# RX Family

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## Ethernet Multicast Frame Filter Function Using Firmware Integration Technology Modules

## Introduction

This document explains the usage example of the multicast frame filter function implemented in the Ethernet peripheral module of the RX64M/71M using EPTPC Light FIT (Firmware Integration Technology) module [1]. The multicast frame filter function enhances the total performance of the Ethernet communication by cancel the receiving irrelevant multicast frames. Even if the filter is set enabled, two registered specific multicast frames can be received.

## Target Device

This API supports the following device.

- RX64M Group
- RX71M Group

When using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.

## Contents

# 1. Overview

This document explains the usage example of the multicast frame filter function implemented in the Ethernet peripheral module of the RX64M/71M using EPTPC Light FIT module (hereafter PTP light driver). The multicast frame filter function enhances the total performance of the Ethernet communication by cancel the receiving irrelevant multicast frames. Even if the filter is set enabled, two registered specific multicast frames can be received.

This example is composed of a mc filter project and a test project. The mc filter project does the multicast frame filter functional operation to the incoming test multicast frame (hereafter test frame) from one port. If the mc filter project receives the test frame, it relays the received test frame to the other port. The test project creates the test frames whose data contents are read from the USB memory and transmits those frames. If any relayed test frames via RX64M/71M implemented to the mc filter project existed, the test project receives relayed test frames, and measures the propagation and operation time of them.

## 1.1 Ethernet Multicast Frame Filter Function Using FIT Modules

This example is implemented in two projects and used as the operation example of the multicast frame filter function using PTP light driver.

## 1.2 Related documents

[1] RX Family EPTPC Light Module Using Firmware Integration Technology, Rev.1.11, Document No. R01AN3035EJ0111, Nov 11, 2016

[2] RX Family Ethernet Module Using Firmware Integration Technology, Rev.1.12, Document No. R01AN2009EJ0112, Nov 11, 2016

[3] RX Family Flash Module Using Firmware Integration Technology, Rev.1.20, Document No. R01AN2184EU0120, Dec 22, 2014

[4] Renesas USB MCU USB Basic Host and Peripheral firmware Using Firmware Integration Technology, Rev.1.10, Document No. R01AN2025EJ0110, Dec 26, 2015

[5] Renesas USB MCU USB Host Mass Storage Class Driver (HMSC) Using Firmware Integration Technology, Rev.1.10, Document No. R01AN2026EJ0110, Dec 26, 2015

[6] RX Family Open Source FAT File System [M3S-TFAT-Tiny] Module Firmware Integration Technology, Rev.3.00, Document No. R20AN0038EJ0300, Apr 01, 2014

[7] RX Family EPTPC Module Using Firmware Integration Technology, Rev.1.12, Document No. R01AN1943EJ0112, Nov 11, 2016

[8] RX64M Group Renesas Starter Kit+ User's Manual For $e^2$ studio, Rev. 1.10, Document No. R20UT2593EG0110, Jun 25, 2015

[9] RX71M Group Renesas Starter Kit+ User's Manual, Rev. 1.00, Document No. R20UT3217EG0100, Jan 23, 2015

## 1.3 Hardware Structure

This example uses the Ethernet peripheral modules of the RX64M/71M. The Ethernet peripheral modules are composed of the EPTPC, the PTP Host interface peripheral module (PTPEDMAC), dual channel Ethernet MAC ones (ETHERC (CH0), ETHERC (CH1)) and dual channel Ethernet Host interface ones (EDMAC (CH0), EDMAC (CH1)).

Furthermore, the test project use the USB module (USB), Multi-Function Timer Pulse Unit (MTU3) module and data flash of the RX64M/71M.

In detail, please refer to RX64M/71M Group User's Manual: Hardware.

## 1.4 Software Structure

This sample is operations example of the application layer applied to plural FIT modules. The application is different from the mc filter project and test project. The mc filter project manages the operation sequence and set the multicast frame filter function. The test project manages the operation sequence, loads/writes the MAC address from/to the data flash, creates and verifies test frame, reads test data form the USB memory, writes transferred data and saves result data to the USB memory. The Ether driver [2] of each channel transmits and receives frames, MTU3 driver measures the propagation and operation time of the transferred test frame, the data flash driver [3] erases and writes communication parameter[1] to the data flash. The USB Host driver [4], [5] accesses the USB memory as the logical block unit. The FAT file system (M3S-TFAT-Tiny) [6] manages the data in the USB memory as the file using the USB Host driver. The mc filter project only uses the two channel Ether driver and PTP Light driver. Figure 1.1 shows the typical structure and functional overview of the software.

[1] MAC address in this example.

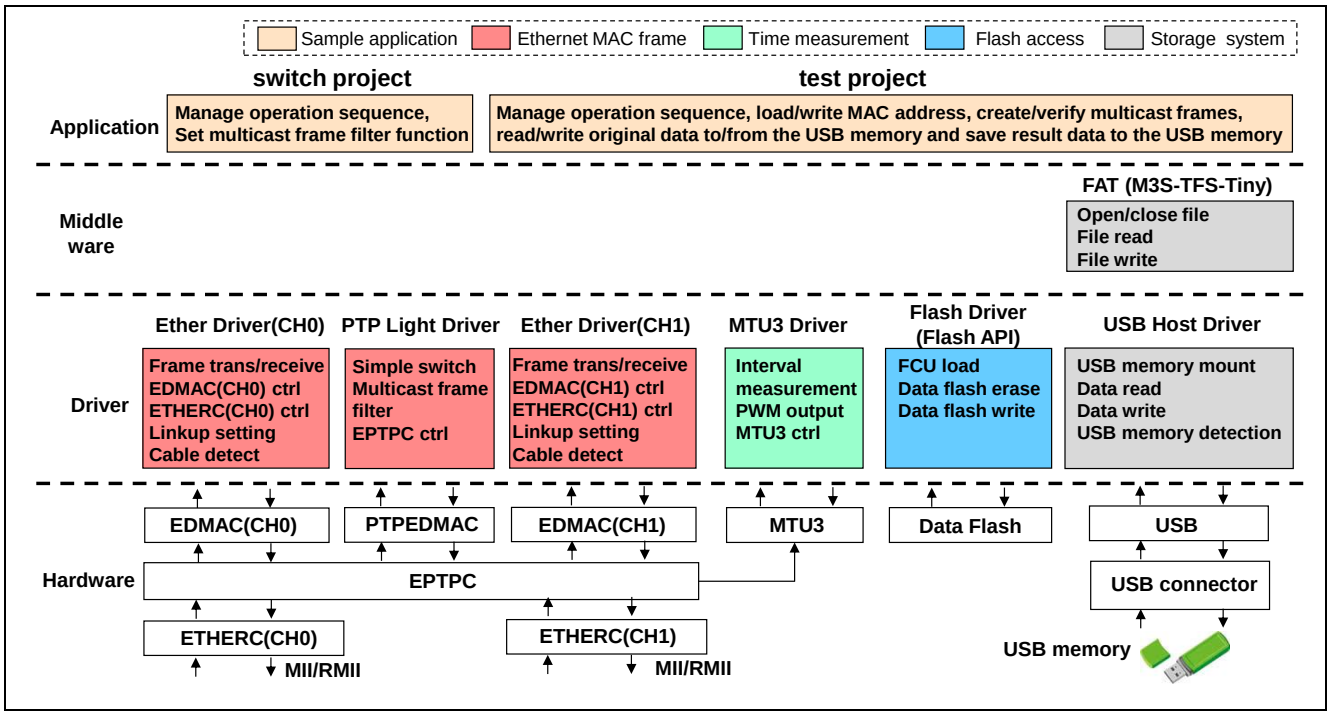


**Figure 1.1 Software structure of this sample**

## 1.5 File Structure

This sample codes are stored the “demo_src” and lower hierarchical folders. Figure 1.2 and Figure 1.3 show the source and header file structures of mc filter project and test project respectively. The sample data of the test project are stored in the USB memory. As for the detailed information of the FIT based modules (BSP, Ethernet Driver, Flash Driver, PTP Light Driver, FAT file system and USB Driver), please refer to the documentation of the each FIT module.

```
demo_src: main operation
|   sample_main.c
|   sample_main.h
|
+ --- usr: LED control
|       led.c
|       led.h
|
```

```
r_bsp: BSP (Board Support Package) FIT module

r_config: configuration setting of FIT modules
|       r_bsp_config.h
|       r_bsp_interrupt_config.h
|       r_ether_rx_config.h
|       r_ptp_light_rx_config.h

r_ether_rx: Ethernet Driver FIT module

r_ptp_light_rx: PTP Light Driver FIT module
```

**Figure 1.2 File structure of mc filter project**

```
demo_src: main operation
|  sample_main.c
|  sample_main.h
|
+ --- ether_if: Ethernet frame operation
|      ether_if.c
|      ether_if.h
|
+ --- flash_if: Data flash access operation
|      flash_if.c
|      flash_if.h
|
+ --- tfat_if: File system IF to USB driver
|      file_if.c
|      file_if.h
|      r_data_file.c
|      r_data_file.h
|      r_tfat_drv_if.c ;USB driver interface
|
+ --- tmr_if: Timer (MTU3) operation
|      tmr_if.c
|      tmr_if.h
|
+ --- usb_if: USB Host memory access control
|      r_usb_hmsc_defep.c
|      usb_memory_access.c
|
+ --- usr: LED control
|      led.c
|      led.h
|
+ --- usb_memory_sample: Sample of USB memory data (data parts of transfer frame)
|      + --- TEST: SRC_X.txt; Data files stored (X = 0,1,2,, 200)
```

```
r_bsp: BSP (Board Support Package) FIT module

r_config: configuration setting of FIT modules
|      r_bsp_config.h
|      r_bsp_interrupt_config.h
|      r_ether_rx_config.h
|      r_flash_rx_config.h
|      r_ptp_light_rx_config.h
|      r_usb_basic_config.h
|      r_usb_hmsc_config.h

r_ether_rx: Ethernet Driver FIT module

r_flash_rx: Flash Driver (Flash API) FIT module

r_ptp_light_rx: PTP Light Driver FIT module

r_tfat_rx: FAT file system (M3S-TFS-Tiny) FIT module
|      r_tfat_lib.h ;FAT library header file
|      + --- lib:  FAT library stored folder
|              r_mw_version.h ; middleware version information
|              r_stdint.h ; integer type definition
|              tfat_rx600_big.lib ; big endian
|              tfat_rx600_little.lib ; little endian
|

r_usb_basic: USB driver (USB basic operation) FIT module

r_usb_hmsc: USB driver (Host Mass Storage Class) FIT module
```

**Figure 1.3 File structure of test project**

# 2. Functional Information

This example is developed by the following principles.

