Applicatoin Note
AN240 Rev A1

Utilizing RF Modem ID Codes and ID Mask

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Summary

Raveon has products with various radio identification ID features. Each radio has an ID, and is assigned and ID to talk to. This Application Note AN240 describes how ID processing works and describes all the ID features Raveon's radios have that use the IDs such as broadcasting and repeating.

Addressing Basics

One of the more powerful aspects of the radio modem is its addressing scheme. Addressing allows multiple radio systems on the same frequency to co-exist, and not interfere with each other.   Addressing is used to differentiate one radio modem from another. Each unit has a unique number, so that when data or a GPS position report is received, the radio modem that sent the message is known. Use the Data Encryption Security KEY to protect messages from being intercepted. Use the ID addressing to identify individual radio modems and GPS transponders.

Note: The underlying ID digital technology is a 16-bit address, and thus the valid address range is 0000 – FFFF in hex.
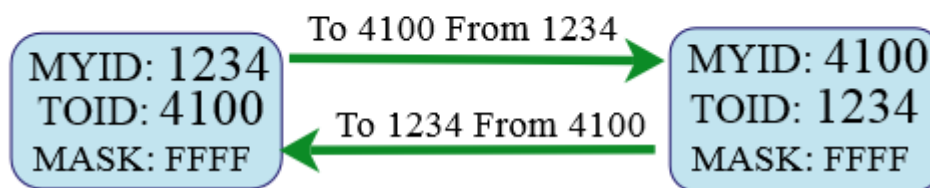
This addressing scheme allows up to 65,000 (FFFF) radio modems to be on one radio channel, or split-up into sub-groups so they do not interfere with each other. For example, one group could use IDs 1200-1299 and another group use IDs 1300-1399. When properly configured, the two groups will not receive each other's signals.

A way to disable addressing altogether is set the Address Mask to 0000 (**ATMK** 0000 command). This address makes 0000 tells the radio to ignore the address, and receive every transmission.
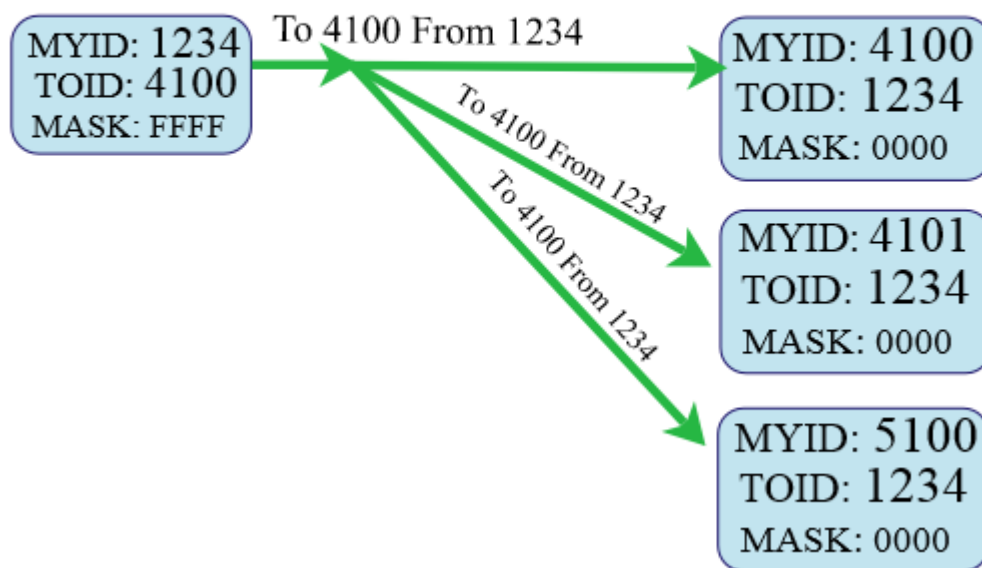
For a unit to receive a message from another unit, all of the following conditions must exist:

- *The bits in the TOID of the sending unit must match the bits in the MYID of the receiving unit that are designated in the address mask.*

- *If encryption is used, the KEYPHRASE of both units must match.*

When the MASK is set to 0, the radio will receive all messages, unles they are encrypted.

