving data
uart_io
(Application)
get_s_cec
opt
[Receiving information == With received data]
Received data extraction
opt
[Receiving status== Receiving successful]
Received data UART
output
Number of received data = get_s_cec(-)


Transmission data input procedure
uart_io
(Application)
get_char_once()
opt
[With UART input data]
Transmission data are stored.
Input data== New line?
YES
Transmission data are displayed.
printf
ref
Data transmission


Receiving data
CEC
(Driver)
cec_receiveIt() is executed when CEC is initialized.
cec_receiveIt()
cec_receiveIt(-)
irq_cec_rx()
cec_receive_irq_handler()
OPT
[Receiving completion]
opt
[Message end detection|| Error detection]
The receiving result is stored.
Registration receiving handler
(User ID, and receiving result)
Registration receiving handler (-)
cec_receive_irq_handler()


Data transmission
CEC
(Driver)
cec_transmitIt()
cec_transmitIt(-)
irq_cec_tx()
cec_transmit_irq_handler()
OPT
[Transmission completion || Error detection]
Registration transmission handler
(CEC transmission instance address, and transmission result)
Transmission result is stored.
Registration transmission handler (-)
cec_transmit_irq_handler()

10. Precaution

When using the sample program with CPU other than TMPM4G9F15, please check operation sufficiently.

11. Revision History

Rev	Date	Description
1.0	2018-11-26	First release

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