## 2.1 Hardware Requirements

This driver requires your MCU supports the following feature:

- EPTPC
- ETHERC
- EDMAC
- MTU3[1]
- Data Flash[1]
- USB[1]

[1] test project only use.

## 2.2 Hardware Resource Requirements

This section details the hardware peripherals that this example requires. Unless explicitly stated, these resources must be reserved for the following driver, and the user cannot use them.

### 2.2.1 EPTPC Channel

This example uses the EPTPC. This resource needs to the multicast frame filter function.

### 2.2.2 ETHERC Channel

This example uses the ETHEC (CH0) and ETHEC (CH1). Those resources need to the Ethernet MAC operations.

### 2.2.3 EDMAC Channel

This example uses the EDMAC (CH0) and EDMAC (CH1). Those resources need to the CPU Host interface of frame operations.

### 2.2.4 MTU3 Channel

This example uses the MTU3 (CH1) and MTU3 (CH2) for measurement the interval of the inter ports frame transfer applying to cascade connection.

### 2.2.5 Data Flash

This example uses the Data Flash to store the MAC address.

### 2.2.6 USB Channel

This example uses the USB 2.0 FS Host/Function Module to read test data from the USB memory and write transferred and result data to the USB memory.

## 2.3 Software Requirements

This example depends on the following packages (FIT modules):

- r_bsp
- r_ether_rx
- r_ptp_light_rx
- r_flash_rx[1]
- r_tfat_rx[1]
- r_usb_basic[1]
- r_usb_hmsc[1]

[1] test project only includes.

## 2.4 Limitations

There are following limitations in this example

- Not support PTP time synchronization.
- Cannot use the PTP driver (full version) [7] substitute for the PTP light driver.
- Cannot receive and process the PTP message frames[1] in the mc filter project.

[1]Relay control is possible.

## 2.5 Supported Toolchains

This example is tested and works with the following toolchain:

- Renesas RX Toolchain v2.05.00

## 2.6 Header Files

### 2.6.1 mc filter project

Each function call is accessed by including a single file, *r_ether_rx_if.h or r_ptp_light_rx_if.h* which is supplied with this project code.

### 2.6.2 test project

Each function call is accessed by including a single file, *r_ether_rx_if.h, r_ptp_light_rx_if.h, r_frash_rx_if.h r_tfat_lib.h, r_usb_basic_if.h or r_usb_hmsc_if.h* which is supplied with this project code.

## 2.7 Integer Types

This project uses ANSI C99. These types are defined in *stdint.h*.

## 2.8 Configuration Overview

This section describes the configuration in this example.

### 2.8.1 mc filter project

The configuration options in this project are specified in *sample_main.h.* The option names and setting values are listed in the table below.

| Configuration options | |
|---|---|
| **#define LINK_CH**<br>**- Default value = 1** | Specify the Ethernet link channel at first.<br>- When this is set to 0, Ethernet CH0 is selected.<br>- When this is set to 1, Ethernet CH1 is selected. |
| **#define NUM_CH**<br>**- Default value = 2** | Set the number of channels of the Ethernet controller.<br>- Set 2 in this example. |

### 2.8.2 test project

The configuration options in this project are specified in *sample_main.h and r_data_file.h.* The option names and setting values are listed in the table below.

| Configuration options | |
|---|---|
| **#define NUM_TEST**<br>**- Default value = 201** | Specify the total test times (frame transfer times).<br>- Set 1 to 201 in this example. |
| **#define LINK_CH**<br>**- Default value = 1** | Specify the Ethernet link channel at first.<br>- When this is set to 0, Ethernet CH0 is selected.<br>- When this is set to 1, Ethernet CH1 is selected. |
| **#define NUM_CH**<br>**- Default value = 2** | Set the number of channels of the Ethernet controller.<br>- Set 2 in this example. |
| **#define SRC_IDX**<br>**- Default value = 1** | Set the frame transfer source channel.<br>- Set 0 or 1, and different channel specified by "DST_IDX" in this example. |

| Configuration options | |
|---|---|
| **#define DST_IDX**<br>**- Default value = 0** | Set the frame transfer destination channel.<br>- Set 0 or 1, and different channel specified by "SRC_IDX" in this example. |
| **#define MUL_IDX**<br>**- Default value = 0** | Selection index of multicast frame address.<br>- Set 0 or 1 in this example. |
| **#define MAC_ADDR_1H/2H**<br>**- Default value = 0x00007490** | Set the Ethernet MAC address upper 16 bits for port0/port1.<br>The lower 16 bits of default value are set the upper 16bits of the Renesas vendor ID (=74-90-50).<br>The upper 16 bits of default value are reserved field and should be set 00-00.<br>If first time access or forcing erase option (=" FORCE_ERASE_PRM) defined, this address value is written to the data flash.<br>Please change this value when users applied to this sample their own system. |
| **#define MAC_ADDR_1L/2L**<br>**Case of SRC_IDX = 0,**<br>**- Default value = 0x50007930 (port0)**<br>**- Default value = 0x50007931 (port1)**<br>**Case of SRC_IDX = 1,**<br>**- Default value = 0x50007932 (port0)**<br>**- Default value = 0x50007933 (port1)** | Set the Ethernet MAC address lower 32 bits for port0/port1.<br>The upper 8 bits of default value are set the lower 8bits of the Renesas vendor ID (=74-90-50).<br>The lower 24 bits of default value are set the unique value for this sample.<br>If first time access or forcing erase option (=" FORCE_ERASE_PRM) defined, this address value is written to the data flash.<br>Please change this value when users applied to this sample their own system. |
| **#define MUL_ADDR_H**<br>**- Default value = 0x00000100** | Set the multicast destination address upper 16 bits.<br>The lower 16 bits of default value are set the upper 16bits include multicast address bit (=01-00-00).<br>The upper 16 bits of default value are reserved field and should be set 00-00. |
| **#define MUL_ADDR_L**<br>**Case of MUL_IDX = 0,**<br>**- Default value = 0x00000000**<br>**Case of MUL_IDX = 1,**<br>**- Default value = 0x5E000000** | Set the multicast destination address lower 32 bits.<br>If selection index of multicast frame address (=MUL_IDX) is 0, all 0 value is set.<br>If selection index of multicast frame address is 1, multicast address for IP is set.<br>The lower 24 bits of default value are set the unique value for this sample. |
| **#define FORCE_ERASE_PRM**<br>**- undefined** | Select whether erasing the MAC address written in the data flash after finishing operation or not?<br>- If defined, the MAC address is erased from the data flash. |
| **#define WAIT_MAX_CNT**<br>**- Default value = 1000000** | Set the loop maximum count value to wait read the reception frame.<br>This value specifies the timeout of the frame reception. |
| **#define RETRY_MAX_CNT**<br>**- Default value = 1000** | Set the read retry maximum times[1]. |
| **#define MAX_DAT_SIZE**<br>**- Default value = (1514 – 12)** | Set the maximum test file data size in byte unit to which equals the frame data field size.<br>- Maximum value is 1502 byte. |
| **#define READ_DIR**<br>**- Default value "TEST"** | Specify the directory name of the original test file stored. |
| **#define READ_FILE**<br>**- Default value "SRC"** | Specify the file name of the original test file.<br>This string is concatenated the file number assigned frame transmitted order and the file extension equal to ".txt".<br>Ex. "SRC_0.txt", "SRC_1.txt", , "SRC_200.txt" |
| **#define WRITE_DIR**<br>**- Default value "RCV"** | Specify the directory name of the received test file stored. |
| **#define WRITE_FILE**<br>**- Default value "DST"** | Specify the file name of the received test file.<br>This string is concatenated the file number assigned frame received order and the file extension equal to ".txt".<br>Ex. "DST_0.txt", "DST_1.txt", , "DST_200.txt" |

| Configuration options | |
|---|---|
| **#define RESULT_FILE**<br>**- Default value "RESULT"** | Specify the file name of the result file to indicate file size and transfer interval time.<br>This string is concatenated to the file extension equal to ".txt".<br>Ex. "RESULT.txt" |
| **#define FILESIZE**<br>**- Default value = 2048** | Specify the FAT file system data buffer size<br>- Set 2048 in this sample. |

[1] Read retry operation is need when received data was not transferred to the receive buffer by the EDMAC after frame reception interrupt detected.

## 2.9 Data Structures

This section details the data structures that are used with the functions of this example.

### 2.9.1 mc filter project

The multicast frame filter function setting structure is only defined in *sample_main.c*.

```
/* TRNMR setting values table */
typedef struct
{
   RelEnabDir rel;
   TranMode trn;
} TrnTbl;
```

### 2.9.2 test project

Those data structure in this project are located in *sample_main.h and ether_if.h* as the prototype declaration.

```
/* Ether & USB access state */
typedef enum
{
   APL_START = 0, /* Operation start state */
   APL_READ,      /* USB memory read state */
   APL_COM,       /* Ether communication state */
   APL_WRITE,     /* USB memory write state */
   APL_STOP,      /* Operation stop state */
} APLState;
```

```
/* Data access information structure */
typedef struct
{
   uint16_t size[NUM_TEST]; /* Data size */
   int8_t *src;             /* Address of source data */
   int8_t *dst;             /* Address of destination data */
   uint32_t time[NUM_TEST]; /* Operation time */
} ACCInfo;
```

```
/* Ether communication state information */
typedef enum
{
   COM_ERR = -1, /* General error */
   COM_OK = 0,   /* No error */
   COM_TOUT,     /* Timeout occured */
   COM_OTH_SRC,  /* Received from other source */
   COM_OTH_CH,   /* Received from other channel */
   COM_ERR_FRM,  /* Error frame received */
} COMInfo;
```

## 2.10 Return Values

This section describes return values of the functions of this example. There is no return value in the mc filter project.

