

Telegesis™	 SILICON LABS	TG-APP-0024r3
ETRX357		Application note

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## ETRX357 ZIGBEE® MODULES

### Using R3xx Firmware in a Home Automation Network



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## 1 Introduction

The off-the-shelf Telegesis firmware that uses our manufacturer specific profile can also be used in a Home Automation network, but several registers must first be configured in order that it can join or form a network and present incoming data. Further registers can be set if it is necessary to send HA commands and to allow endpoint 2 to properly respond to queries from other devices such as requests for active endpoints. This note presents a minimal list of the register settings and some examples of data received from a temperature/humidity sensor. For more detailed information refer to:

R309 AT Command Manual (or the version that relates to your actual firmware) (*SiLabs*)

Application Note on Interoperability (*SiLabs*)

ZigBee Cluster Library Specification (*ZigBee Alliance*)

ZigBee Home Automation Public Application Profile (*ZigBee Alliance*)

Although the AT command set firmware that is normally supplied pre-loaded into the ETRX357 modules can send HA commands, it is necessary to assemble them at the byte level by reference to the ZigBee specifications, and incoming messages have to be handled by a host processor. If it is used as the coordinator in a network that includes Intruder Alarm System devices, the host also needs to support a zone table. For these reasons it may be better to use the Telegesis HA Combined Interface firmware that has commands tailored to HA operations.

## 2 Format of commands and data in this note

**Bold text:** command to be typed in

*Italic:* example data received

## 3 Register settings and commands

The default setting of the ETRX357's serial port is 19200 baud, 8 data bits, no parity, 1 stop bit. This can be changed by writing a new value into register S12.

The S-register settings only need to be entered once as they are mostly non-volatile. The volatile registers have an associated default setting which is applied when the device is reset. Follow the sequence of operations as given here until you are familiar with the effects of the various commands, because some of the registers must be set before the device starts or joins a network. Some of the commands are optional, such as allowing and blocking joining.

### 3.1 Typical commands to start a PAN

<b>AT+DASSL</b>	Disassociate from previous network if desired
<b>AT&amp;F</b>	Restore to a known state if desired
<b>ATI</b> <i>Telegesis ETRX357-LRS R309C 000D6F0001B65311</i>	Check firmware version. It ought to be R308 or higher
<b>AT+N</b>  <i>+N=NoPAN</i>	Check network status
<b>ATS00=6319</b>	Home Automation channel mask
<b>ATS0A=0114;password</b>	Use predefined Link Key
<b>ATS09=5A6967426565416C6C69616E63653039;password</b>	Define HA Link Key
<b>AT+EN</b>	Establish network if necessary
<b>ATS0A0=0;password</b>	Allow joining (optional, this is the default setting)
<b>ATS0A0=1;password</b>	Disallow joining when all the sensors have joined
<b>ATSALL:FFFD,0A0=0;password</b>	Allow joining via all other devices in the PAN
<b>ATSALL:FFFD,0A0=1;password</b>	Block joining via any other device in the PAN
<b>ATS0F=0104</b>	Allow display of messages that arrive on endpoint 2
<b>ATS0EA=1</b>	Suppress display of "SR..." prompts
<b>ATS0FC=1</b>	Optional with R309. Data is shown in hexadecimal format instead of raw characters

<i>RX:4B5C,0104,02,02,0402,08:• • )û</i>	Presentation of the raw binary characters will depend on the terminal software being used
<i>RX:4B5C,0104,02,02,0405,08:• • !Ù</i>	
<i>RX:4B5C,0104,02,02,0402,08:18180A000029FC08</i>	
<i>RX:4B5C,0104,02,02,0405,08:18190A000021B80E</i>	
<i>RX:4B5C,0104,02,02,0402,08:&lt;18&gt;&lt;03&gt;&lt;0A&gt;&lt;00&gt;&lt;00&gt;)&lt;9F&gt;&lt;08&gt;</i>	
<i>RX:4B5C,0104,02,02,0405,08:&lt;18&gt;&lt;04&gt;&lt;0A&gt;&lt;00&gt;&lt;00&gt;!W&lt;0F&gt;</i>	

### 3.2 Typical received data

These are examples of readings from a temperature and humidity sensor. The actual format depends on the terminal software you are using, except that bit C of register S0F turns raw characters into hexadecimal format (R309 only). Note that 16-bit data arrives low-byte first.

