



- FOX3/-3G Integration With AgoraBee Reader

- for tracking skip and roll-off containers and

- construction equipment activity

- **Application Note**

- **FOR FOX3 & FOX3-3G DEVICES**

## Version history:

*This table provides a summary of the document revisions.*

Version	Author	Changes	Modified
1.0.3	F. Beqiri	- A note added to figure 2 - See <a href="#">Figure 2</a> - A new point added in typical application (Construction equipment activity) - See chapter <a href="#">1.3</a>	16/07/2015
1.0.2	F. Beqiri	- Updated chapters <a href="#">1.2</a> and <a href="#">1.6</a> .	15/07/2015
1.0.1	F. Beqiri	- Added some configuration examples when using the EVENTS Mode - See chapter <a href="#">1.6</a>	14/07/2015
1.0.0	F. Beqiri	- Initial version	10/07/2015

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## AgoraBee S.A.

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## Note

Because our products are being continuously improved, specifications and information given in this document are subject to change by FALCOM without notice.

# 1 ABOUT THIS DOCUMENT

The aim of this application note is to describe, evaluate and integrate the AgoraBee reader to the FALCOM FOX3/-3G device in order to improve transportation, distribution, asset tracking and management as well as logistics businesses.

## 1.1 Contact Information

Location Name	Contacts
FALCOM support	Web : <a href="http://www.falcom.de">http://www.falcom.de</a> Online form: <a href="http://www.falcom.de/support/support-form/">http://www.falcom.de/support/support-form/</a>
AgoraBee support	Web : <a href="http://www.agorabee.com/Site2015/#products">http://www.agorabee.com/Site2015/#products</a> E-mail : <a href="mailto:support@agorabee.com">support@agorabee.com</a>

## 1.2 Introduction

Radio Frequency Identification (RFID), is a method of communicating using radio waves. Radio waves can communicate between active RFID tags, attached to objects for tracking purpose and automatic identification, and an RFID reader without requiring line-of-sight visibility. Active RFID tags can be read remotely over a range of distance up to 100 meters or more allowing to keep track of valuable assets, monitor their movement and locate them quickly. This allows a highly defined reading area when tags go in and out of the interrogation zone and thereby a great flexibility in applications such as asset protection and supervision.

The mobile controlled RFID system consists of a FOX3/-3G, web server, active reader and tags.

<b>Tags</b>	Assets, goods and other objects to be tracked are fitted with active RFID tags. Active tags have transmitters and use batteries to send back their information to the reader. Such tags can contain sensors to monitor conditions such as temperature, humidity and other product-related information.
<b>Reader</b>	The AgoraBee reader is connected via serial interface to the FOX3/-3G device. The encoded radio signals sent from the tags are received by the reader which filters them and generates relevant events in addition to maintaining an updated inventory. The events are pushed as they occur through the serial interface to the FOX3/-3G; while in order to get the inventory, the FOX3/-3G needs to poll with a specific command on the serial port.
<b>FOX3/-3G</b>	The FOX3/-3G needs to be configured to react to data received on that serial port and to forward this data to the central tracking server via TCP or to a mobile phone via SMS.
<b>Web Server</b>	The client server/phone receives automatically information from the FOX3/-3G device to know when one tag or more arrive in or leave from the reader operating area.