Those return values in the test project are located in *ether_if.h*, *flash_if.h and file_if.h* as the prototype declarations.

```
/* Ether access return value */
typedef enum
{
    ETHIF_ERR = -1, /* General error */
    ETHIF_OK = 0,
    ETHIF_TOUT,     /* Timeout occured */
} ethif_t;
```

```
/* Data flash access return value */
typedef enum
{
    FLSIF_ERR = -1, /* General error */
    FLSIF_OK = 0,
    FLSIF_ERASE_ERR,  /* Erase error */
    FLSIF_WRITE_ERR,  /* Write error */
    FLSIF_VERIFY_ERR, /* Verify error */
} flshif_t;
```

```
/* File access return value */
typedef enum
{
    FLIF_ERR = -1, /* General error */
    FLIF_OK = 0,
} flif_t;
```

# 3. Specification of This Example

## 3.1 Outline of Functions

The function of this example in mc filter project and test project show Table 3.1 and Table 3.2 respectively.

**Table 3.1 Function of mc filter project**

| Item | Contents |
|---|---|
| main() | Main operation of this project. |
| wait_seq() | Wait operation of the sequence state transfer |
| EINT_Trig_isr() | Frame reception interrupt handler. |
| led_init() | Initialize user LED. |
| led_ctrl() | Update user LED pattern |

**Table 3.2 Function of test project**

| Item | Contents |
|---|---|
| main() | Main operation of this project. |
| led_init() | Initialize user LED. |
| led_ctrl() | Update user LED pattern |
| prm_init() | Initialize operation parameter. |
| usb_memory_start() | USB memory task start. |
| Sample_Task() | Sample application task. |
| EtherStart() | Ether start operation. |
| EtherCom() | Ether communication. |
| EINT_Trig_isr() | Frame reception interrupt handler. |
| EtherErr() | Ether error retrieval operation. |
| FlashInit() | Initialize flash API. |
| load_prm() | Load communication parameter (MAC address) from data flash. |
| upd_param() | Update communication parameter (MAC address) to data flash. |
| ers_param() | Erase communication parameter (MAC address) from data flash. |
| file_crt_dir() | Create received data directories. |
| file_read() | File reading operation. |
| file_write() | File writing operation. |
| file_stop() | File finalizing and operation result save operation. |
| file_err() | File error retrieval operation. |
| mtu3_dev_start() | Start MTU3 (The module-stop state is canceled). |
| mtu3_port_init() | Initial setting of the MTU3 ports. |
| mtu3_dev_stop() | Stop MTU3 (Transition to the module-stop state is made). |
| init_timer() | Initial setting of the MTU3 registers related to the measurement. |
| start_eval() | Start measurement of a communication interval. |
| stop_eval() | Stop measurement of a communication interval. |
| end_timer() | Finalizing of the MTU3 registers related to the measurement. |
| get_eval_cycle() | Get cycles of a communication interval. |

## 3.2 Environment and Execution

Execution of this example needs two RX64M/71M RSK boards[1], an Ethernet cable, and a USB memory.

The outline of the execution sequence is following.

- Write the mc filter project execution code to one of the RX64M/71M RSK board (hereafter RSK board1). And then, write the test project execution code to the other RX64M/71M RSK board (hereafter RSK board2).
- Connect RSK board1 to RSK board2 by the Ethernet cable. The one edge and the other edge of the Ethernet cables are connected to identical channel (CH0 to CH0, CH1 to CH1)). Test frames are transferred between RSK board1 and RSK board2 via the Ethernet cable. The internal timer MTU3 of the RSK board2 measures the frame transverse time between two boards. The Data flash of the RSK board2 stores the MAC address to Block1 (Block0) when the direction of transfer is from CH1 to CH0 (from CH0 to CH1).
- Insert the USB memory to the USB port in the RSK board2. The USB memory stores the test and reception data to which transferred as the frames and the result data to indicate the performance of the frame transfer.
- The test data sample is prepared in the test project and it is stored the demo_src/usb_memory_sample folder. You can use it copying it to root layer of the USB memory.
- Power on the RSK board1 and the RSK board2.
- When the RSK board1 finishes Ethernet driver initialization and open process, the user LED composed of LED0, LED1, LED2 and LED3 shows the all-on pattern (LED0: ON, LED1: ON, LED2: ON, LED3: ON). The MAC addresses[2] assigned “74-90-50-00-79-34” for CH0 and “74-90-50-00-79-35” for CH1 in the source file in advance.
- When the RSK board2 finishes Ethernet, MTU3, Flash and USB Host driver initialization and open process, the user LED composed of LED0, LED1, LED2 and LED3 shows the “0x1” pattern (LED0: ON, LED1: OFF, LED2: OFF, LED3: OFF). In this initialization process, the MAC addresses programmed in the data flash are updated if appropriate values[3] were not set in advance.
- Push the SW1 switch of the RSK board1 and starts the mc filter project operation described in the Section 3.3.
- The user LED shows the times of pushing the SW1 switch. The times indicate setting pattern of the multicast frame filter function. As for the setting pattern, please refer to the Section 3.4.
- If any error detected during the operation, the user LED shows the odd pattern (LED0: OFF, LED1: ON, LED2: OFF, LED3: ON).
- Push the SW1 switch of the RSK board2 and starts the test project operation described in the Section 3.3.
- When the test project operation finished without any error, the user LED shows the all-on pattern (LED0: ON, LED1: ON, LED2: ON, LED3: ON).
- If any error detected during the Ether communication, the user LED shows the “0x6” pattern (LED0: OFF, LED1: ON, LED2: ON, LED3: OFF).
- If any error detected during the USB communication or file access, the user LED shows the odd pattern (LED0: OFF, LED1: ON, LED2: OFF, LED3: ON).
- If any error detected during the erasing MAC address from the data flash in case of “FORCE_ERASE_PRM” option is defined, the user LED shows the “0xE” pattern (LED0: OFF, LED1: ON, LED2: ON, LED3: ON).

[1] Product name is a Renesas Starter Kit+ for RX64M [8] or a Renesas Starter Kit+ for RX71M [9].

[2] Please change this value when users applied to this sample their own system.

[3] Judging from the Renesas vendor ID (=74-90-50).

Figure 3.1 shows one of the environments during this example.

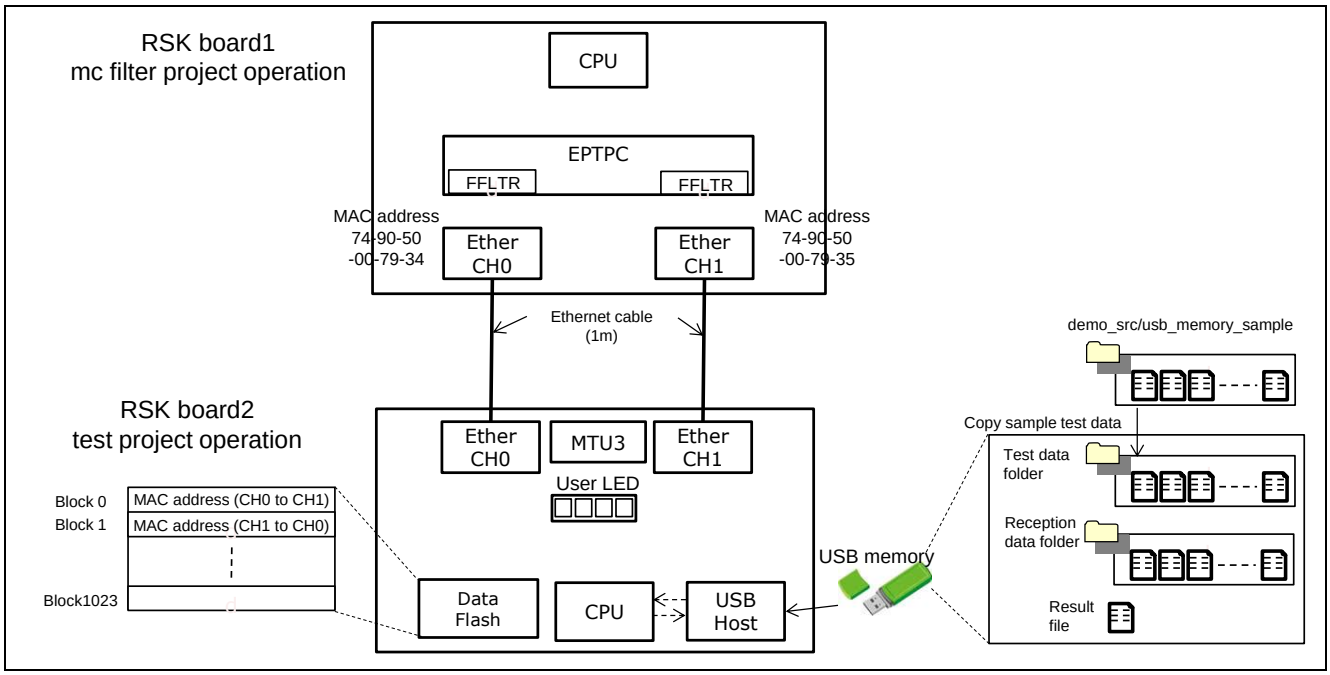


**Figure 3.1 Environment**

## 3.3 Operation Sequence

In this section, explain the operation sequence in this example when the direction of frame transfer is from CH1 to CH0 and the total test times are 201 specified to “NUM_TEST”.

Figure 3.2 shows the USB memory contents. There are TEST folder, RCV folder, and RESULT.txt file in the USB memory. The TEST folder stores the test data in the files from “SRC_0.txt” to “SRC_200.txt”. The RCV folder stores the reception data in the files from “DST_0.txt” to “DST_200.txt”. The test data and reception data mean the part of transmitting and receiving frame respectively. The contents of test data and reception one is identical if transfer operation finished without error. Figure 3.2 also shows the contents of SRC_2.txt and DST_2.txt as example. The RESULT.txt stores the number of the total test times, the frame transfer operation intervals and transferred frame sizes as the performance sample data.