One Broadcast to All Radios
#4100 TOID is Received by ALL radio because MASK = 0

MYID: 1234	To 4100 From 1234	MYID: 4100
TOID: 4100		TOID: 1234
MASK: FFFF		MASK: 0000

To 4100 From 1234

MYID: 4101
TOID: 1234
MASK: 0000

To 4100 From 1234

MYID: 5100
TOID: 1234
MASK: 0000

Broadcast Transmissions

The double FF is used to identify a broadcast packet. A transmission with a two digit FF in the first two positions of the destination ID, or in the last two positions of the destination ID, will be interpreted as a broadcast, and any modem with an ID that matches the two non-FF digits will receive the data. For example, sending data with a destination ID of 12FF will be received by any modem with a unit ID 1200 through 12FF. Sending data with a destination ID of FF34 will be received by any modem with a unit ID of 0034 through FF34.
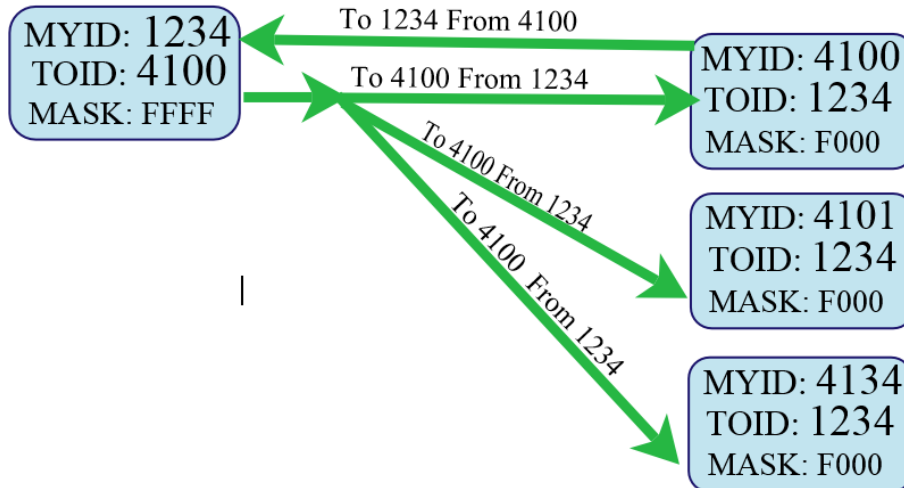
The Address Mask

Only in systems where some modems should only talk to certain other modems, might you want to change the address mask. Whenever data is received over the air, the Destination Address of the transmission is logically "ANDed" with the Address Mask in the receiving modem. This is the Effective Destination Address. The receiving radio also ANDs its own Unit Address with its Address Mask. The result is the Effective Unit Address.

You can also setup radios in Groups by using the Address Mask as F000, FF00, or FFF0 depending upon the group size you would like. F000 masks of the three lower ID numbers, so only the first number in the ID needs to match.

One Radio Broadcasts to All Radios
#4100 TOID is Received by ALL radio because MASK = 4000
All Radio hear Radio 1234. Transmissions from All radios on received by 1234.

MYID: 1234	To 1234 From 4100	
TOID: 4100		MYID: 4100
MASK: FFFF	To 4100 From 1234	TOID: 1234
		MASK: F000

To 4100 From 1234

MYID: 4101
TOID: 1234
MASK: F000

To 4100 From 1234

MYID: 4134
TOID: 1234
MASK: F000

Addressing Examples:

Example 1 (default configuration)

> Sending radio modem Unit Address = 0001
>
> Sending Destination Address = 0001
>
> Receiving Unit's Unit Address = 0001
>
> Receiving Unit's Address Mask = F000
>
> Result: Unit will receive the data, because the addresses identically match. When the addresses are identical, the value of the mask is not important.
>
> Notes: This is the default configuration. All units have address 0001, and all modems will talk to all other modems with address 0001.

Example 2 (a configuration that won't work)

> Sending to Destination Address = **1001**
>
> Receiving Unit Address = **0001**
>
> Receiving Unit's Address Mask = **F000**
>
> Result: No data will be received, because the address do not match, and the address mask of FFFF requires that at least the first digit match. .

Example 3 (able to receive data from a sub-group, 1000 – 1999)

