# Quick Start Guide for RTKM

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## Introduction

RTKM is a pre-allocated memory management feature. It manages memory sizes larger than 1 page size (4096 bytes[1]). It can prevent the memory fragmentation issue during something like install/uninstall or any dynamic memory requesting operation from the WiFi driver, but the cost is there will be always some memories occupied til the end of RTKM life cycle.

## 1. Support driver

AX series and driver version higher than 1.19.

## 2. Setup RTKM

It can configure by CONFIG_RTKM in *Makefile* or *platform/{platform}.mk*

{value} : n/m/y

n: not support

m: standalone

The driver will build two ko modules (*rtkm.ko* and *{rtk wi-fi}.ko*).

Insert *rtkm.ko* **before** insert *wi-fi.ko*.

the rtkm memory will be released only when the *rtkm.ko* is removed.

y: built-in

The driver only build one *{rtk wi-fi}.ko*

the rtkm memory will be released when the module is removed.

## 3. Pre-allocate memory

Method 1: Predefined Macros in *Makefile* or *platform/{platform}.mk*

You can define the *RTKM_MPOOL_{0 ~ 8}* to allocate usage per page order pool size.

*RTKM_MPOOL_{order}={value}*

```
CONFIG_RTKM = y
EXTRA_CFLAGS += -DRTKM_MPOOL_0=0
EXTRA_CFLAGS += -DRTKM_MPOOL_1=12292
```

[1] In x86 Linux, one page size is 4Kb

```
EXTRA_CFLAGS += -DRTKM_MPOOL_2=1
EXTRA_CFLAGS += -DRTKM_MPOOL_3=132
EXTRA_CFLAGS += -DRTKM_MPOOL_4=0
EXTRA_CFLAGS += -DRTKM_MPOOL_5=0
EXTRA_CFLAGS += -DRTKM_MPOOL_6=0
EXTRA_CFLAGS += -DRTKM_MPOOL_7=3
EXTRA_CFLAGS += -DRTKM_MPOOL_8=0
```

Method 2: module parameter

You can use the module parameter *mpool* to allocate usage per page order pool size.

*mpool: pre-allocated memory pool (array of int)*

```
$ insmod rtkm.ko mpool=0,12292,1,132,0,0,0,3,0
```

| Order | mpool | Size[2] (byte) | Trace bit mask | Default value |
|---|---|---|---|---|
| 0 | RTKM_MPOOL_0 | 0x1000 | 0x01 | 0 |
| 1 | RTKM_MPOOL_1 | 0x2000 | 0x02 | 0 |
| 2 | RTKM_MPOOL_2 | 0x4000 | 0x04 | 0 |
| 3 | RTKM_MPOOL_3 | 0x8000 | 0x08 | 0 |
| 4 | RTKM_MPOOL_4 | 0x10000 | 0x10 | 0 |
| 5 | RTKM_MPOOL_5 | 0x20000 | 0x20 | 0 |
| 6 | RTKM_MPOOL_6 | 0x40000 | 0x40 | 0 |
| 7 | RTKM_MPOOL_7 | 0x80000 | 0x80 | 0 |
| 8 | RTKM_MPOOL_8 | 0x100000 | 0x100 | 0 |

Note: Please contact FAE for initial value setting.

## 4. Checking and Debugging

Checking current pre-allocate memory usage.

```
$ cat /proc/net/rtl8852bu/rtkm
====================== RTKM
======================
 order       use      peak    alloc+      size
--------------------------------------------------
    1     12291     12292     12292  100696064
    2         1         1         1      16384
    3       132       132       132    4325376
    7         2         2         3    1572864
  sum     12426     12427     12428  106610688
```

Debugging/Tracing pre-allocate memory

Enable debug trace by set the bit mask.

Method 1: proc file system

echo order bit mask to /proc/net/rtl8852bu/rtkm

```
$ echo 0x8 > /proc/net/rtl8852bu/rtkm
```

Method 2: module parameter

[2] In x86 system, size = PAGE_SIZE(4Kb) * ( 1 << Order )

parm: rtkm_trace:Trace memory pool (uint)

```
$ insmod rtkm.ko rtkm_trace=0x8
```

Driver logs:

```
rtkm: _kmalloc: require(00000000c52a3603, 32768) usage(3 132/132)
        dbg_rtw_zmalloc+0x58/0xac [8852bu]
        phl_register_tx_ring+0xf7/0x1a8 [8852bu]
        phl_alloc_stainfo_sw+0x8eb/0x983 [8852bu]
        rtw_phl_wifi_role_alloc+0x5e6/0x9f1 [8852bu]
```

Memory leak

When rtkm destroy, if the memory entries still in used, rtkm will print trace log for debugging.

Negative example log:

```
rtkm: rtkm_prealloc_destroy
rtkm: rtkm_destroy_phy
rtkm: ====================== RTKM
======================
rtkm:  order        use       peak      alloc+       size
rtkm: ----------------------------------------------------
rtkm:       1          1          1       4098    33570816
rtkm: rtkm_destroy_phy: memory leak! order=1 num=1
rtkm: rtkm_destroy_phy: rb tree leak! order=1
rtkm: rtkm_destroy_phy: memory leak! (00000000bc134dab, 8192)
        dbg_rtw_zmalloc+0x58/0xac [8852bu]
        alloc_txring+0x7f/0x150 [8852bu]
        _rtw_init_xmit_priv+0x33d/0x37e [8852bu]
        rtw_init_drv_sw+0x80/0x1bd [8852bu]
rtkm: rtkm_prealloc_destroy: done
```

## 5. Document revision history

| Version | Date YYYY-MM-DD | Remarks |
|---|---|---|
| 1.0 | 2022-05-17 | Initial release |
| | | |
| | | |