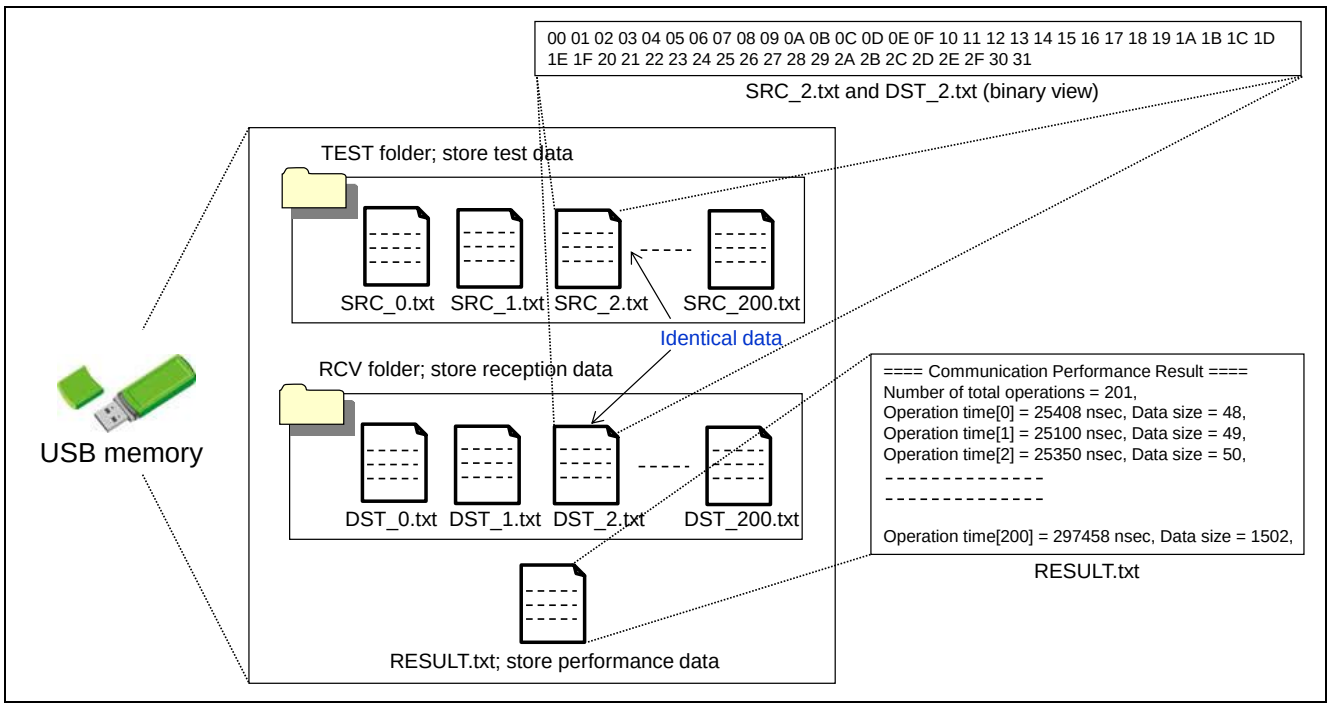


**Figure 3.2 USB memory Contents**

Figure 3.3 explains the test frame format in relation to the Mac addresses written in the data flash, the test data refer to the SRC_2.txt when the direction of frame transfer is from CH1 to CH0, and the multicast address selected by index 0 (MUL_IDX = 0). The port0 MAC address of the RSK board2 is written beginning 6 byte in the Block1 whose address is “0x0010_0040 – 0x0010_0045” and the port1 MAC address of the RSK board2 is written next 6 byte in the Block1 whose address is “0x0010_0046 – 0x0010_004B”.

The destination MAC address is set the multicast frame address. The source MAC address is set the port1 MAC address loaded from the data flash. After the source MAC address filed, that is start from type filed, the test data in the SRC_2.txt is concatenated. The total length of the frame becomes 62 byte (12 byte plus 50 byte).

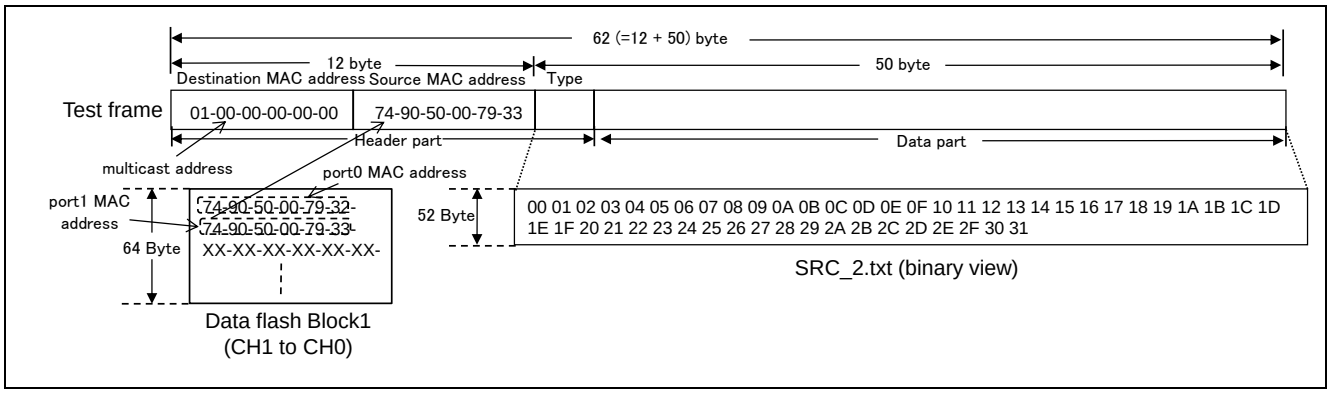


**Figure 3.3 Frame format**

Figure 3.4 shows the sequence over view in this example.

- RSK board1

(1) Set multicast frame filter function of the CH1.

- RSK board2

(2) Read the test data transferred as the test frame from the USB memory via USB Host.

(3) Load MAC addresses from the data flash.

(4) Create the test frame showed by the Figure 3.3.

(5) Transmit the test frame from port1.

- RSK board1

(6) Cancel or receive the test frame depend on the FFLTR setting.

(7) If the test frame received, relay and transmit it to CH0.

- RSK board2

(8) Receive the relayed frame.

(9) Measure the frame transfer interval using the MTU3.

(10) Write the reception data transferred as the frame to the USB memory.

(11) Repeat the specified times of the USB read, frame transfer with interval measurement, and USB write. Thereafter, write the result of the frame transfer intervals to the USB memory.

(12) The MAC addresses in the data flash are erased if “FORCE_ERASE_PRM” option is defined.

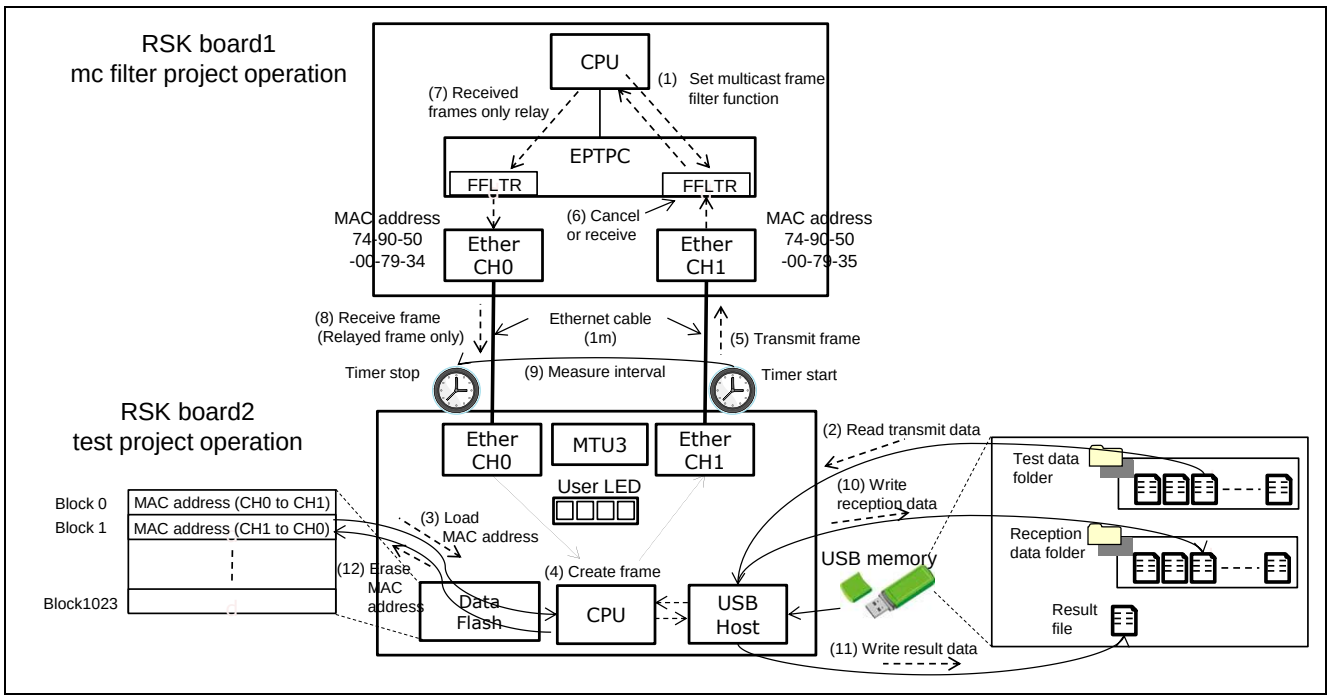


**Figure 3.4 Sequence overview**

## 3.4 Multicast Frame Filter Setting

Figure 3.5 shows the module structure and register specification related to the multicast frame filter function. The multicast frame filter function is implemented in the both channel's PTP Frame Operation parts of the Ethernet peripheral module. It is possible to enhance the total performance due to cancel irrelevant multicast frames[1]. Even if the filter is set enabled, specific two frames can be received.

[1] For PTP frames, the other PTP specific filters (SYRFL1R/2R) are implemented. As for those filters setting, please refer to section 3.8 R_PTPL_SetSyncConfig function of the EPTPC Light FIT module [1].