#### 3.2.1 Device joins the network

<i>MED:00124B00029ACA1C,21E6</i>	
MED	A Mobile End Device has joined the network. Can also be FFD or SED
00124B00029ACA1C	EUI64 of new device
21E6	Network address of new device

#### 3.2.2 Temperature reading received

<i>RX:4B5C,0104,02,02,0402,08:&lt;18&gt;&lt;3B&gt;&lt;0A&gt;&lt;00&gt;&lt;00&gt;&lt;29&gt;&lt;DD&gt;&lt;08&gt;</i>	
4B5C	Source network address
0104	HA profile ID
02	Destination endpoint
02	Source endpoint
0402	Temperature cluster ID
08	Number of payload bytes
<18>	Frame control
<3B>	Sequence no
<0A>	Cmd ID: report attributes
<0000>	Attribute ID: measured value
<29>	Type int16s
<DD08>	08DD = 2269 = 22.69°

### 3.2.3 Humidity reading received

*RX:4B5C,0104,02,02,0405,08:<18><3C><0A><00><00><21><35><0E>*

4B5C	Source network address
0104	HA profile ID
02	Destination endpoint
02	Source endpoint
0405	Relative humidity cluster ID
08	Number of payload bytes
<18>	Frame control
<3C>	Sequence no
<0A>	Cmd ID: report attributes
<0000>	Attribute ID: measured value
<21>	Type int16s
<350E>	0E35 = 3637 = 36.37%

### 3.3 Send HA commands

These are not needed if data is only to be received. You will need these settings to configure attribute reporting, though. Most sensors that report attributes from more than one cluster seem to use the same reporting interval for all clusters, but this may not always apply especially if you set a reportable change level.

<b>ATS40=0202</b>	Current source and destination endpoint
<b>ATS41=0202</b>	Default source and destination endpoint
<b>ATS42=0402</b>	Current cluster ID
<b>ATS43=0402</b>	Default cluster ID
<b>ATS44=0104</b>	Current profile ID
<b>ATS45=0104</b>	Default profile ID

Example: sent 14 bytes to network address 4B5C to configure reporting interval. The actual sequence number is not important. The characters after the '>' indicate the value of each byte, not the format which will depend on the terminal application in use.

**AT+UCASTB:0D,4B5C**  
**>00 03 06 00 00 00 29 00 00 0A 00 FF FF**

00	Frame control
03	Sequence no
06	Cmd ID: configure reporting
00	Direction
0000	Attribute ID
29	Type int16s
0000	Minimum reporting interval (off)
000A	Maximum reporting interval (10 secs)
FFFF	Reportable change (off)

This approach is suitable when the endpoint and cluster ID do not change often. The R309 firmware introduces a new set of commands such as AT+SENDUCAST; these commands take the endpoints, profile and cluster ID as parameters so they can be altered with each command. The registers and command in the example above then become

**AT+SENDUCASTB:0D,4B5C,02,02,0104,0402**  
**>00 03 06 00 00 00 29 00 00 0A 00 FF FF**

and there is no longer any need to write new S-register values.