Sending to Destination Address = **1236**

Receiving radio modem Unit Address = **1234**

Receiving radio modem Address Mask = **F000**

Result: Data will be received. 1236 AND'ed with F000 is 1000. 1234 ANDed with F000 is 1000. The results of the ANDing perfectly match, and thus the data will be received.
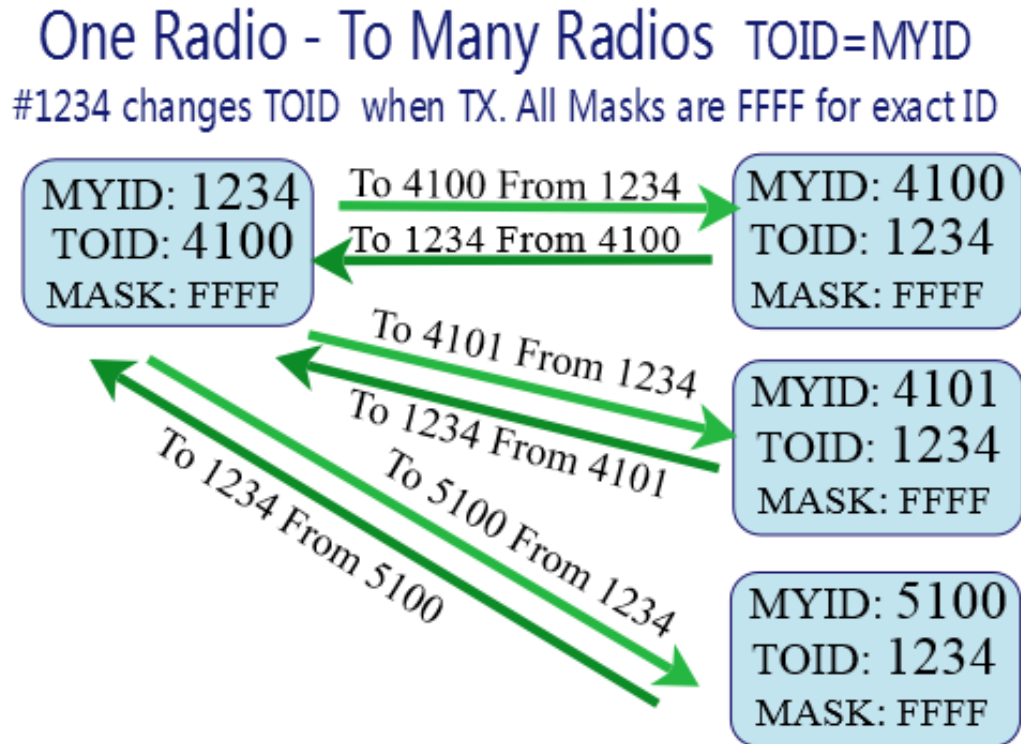
Example 4 (able to receive from a sub-group, 34xx where xx is any two digits)

Sending Destination Address = **3410**

Receiving radio modem Unit Address = **3499**

Receiving radio modem Address Mask = **FF00**

Result: Data will be received. FF00 means first two digits must match, and they do, so the units will receive each other.

One Radio - To Many Radios TOID=MYID
#1234 changes TOID when TX. All Masks are FFFF for exact ID

MYID: 1234	To 4100 From 1234 →	**MYID: 4100**
TOID: 4100	← To 1234 From 4100	**TOID: 1234**
MASK: FFFF		**MASK: FFFF**

To 4101 From 1234

To 1234 From 4101

MYID: 4101
TOID: 1234
MASK: FFFF

To 1234 From 5100

To 5100 From 1234

MYID: 5100
TOID: 1234
MASK: FFFF

One effect of this is that an address mask of 0000 will cause the *Radio Modem* modem to received any data from any unit that transmits. The Destination Address will effectively be ignored and all data received if the mask is set to 0000.

ATMY	The ID of this unit. Default is 1234.
ATMK	The network address mask. Default is FFFF.
ATDT	The address of the unit this modem will talk to. Default is 1234.
TOID	The address of the unit this modem will talk to. Default is 1234.

Listen Address:

The Listen Address is a second ID programmed into the radio, that the unit will Listen for. The Listen Address is configured using the **ATLA xxxx** command.

If the Listen Address is set to **FFFF**, then this feature is ignored, and **FFFF** is the factory default so by default the Data Radio Modem does not use the Listen Address. If you would like a Data Radio Modem to transmit using ID 1234 but also be able to receive data sent to ID 5555 then you could set the **MYID** to 1234 (**ATMY 1234**<enter>) and the Listen Address to 5555 using the ATLA command (**ATLA 5555**<enter>)

The Listen Address gives the radio the ability to receive data sent to a second ID, set with the **ATLA xxxx** command.

Addressing Examples:

Example 1 (a configuration that works)

> Sending to Destination Address = **1236**
>
> Receiving Unit Address = **1234**
>
> Receiving Unit's Address Mask **= FFFF**
>
> Receiving Unit's Listen Address **= 1236**
>
> Result: Data will be received. All radios with this 1236 Listen Address will receive this message.