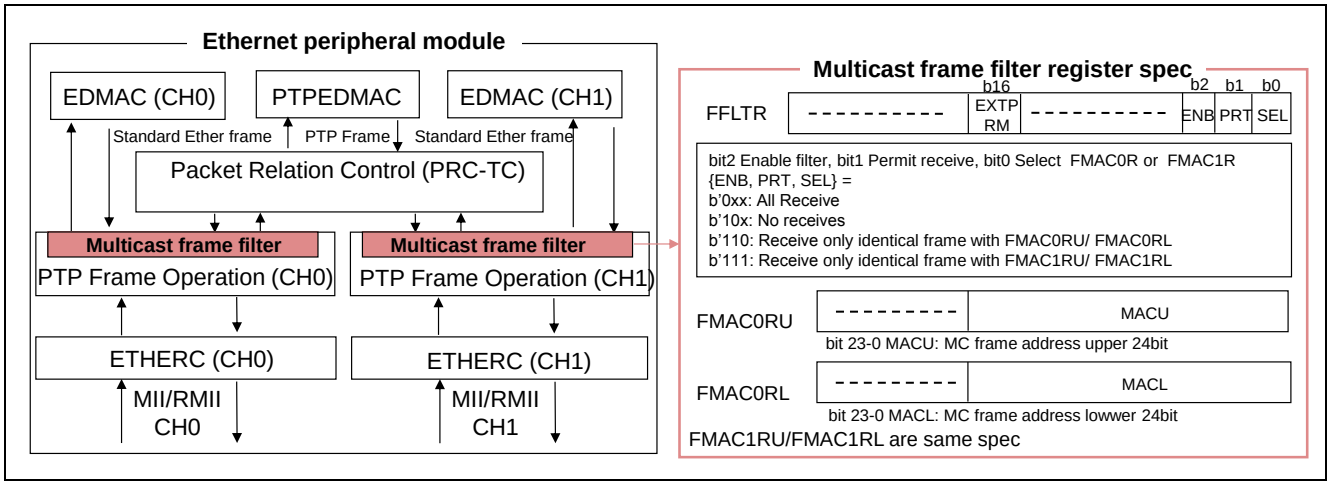


**Figure 3.5 Module structure and register spec**

The multicast frame filter setting register of each channel is set by the times of pushing the SW1 switch of the RSK board1. Table 3.3 shows the setting of the multicast frame filter and frame transfer result when the identical address of the test frame selected index is 0 whose address is "01-00-00-00-00-00" set to the both of FMAC0R and FMAC1R. 2nd row indicates the LED pattern depend on the SW1 pushing times after completed of Ethernet initialize sequence. 3rd row indicates FFLTR register value whose setting decides the multicast frame filter function behavior when test frame received. 8th row indicates the reception channel of the test frames. 9th row shows the expectation number of reception (relayed via RSK board1) frames if total number of the test frames is 201 specified to "NUM_TEST".

**Table 3.3 Multicast frame filter setting and frame reception result**

| No. | LED pattern | FFLTR | EXTPRM (b16) | ENB (b2) | PRT (b1) | SEL (b0) | Reception channel | Num of Frames | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 1 | OFF-OFF-OFF-OFF | 00-00-00-07 | 0:Normal operation | 1:Reception filter enable | 1:Frame reception enable | 1:Select FMAC1R | CH0 | 201 | Receive only frame whose address is "01-00-00-00-00-00". |
| 2 | | | | | | | CH1 | 201 | Receive only frame whose address is "01-00-00-00-00-00". |
| 3 | OFF-OFF-OFF-ON | 00-00-00-06 | | | | 0:Select FMAC0R | CH0 | 201 | Receive only frame whose address is "01-00-00-00-00-00". |
| 4 | | | | | | | CH1 | 201 | Receive only frame whose address is "01-00-00-00-00-00". |
| 5 | OFF-OFF-ON-OFF | 00-00-00-04 | | | 0:Frame reception disable | | CH0 | 0 | |
| 6 | | | | | | | CH1 | 0 | |
| 7 | OFF-OFF-ON-ON | 00-00-00-00 | | 0:Reception filter disable | | | CH0 | 402 | |
| 8 | | | | | | | CH1 | 402 | |
| 9 | OFF-ON-OFF-ON | 00-01-00-00 | 1:Extended promiscuous mode | 0:Reception filter disable | | | CH0 | 402 | |
| 10 | | | | | | | CH1 | 402 | |

FMAC0RU:00-01-00-00, FMAC0RL:00-00-00-00, FMAC1RU:00-01-00-00, FMAC1RL:00-00-00-00

## 3.5 Software Operation Flow

In this section, describes the software operation flow of this sample.

### 3.5.1 mc filter project

Figure 3.6 shows the operation flow. The mc filter project set the Ethernet peripheral modules to do Ethernet communication. Thereafter, it set the multicast frame filter function and transmits the reception frame to the other channel using the frame received interrupt handler.

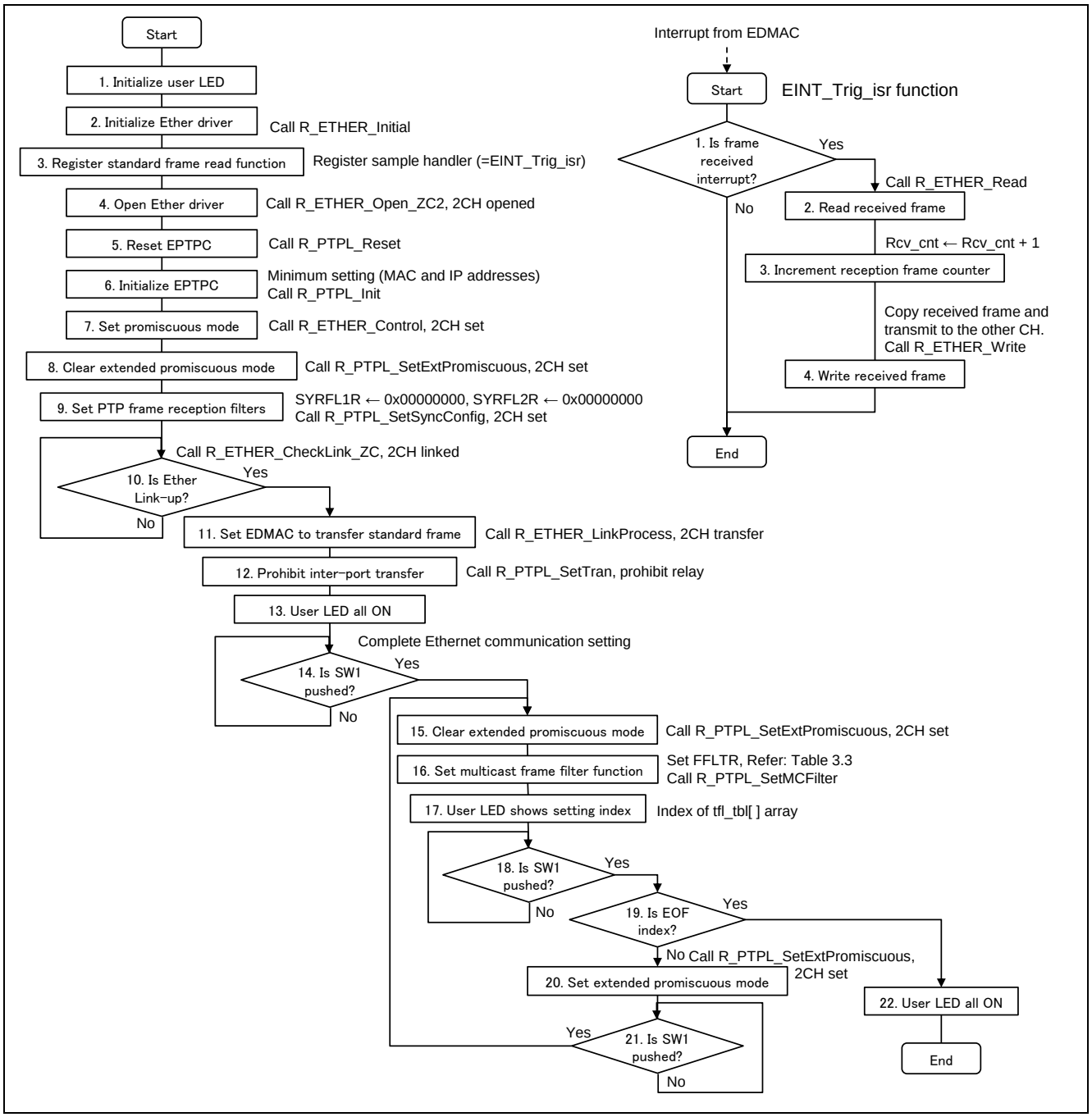


**Figure 3.6 operation flow of the mc filter project**

### 3.5.2 test project

Figure 3.7 shows the initialize operation and infinite loop. This sample task (Sample_Task function) is called via USB application task showed by Figure 3.8 within the infinite loop. Figure 3.9 shows the each task structure managed by the application state.