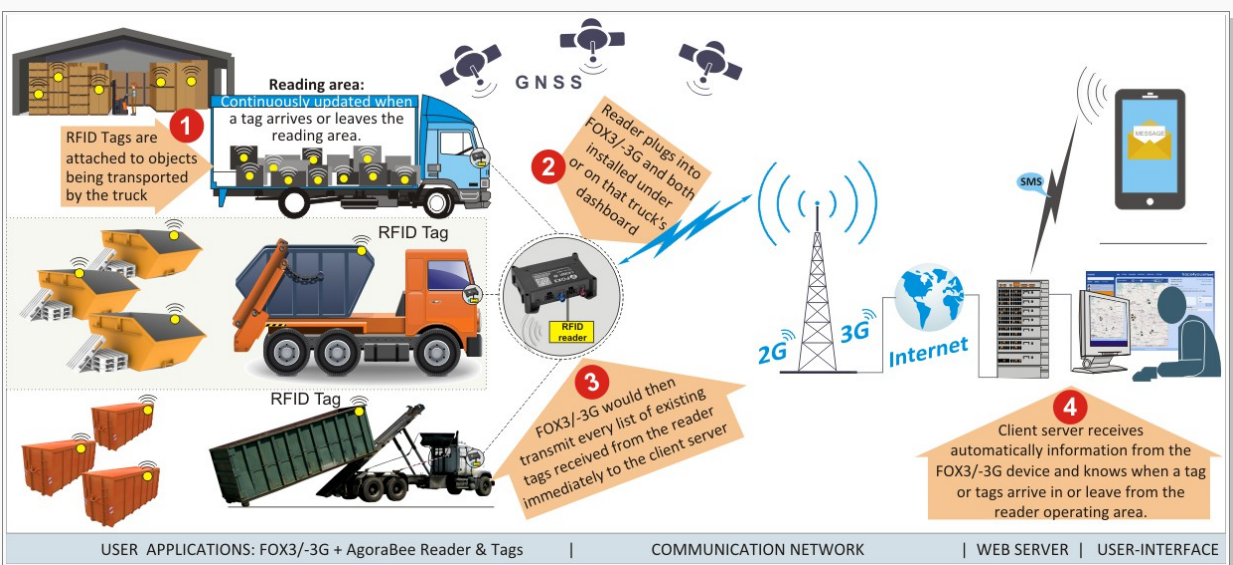


Figure 1: Typical application example using FOX3/-3G with active RFID reader and tags

### 1.3 Typical applications

- Inventory Management
- Skip and Roll-off Container Tracking
- Construction equipment activity
- Pallet and Construction Tool Tracking
- Remote Monitoring
- Asset Management
- Car Tracking in Rental

### 1.4 Installing AgoraBee reader to FOX3/-3G

To install the AgoraBee reader to the FOX3/-3G use either CA31 which connects to 8pin main port or CA69 to 6pin accessory port on the FOX3/-3G. Both cables have a 4pin connector consisting of an RS-232 interface (RX, XT) and power (+IN, GND) pins. At the end of both cables there are also the power supply lines that need to be connected to an external power source ranging from +12 VDC to +32 VDC (e.g. 12VDC).