### 3.4 Intruder Alarm System devices

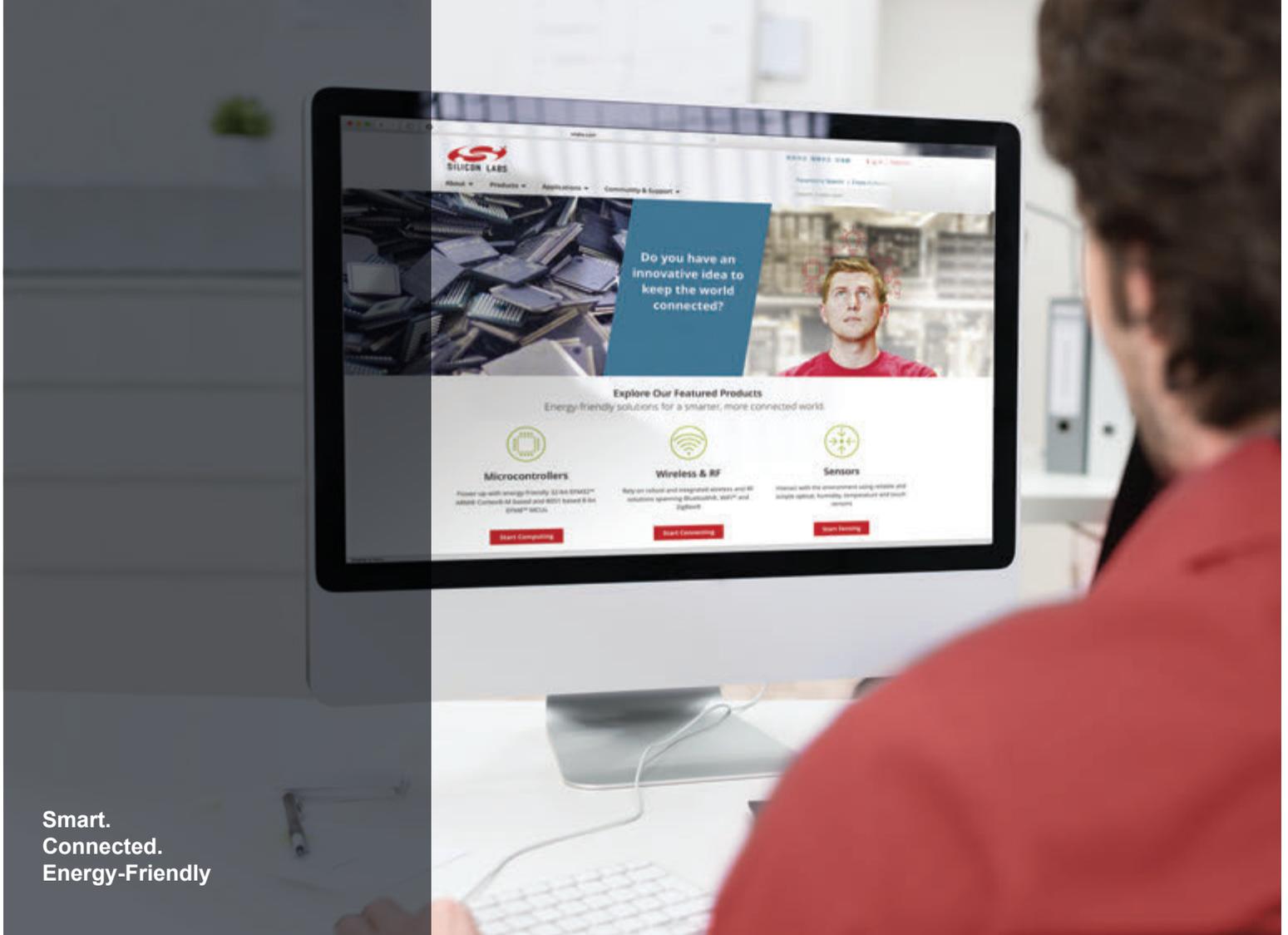
IAS Zone devices are typically encountered as motion sensors, door/window sensors and similar products. They need to be assigned to zones when they join the network and may leave quite quickly if they do not receive suitable responses to their queries. IAS devices must enrol with the Control and Indicating Equipment (CIE) that is implemented with the R3xx firmware, so the latter needs to be configured correctly in order that the IAS device can find it. A typical sequence of operations is:

CIE	IAS
	Join network
	Send Match Description Request to find IAS Zone cluster client
	Send Zone Enroll Request
Send Zone Enroll Response	
Send IAS_CIE_address attribute	

In order that the CIE device can respond automatically to the Match Description Request the user must first set three S-registers:

- ATS0AB=1;password** Allow Endpoint 2 to reply to ZDO endpoint queries
- ATS48=0104** Set endpoint 2 Profile ID to Home Automation
- ATS4C=0500** Add IAS Zone cluster to endpoint 2 Output Cluster List

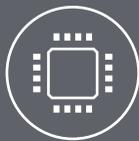
The user's application must recognise the Zone Enroll Request (cluster 0x0500, command 0x01, server to client) and reply with a Zone Enroll Response (command 0x00, client to server) with the user's choice of zone ID. Finally the CIE must write its own EUI64 to the IAS\_CIE\_address attribute of the IAS Zone device.



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**SILICON LABS**

Silicon Laboratories Inc.  
400 West Cesar Chavez  
Austin, TX 78701  
USA

<http://www.silabs.com>