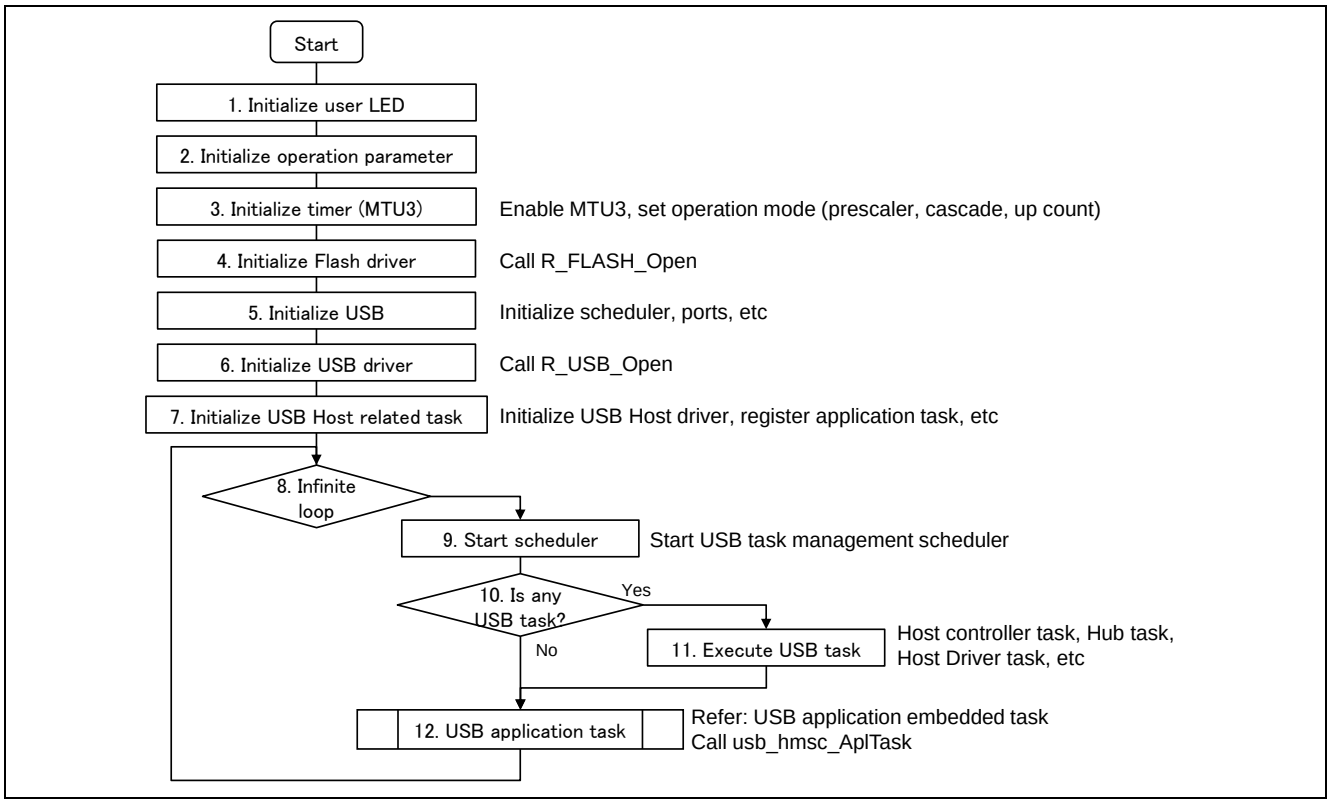


**Figure 3.7 Initial operation**

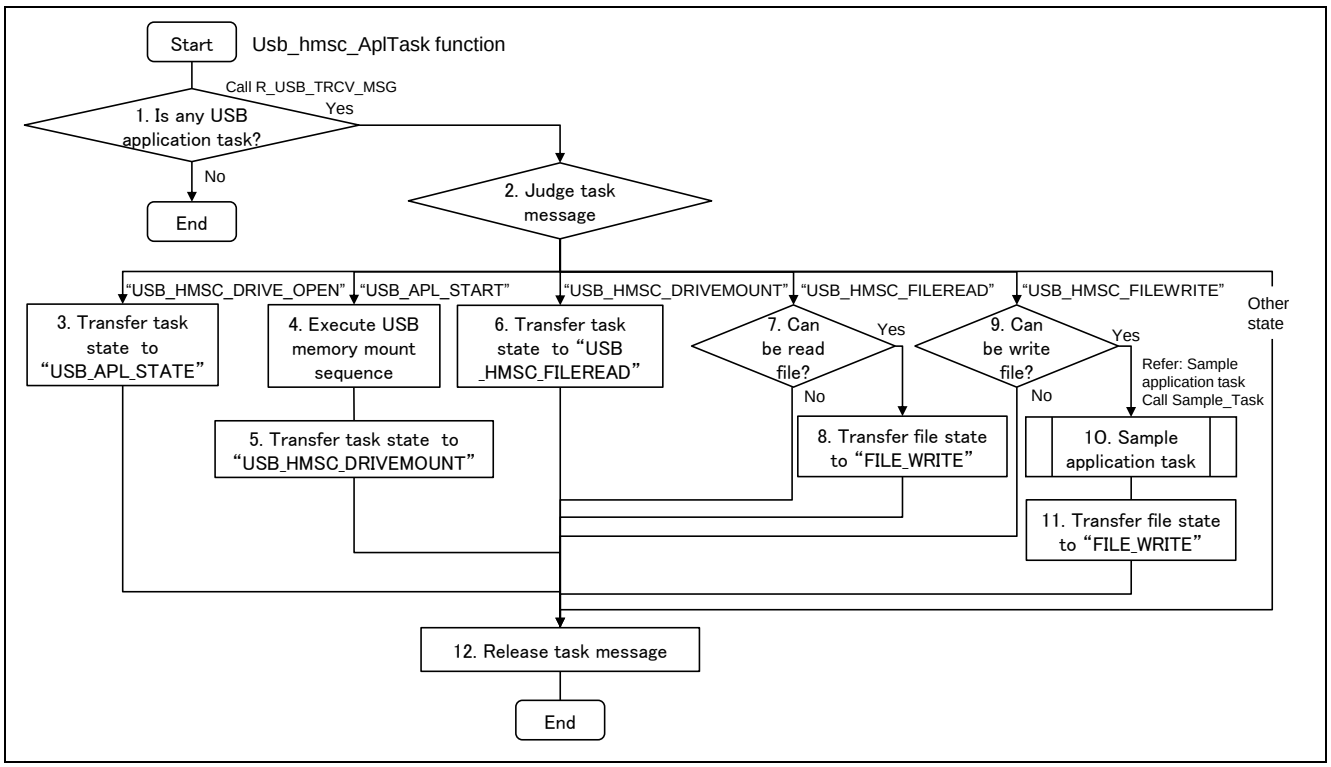


**Figure 3.8 USB application embedded task**

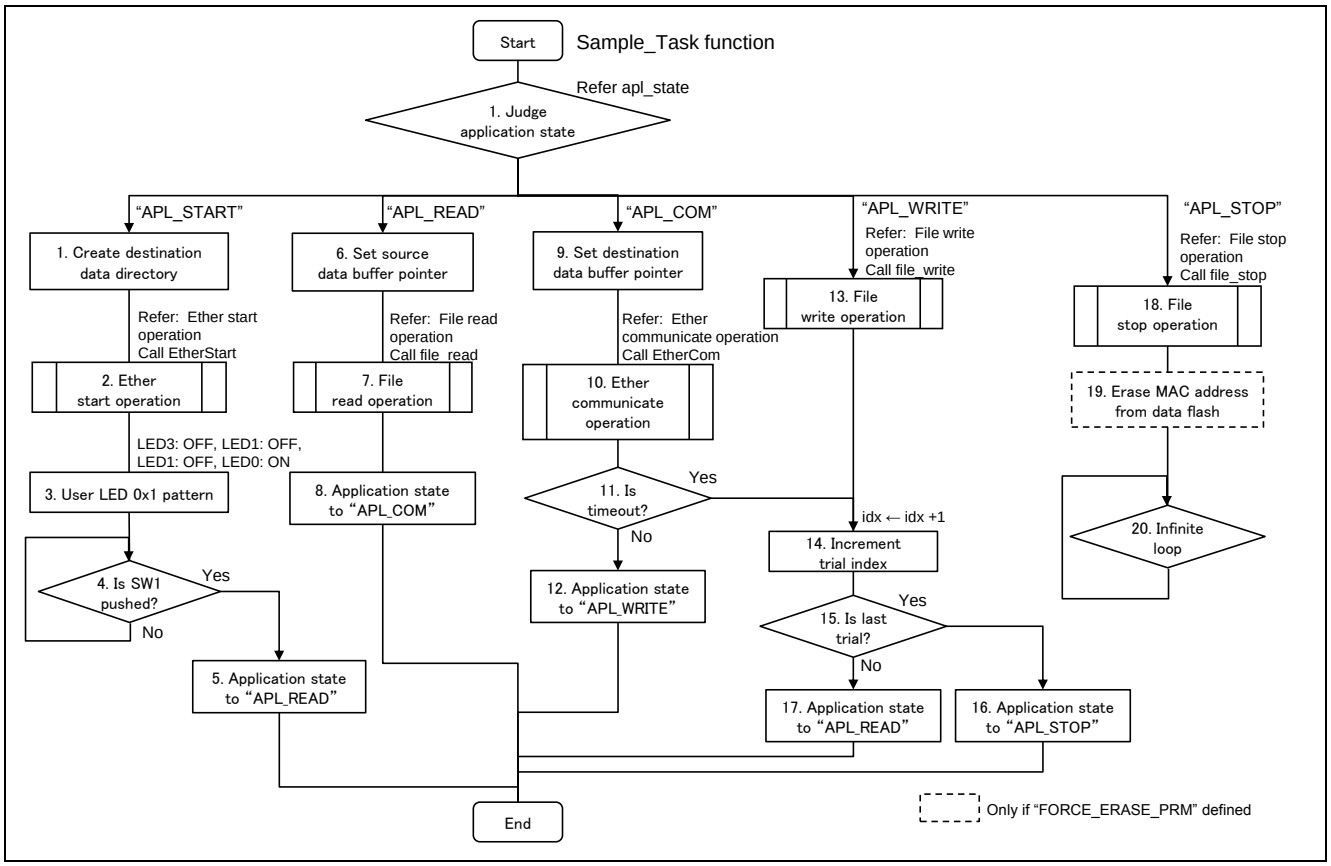


**Figure 3.9 Sample application task**

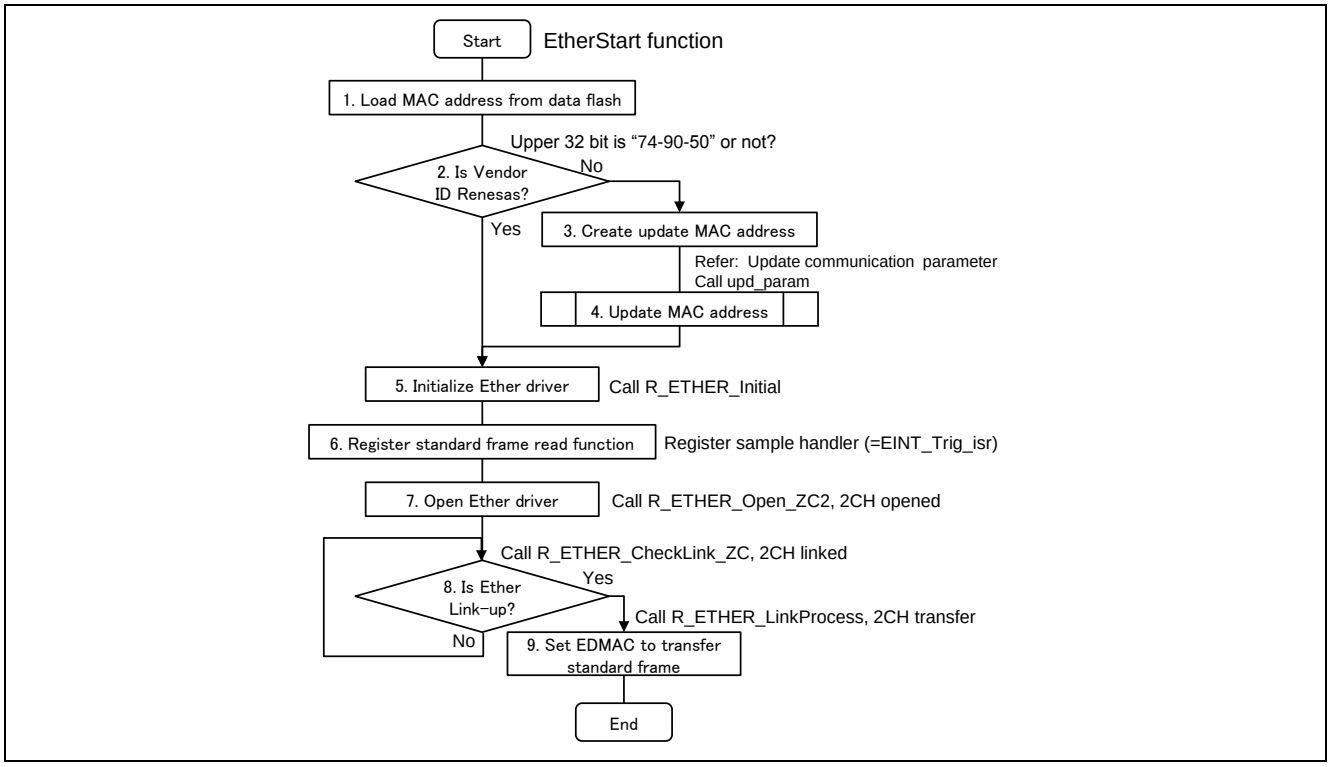


**Figure 3.10 Ether start operation**

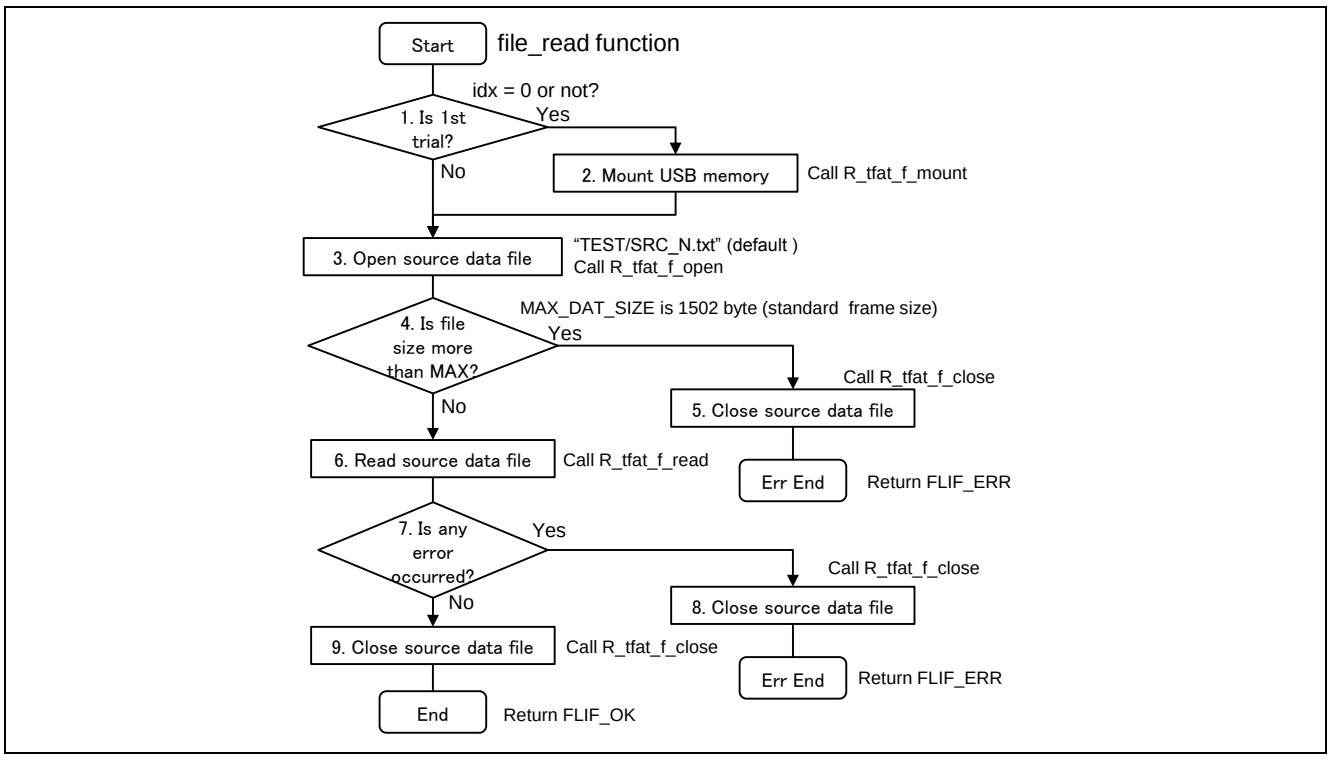


**Figure 3.11 File read operation**

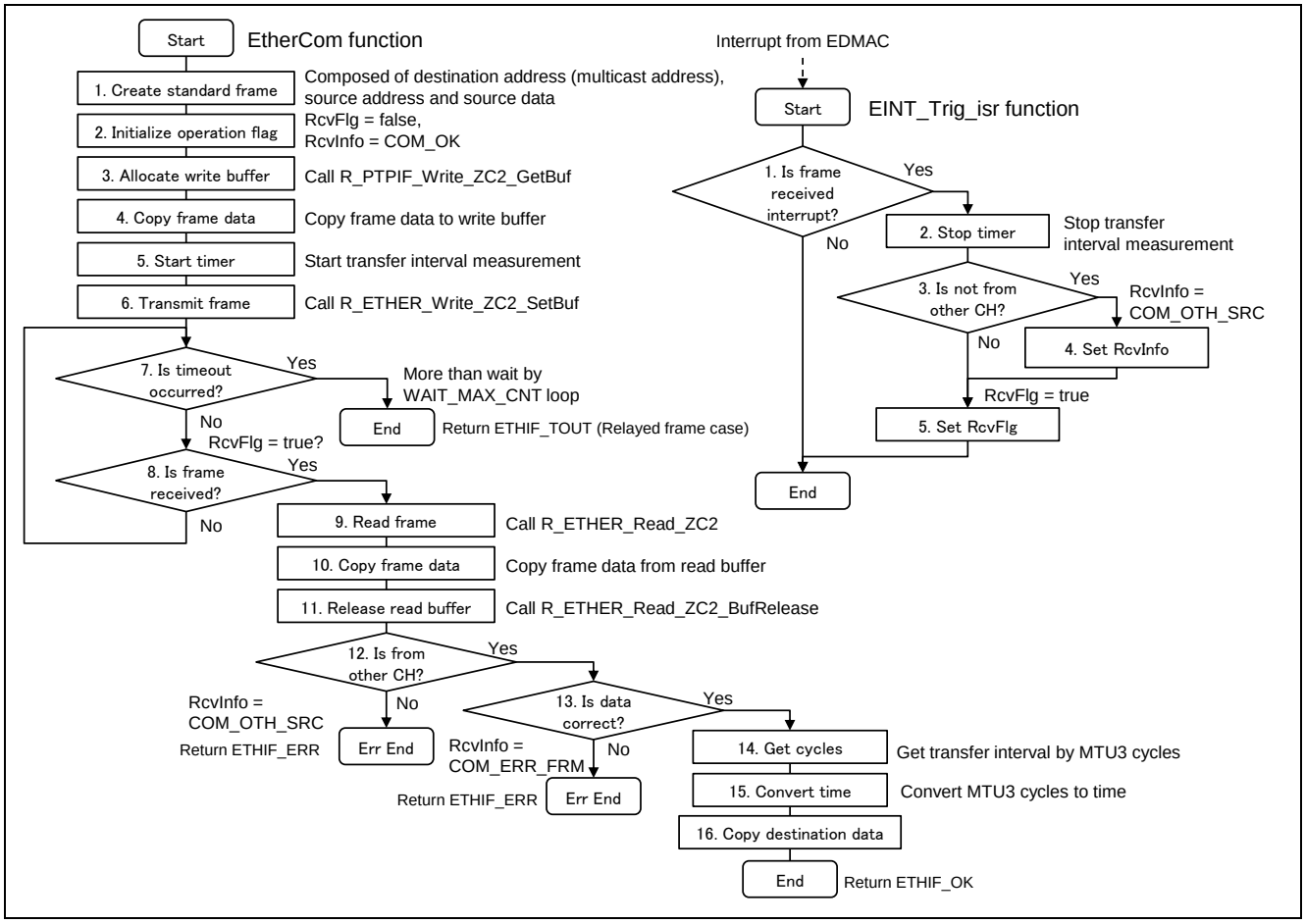


**Figure 3.12 Ether communicate operation**

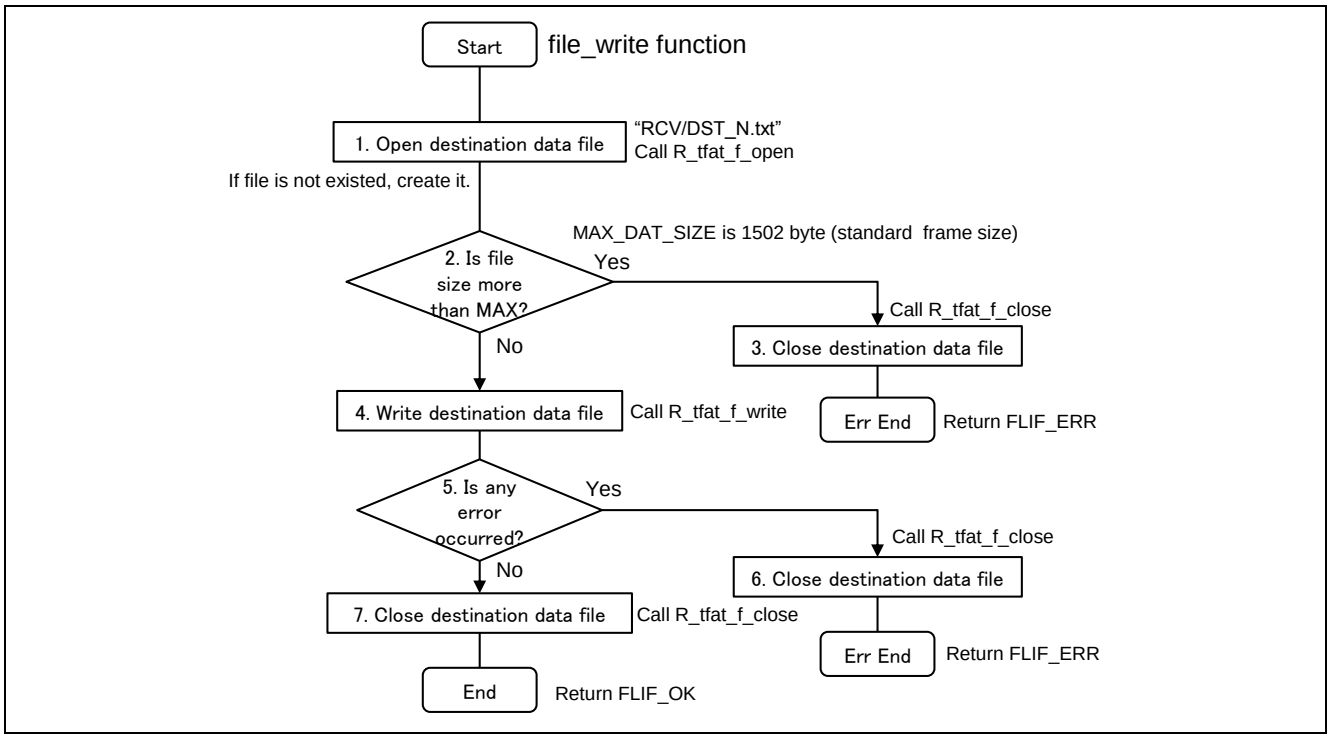


**Figure 3.13 File write operation**

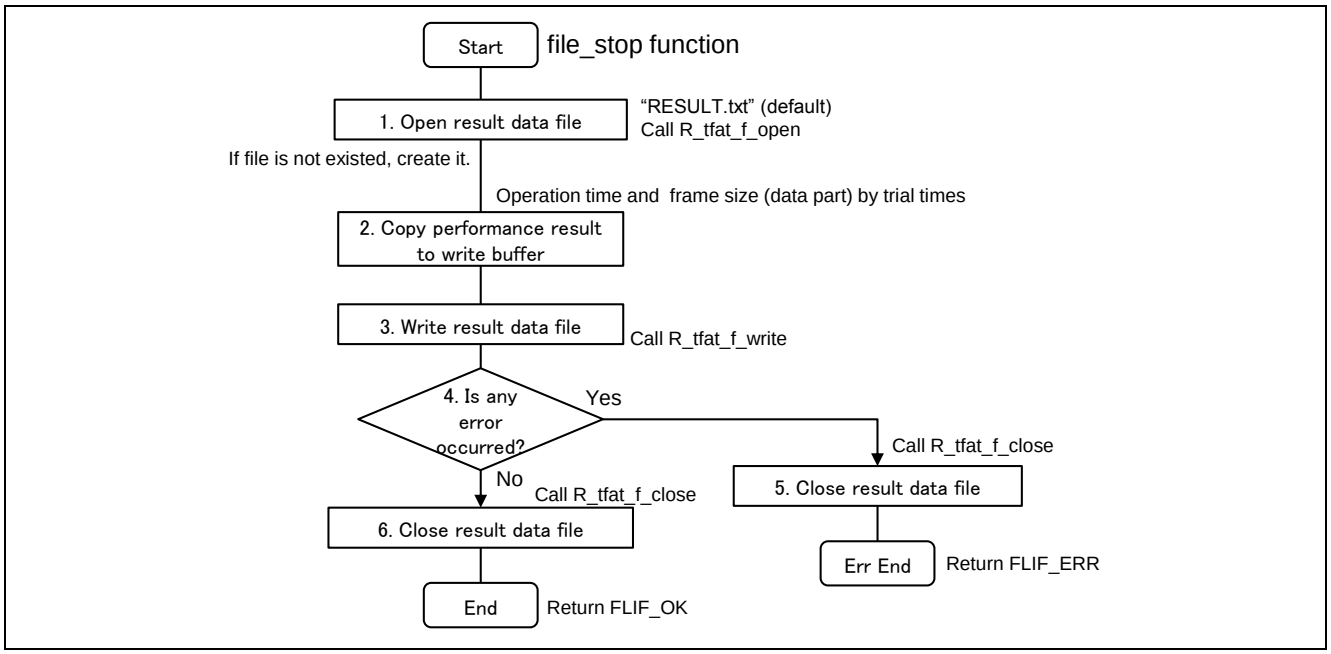


**Figure 3.14 File stop operation**

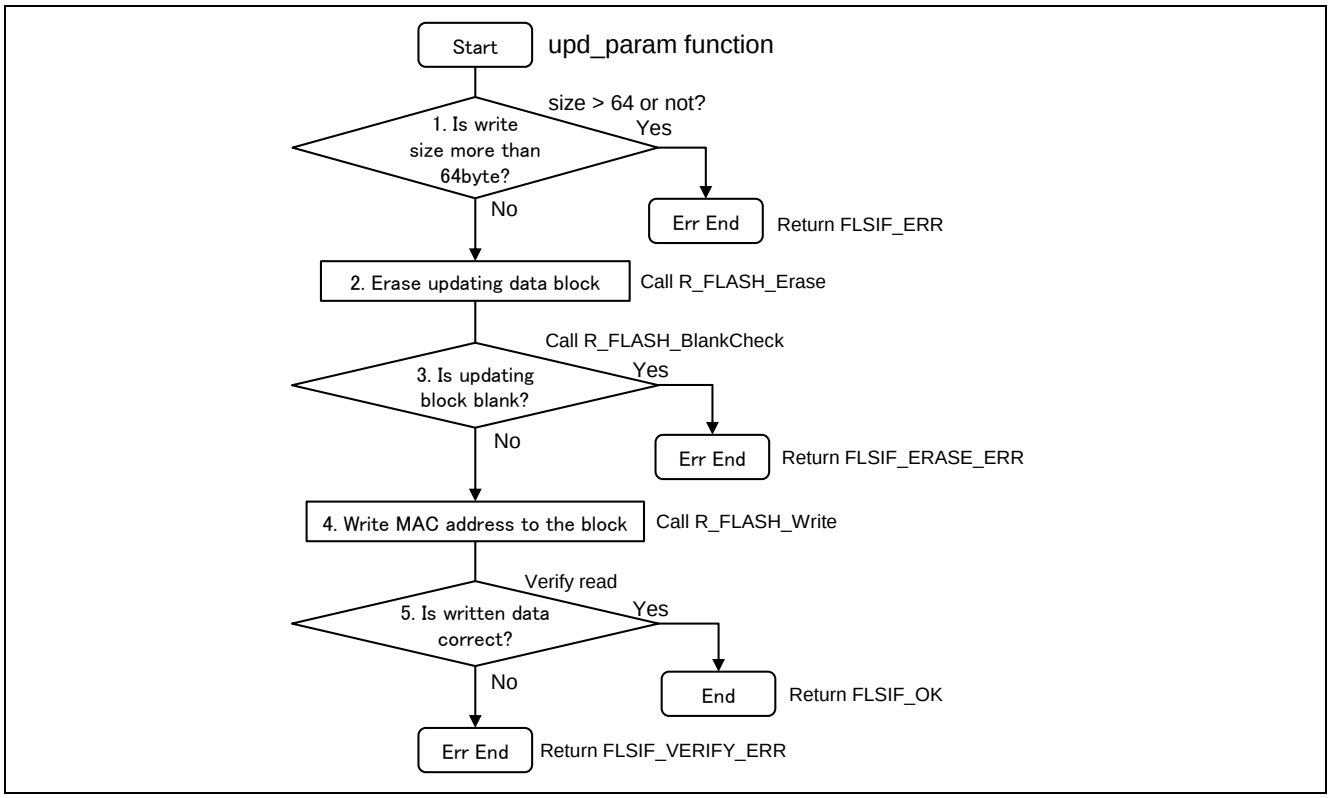


**Figure 3.15 Update communication parameter**

## 3.6 Board Setting

There are four jumpers changing from the default setting of the RX64M/71M RSK board to execute this example. The Ether PHY access channel is set consistent with the software configuration. The USB access setting[1] has to be changed from the board default setting. When the product name of the RX64M/71M RSK board is R0K50564MC001BR or R0K5RX71MC010BR, Figure 3.16 indicates their changing. And when the product name of the RX71M RSK board is R0K50571MC000BR, Figure 3.17 indicates their changing.