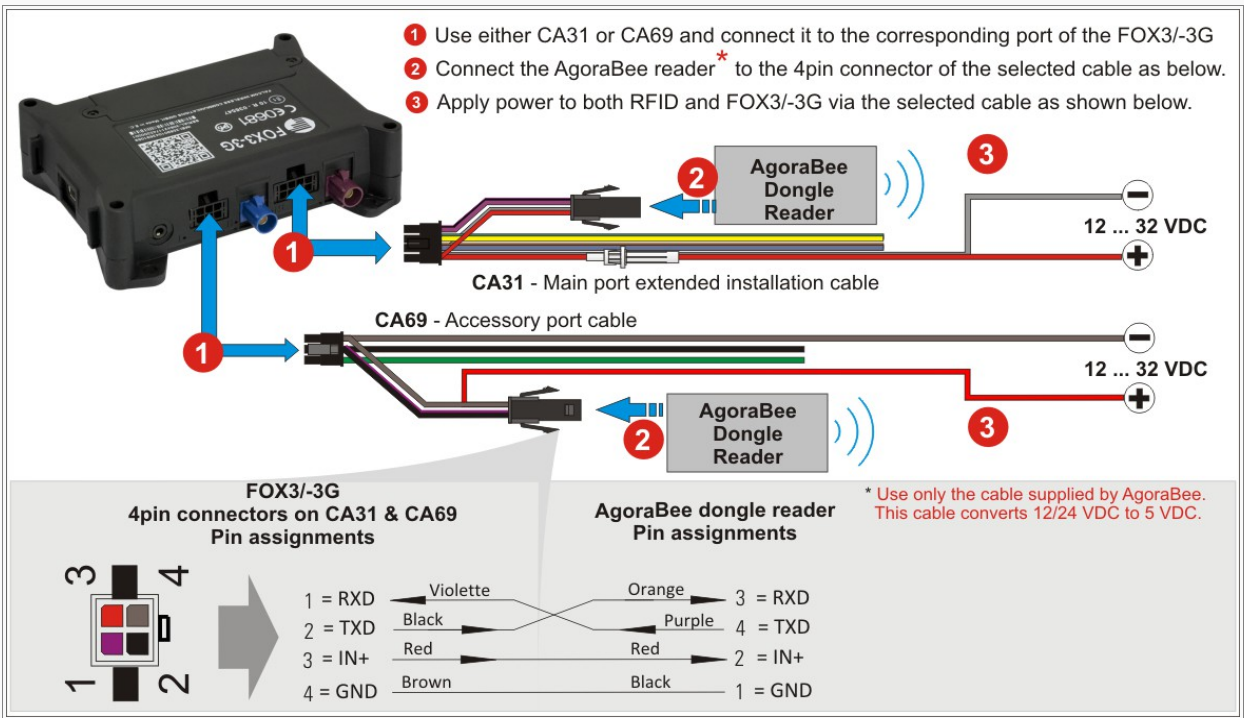


Figure 2: Use one of the cables to interface the AgoraBee reader to FOX3/-3G

### 1.5 Testing RFID reader and active tags operation

After connecting the AgoraBee reader to one of the serial ports of the FOX3/-3G, use the following steps to perform the test:

- ✓ Read the corresponding manual of the RFID reader you are using
- ✓ Check the operating voltage of the RFID Reader
- ✓ Connect the RFID reader to the FOX3/-3G device as mentioned in the figure 2 above.
- ✓ Distribute all active tags within the reader operating area
- ✓ Install and start the FALCOM Workbench software
- ✓ Start testing the system. To test this system locally, use the device configuration in chapter below and replace `TCP.Client.Send, 8, "&(IMEI), &(SerialData0)"` in AL3 with `MSG.Send.Serial1, 8, "&(IMEI), &(SerialData0)"`. In this way, the received data from the reader on the Serial Port 0 is forwarded to the Serial Port 1, instead of to your remote server via TCP

## 1.6 FOX3/-3G device configuration

The AgoraBee reader supports different operation modes. This chapter will show only some configuration examples how to forward the data from the AgoraBee reader to your server when using either **EVENTS mode** or **FALCOM mode**. The main difference between these two modes is: in the **EVENTS mode**, the reader sends the data immediately when the tag is seen or tag state is changed and in the **FALCOM mode**, the reader sends the data only on request. For more details about the PFAL commands used below, refer to the chapter 1.7.

### FOX3/-3G Serial Port Configuration (already tested by FALCOM)

To integrate the AgoraBee reader to the FOX3/-3G, the following configuration should be stored into the FOX3/-3G.

```
$PFAL,Cnf.Set,DEVICE.SERIAL0.BAUDRATE=9600 // AgoraBee reader operates at 9600 bps
$PFAL,MSG.Mode.Serial0=60,C // Allows to send requests to the AgoraBee reader
```

The AgoraBee reader is assumed to be connected to the Serial Port 0 (8-pin main port of FOX3/-3G). If you want to connect the reader to the Serial Port 1 (6-pin accessory port of FOX3/-3G), just change the number **0** (marked in red) to **1** in both configuration lines above. **Hint:** This configuration can be sent to the FOX3/-3G either remotely via TCP or locally through serial port.

### FOX3/-3G Alarm Configuration with Reader in EVENTS mode (already tested by FALCOM)

In the EVENTS mode the AgoraBee reader sends the events to the serial port as they occur. To activate the EVENTS mode, use the following command:

```
$PFAL,MSG.SEND.RawSerial0,0,"&(bin=0x02)084545014D&(bin=0x03)"
```

The message structure is described in the table below (contact AgoraBee for more details). Parsing of this data should be implemented on the server side.