Store-and-Forward Repeating

The *RADIO MODEM* modem has a built-in wireless repeater. Each RADIO MODEM is capable of not only sending and receiving data from/to its serial port, but also re-transmitting data packets it receives over-the-air data.

Automatic Repeater Configuration

The easiest way to enable store-and-forward repeating is the use the **REPEAT 1** command. **REPEAT 1** will turn on the store-and-forward feature, and configure it to repeat all packets the radio can hear on the air. **REPEAT 0** disables store-and-forward repeating.

It is highly recommended that you use this method to configure your RADIO MODEM as a repeater.

Important: The Unit ID of the repeater must be unique in the system. No other radio modem in the system can have the ID of the repeater.

Manual Configuration of the Repeat Feature

There is a sophisticated packet repeating algorithm in the RADIO MODEM, and it may be manually configured for more complex repeating scenarios. In most cases this is not needed. Simply use the **REPEAT 1** command. But, if you do not wish the repeater to repeat all packets, you may manually configure the Repeater Table within the RADIO MODEM. The Repeater

Table is a table of IDs that the RADIO MODEM should repeat. It contains a range of IDs and a mask. There may be up to 4 entries in the Repeater Table, each with a different range of IDs that should be repeated.

Important: The Unit ID of the repeater must be unique in the system. No other radio modem in the system can have the ID of the repeater.

Data is transmitted over-the-air in bursts called packets, and each packet has the Unit ID of the RADIO MODEM that sent the data and the Destination ID of the unit that the data is intended for.

Figure 1   Overview of Repeater Operation
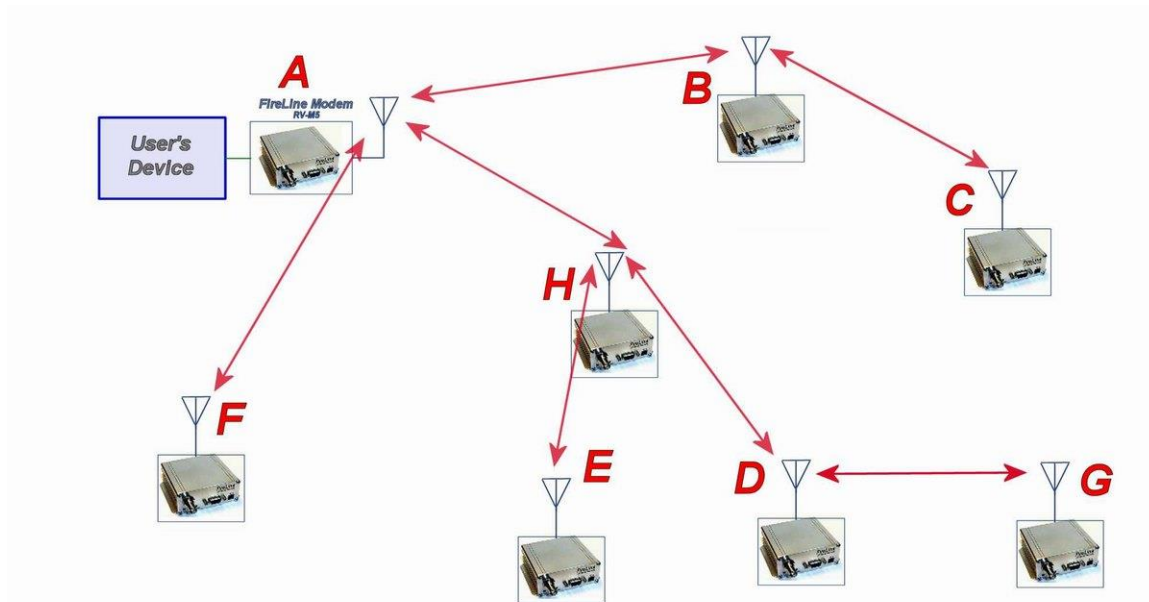
In the example shown in Figure 3 above, *RADIO MODEM* **A** is will communicate with all other modems in the system. It can directly communicate with **B, H**, and **F**.   Because of propagation limits, it cannot communicate reliable to **E, D, C,** and **G**.

To solve this problem, some of the RADIO MODEM modems are configured as repeaters. The still are able to send and receive data, but they also will repeat data out to the modems that are out of range of *RADIO MODEM* **A**.

H is configured to repeat all messages to/from **E, D**, and **G**. **B** is configured to repeat all messages to/from **C**, and **D** is configured to repeat all messages to/from **G**.

The following table illustrates one possible way the RADIO MODEMs could be programmed to accomplish this type of system.

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