[1] USB setting only needs RSK board2 operated by the test project. (not need RSK board1 operated by the switch project)

- Ether PHY access setting

| Jumper | LINK_CH = 1 (Default setting) | LINK_CH = 0 | Functional use |
|---|---|---|---|
| J3 | 2-3 | 1-2 | ETHERC ET0MDIO or ET1MDIO |
| J4 | 2-3 | 1-2 | ETHERC ET0MDC or ET1MDC |

- USB access setting

| Jumper | Board default setting | This example | Functional use |
|---|---|---|---|
| J2 | 2-3 | 1-2 | USB Enables Host Mode |
| J6 | 1-2 | 2-3 | USB USB0VBUSEN |

**Figure 3.16 Jumper setting**

- Ether PHY access setting

| Jumper | LINK_CH = 1 (Default setting) | LINK_CH = 0 | Functional use |
|---|---|---|---|
| J13 | 2-3 | 1-2 | ETHERC ET0MDIO or ET1MDIO |
| J9 | 2-3 | 1-2 | ETHERC ET0MDC or ET1MDC |

- USB access setting

| Jumper | Board default setting | This example | Functional use |
|---|---|---|---|
| J1 | 2-3 | 1-2 | USB Enables Host Mode |
| J3 | 1-2 | 2-3 | USB USB0VBUSEN |

**Figure 3.17 Jumper setting**

## 4. Reference Documents

User's Manual: Hardware

RX64M Group User's Manual: Hardware Rev.1.00 (R01UH0377EJ)
RX71M Group User's Manual: Hardware Rev.1.00 (R01UH0493EJ)
The latest version can be downloaded from the Renesas Electronics website.

User's Manual: Software

RX Family RXv2 Instruction Set Architecture User's Manual: Hardware Rev.1.00 (R01US0071EJ)
The latest version can be downloaded from the Renesas Electronics website.

Technical Update/Technical News

The latest information can be downloaded from the Renesas Electronics website.

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## Revision History

| | | Description | |
|---|---|---|---|
| **Rev.** | **Date** | **Page** | **Summary** |
| 1.00 | Dec 30, 2015 | — | First edition issued. |
| 1.10 | Mar 31, 2016 | — | Applied PTP light driver Rev.1.10 and Ethernet driver Rev.1.10. |
| 1.11 | Nov 11, 2016 | — | Applied PTP light driver Rev.1.11 and Ethernet driver Rev.1.12. |

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   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

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   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
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