Data Mode (3 bytes)	Message Type (3 bytes)	Message Length (3 bytes)	Event Class (3 bytes)	Device UID (12 bytes)	Device Data (6 bytes)	RFR (3 bytes)	Device Event (3 bytes)	Checksum (3 bytes)	End message (2 bytes)
001	002	032	015	101200000190	001192	010	060	220	<CR><LF>

**EXAMPLE 1:** Start a 2 minute timer on `SYS.Device.eStart` event (**AL1**). Reset the AgoraBee reader inventory on `Sys.Timer.e` event (**AL2**). This causes the reader to generate new events (in zone and other type of events) which are forwarded (together with the FOX3/-3G' IMEI and RMC protocol) to the server on `SYS.eSerialData` event during the car ignition (`IO.s8=high`) is on (**AL3**). To test these alarms, store them first into the FOX3/-3G and finally start the timer by performing a device reset with `$PFAL,Sys.Device.Reset`.

```
$PFAL,CNF.Set,AL1=SYS.Device.eStart:Sys.Timer0.Start=cyclic,120000
$PFAL,CNF.Set,AL2=Sys.Timer.e0&IO.s8=high:MSG.SEND.RawSerial0,0,"&(bin=0x02)06524900&(bin=0x03)"
$PFAL,CNF.Set,AL3=SYS.eSerialData0="001002":TCP.Client.Send,8,"&(IMEI),&(SerialData0)"
```

**AL2** = Reset the AgoraBee reader inventory is made as long as the car ignition (`IO.s8=high`) is on. The IGN pin (pin 3) on the FOX3/-3G should be connected to the car ignition, so that it shows 12V when the vehicle is on and 0V when is off. In case the IGN pin (pin 3) is not used, then remove (`IO.s8=high`) from the **AL2**.

The FOX3/-3G device will transmit the following data to your server, for example:

Default format: DEVICE.PFAL.SEND.FORMAT="\$",CKSUM,"", "\$<end>"	Customized format: DEVICE.PFAL.SEND.FORMAT="",NOCKSUM,"", ""
<code>\$353816054967940,001002032015101200000176001133006060041*23&lt;CR&gt;&lt;LF&gt;</code>	<code>353816054967940,001002032015101200000176001133006060041&lt;CR&gt;&lt;LF&gt;</code>
<code>\$GPRMC,080707.000,A,5040.4081,N,01058.8545,E,0.01,0.00,140715,,*00&lt;CR&gt;&lt;LF&gt;</code>	<code>\$GPRMC,080707.000,A,5040.4081,N,01058.8545,E,0.01,0.00,140715,,&lt;CR&gt;&lt;LF&gt;</code>
<code>\$&lt;end&gt;&lt;CR&gt;&lt;LF&gt;</code>	

**EXAMPLE 2:** Reset the AgoraBee reader inventory on `TCP.Client.eReceived` event (**AL1**). This causes the reader to generate new events (in zone and other type of events) which are forwarded (together with the FOX3/-3G' IMEI and RMC protocol) to the server on `SYS.eSerialData` event (**AL2**). To test these alarms, store them first into the FOX3/-3G and then send "INV\_TCP" from your server to the FOX3/-3G device.

```
$PFAL,CNF.Set,AL2=TCP.Client.eReceived="INV_TCP":MSG.SEND.RawSerial0,0,"&(bin=0x02)06524900&(bin=0x03)"
$PFAL,CNF.Set,AL3=SYS.eSerialData0="001002":TCP.Client.Send,8,"&(IMEI),&(SerialData0)"
```

**FOX3/-3G Alarm Configuration with Reader in FALCOM mode (already tested by FALCOM)**

In the FALCOM mode the AgoraBee reader is in polling mode. To get the inventory send the following command "`<STX>0C494E56414C4C<ETX>`".

To activate the FALCOM mode, use the following command:

```
$PFAL,MSG.SEND.RawSerial0,0,"&(bin=0x02)08454D0146&(bin=0x03) "
```

The reader response starts with the header "INV\_ALL," followed by the ID of the reader (e.g. 230090002231) and then the ID of the tags with their associated data as shown in the example below. Parsing of this data should be implemented on the server side.

```
INV_ALL,230090002231,00300100423500000001032,010050016167000000005032,101200000176001155001040,12000001025000000005184,15100000100500000000052,001,EOI232<CR><LF>
```

**EXAMPLE 1:** Start a 2 minute timer on SYS.Device.eStart event (AL1). Request for data from the reader on Sys.Timer.e event (AL2) and forward this data (together with the FOX3/-3G' IMEI and RMC protocol) to the server on SYS.eSerialData event during the car ignition (IO.s8=high) is on (AL3). To test these alarms, store them first into the FOX3/-3G and finally perform a device reset with \$PFAL, Sys.Device.Reset.

```
$PFAL,CNF.Set,AL1=SYS.Device.eStart:Sys.Timer0.Start=cyclic,120000
$PFAL,CNF.Set,AL2=Sys.Timer.e0&IO.s8=high:MSG.SEND.RawSerial0,0,"&(bin=0x02)0C494E56414C4C&(bin=0x03) "
$PFAL,CNF.Set,AL3=SYS.eSerialData0="INV_ALL,":TCP.Client.Send,8,"&(IMEI), &(SerialData0) "
```

**AL2 =** The request for data from the reader is made as long as the car ignition (IO.s8=high) is on. The IGN pin (pin 3) on the FOX3/-3G should be connected to the car ignition, so that it shows 12V when the vehicle is on and 0V when is off.

The FOX3/-3G device will transmit the following data to your server, for example:

Default format: DEVICE.PFAL.SEND.FORMAT="\$",CKSUM,"", "\$<end>"	Customized format: DEVICE.PFAL.SEND.FORMAT="",NOCKSUM,"", ""
<pre>\$353816054967940,INV_ALL,230090002231,00300100423500000000032,010050016167000000005032,1012000001760011550000040,1200000001025000000006184,151000001005000000001052,001,EOI232*1D&lt;CR&gt;&lt;LF&gt; \$GPRMC,122315.000,A,5040.4091,N,01058.8558,E,0.03,0.00,020715,,*06&lt;CR&gt;&lt;LF&gt; \$&lt;end&gt;&lt;CR&gt;&lt;LF&gt;</pre>	<pre>353816054967940,INV_ALL,230090002231,003001004235000000001032,010050016167000000006032,101200000176001155001040,120000001025000000006184,15100001005000000001052,001,EOI229&lt;CR&gt;&lt;LF&gt; GPRMC,122315.000,A,5040.4091,N,01058.8558,E,0.03,0.00,020715,,&lt;CR&gt;&lt;LF&gt;</pre>

**EXAMPLE 2:** Request for data from the reader on TCP.Client.eReceived event (AL1) and forward this data (together with the FOX3/-3G' IMEI and RMC protocol) to the server on SYS.eSerialData event (AL2). To test these alarms, store them first into the FOX3/-3G and then send "INV\_TCP" from your server to the FOX3/-3G device.

```
$PFAL,CNF.Set,AL2=TCP.Client.eReceived="INV_TCP":MSG.SEND.RawSerial0,0,"&(bin=0x02)0C494E56414C4C&(bin=0x03) "
$PFAL,CNF.Set,AL3=SYS.eSerialData0="INV_ALL,":TCP.Client.Send,8,"&(IMEI), &(SerialData0) "
```

**1.7 Additional documentation**

If this application note does not cover all the information you need to setup, refer to the additional documents listed below. In order to download these documents you will have to log-in first using the provided **Username** and **Password**. Click here to log-in: <http://www.falcom.de/>.

Filename	Description
AVL_PFAL_Configuration_Command_Set.pdf	Lists and describes all PFAL commands supported by the FALCOM AVL devices.
FOX3_HardwareManual.pdf	Contains instructions for safety, operation and maintenance of the FOX3/-3G device.
AppNotes_AVL_Installation_Guide.pdf	Provides all the necessary information about installing the FALCOM products properly and safely. (No need to login.)

If you are going to use the FALCOM passive RFID reader, refer to the application note listed below.

Filename	Description
AVL_AppNote_RFID_Howto.pdf	Describes the integration of the FALCOM passive RFID reader with an FALCOM AVL device (FOX3/-3G, STEPIII-UX, BOLERO-LT2). (No need to login.)