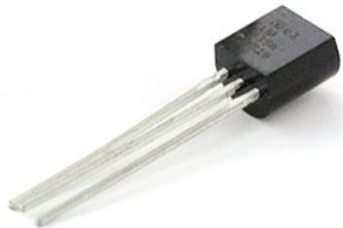
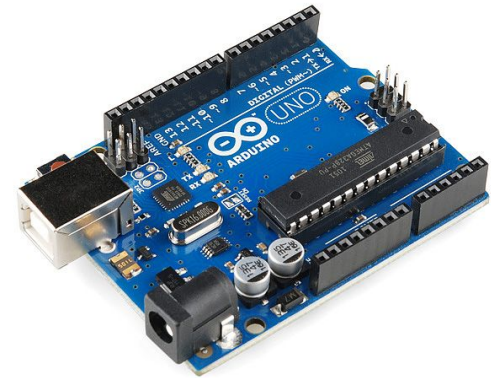


WSN Temperature Monitoring ZigBee

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MO809 - Prof.: L.E. Buzato
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- Reduzir gastos com energia, reduzindo o consumo de energia
- Melhorar a gestão de consumo do sistema de ar-condicionado

Material Utilizado



Hardware

- Xbee Pro 2.5
- Board Arduino
- Sensor de temperatura LM335A
- Arduino USB board
- Ethernet shield



Coordinator



End Device



Software

- Arduino IDE
- HTML/AJAX
- Linguagem C (Xbee.h)
- MySQL



Topologia

Client Computer



Coordinator



End



End



End



End



User Interface

- Acesso via rede
- Mostra os resultados via browser web
- Automatic Display:
 - Mostra os dados dos sensores
- Display According an Instruction:
 - Usuário busca a informação que quer

Coordinator

- “Peça central”
- Coletar as informações dos sensores

HTTP Request

```
GET /index.html HTTP/1.1  
Host: 192.168.x.x  
Connection:close  
value.....
```

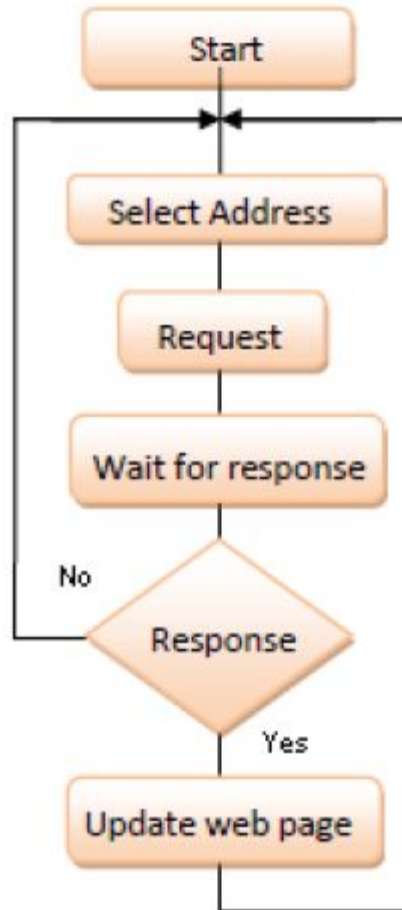
HTTP Response

```
HTTP/1.1 200 OK  
Content-Type:text/html  
Body.....  
Table.....  
Button.....
```

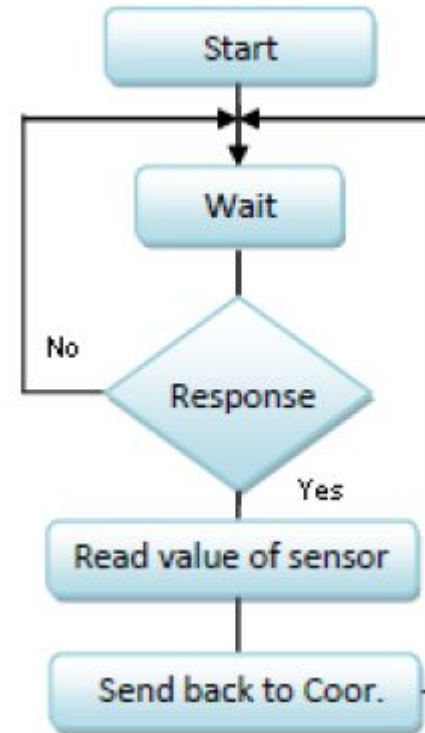
End Devices

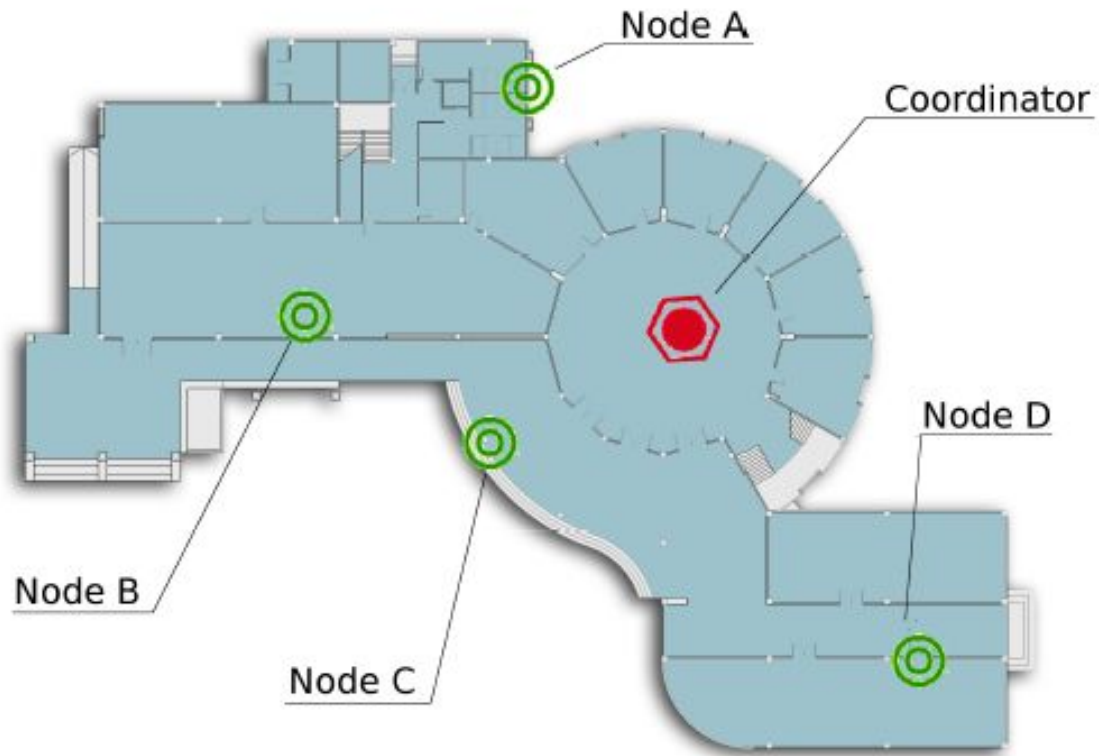
- 1 ou mais sensores de temperatura
- Aguarda requisição do *Coordinator*
- Envia os dados de temperatura

< Coordinator >



< End Device >







XBee WSNs for Temperature Monitoring - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://192.168.1.202> Go Links McAfee

Back Forward Stop Reload Home Search Favorites

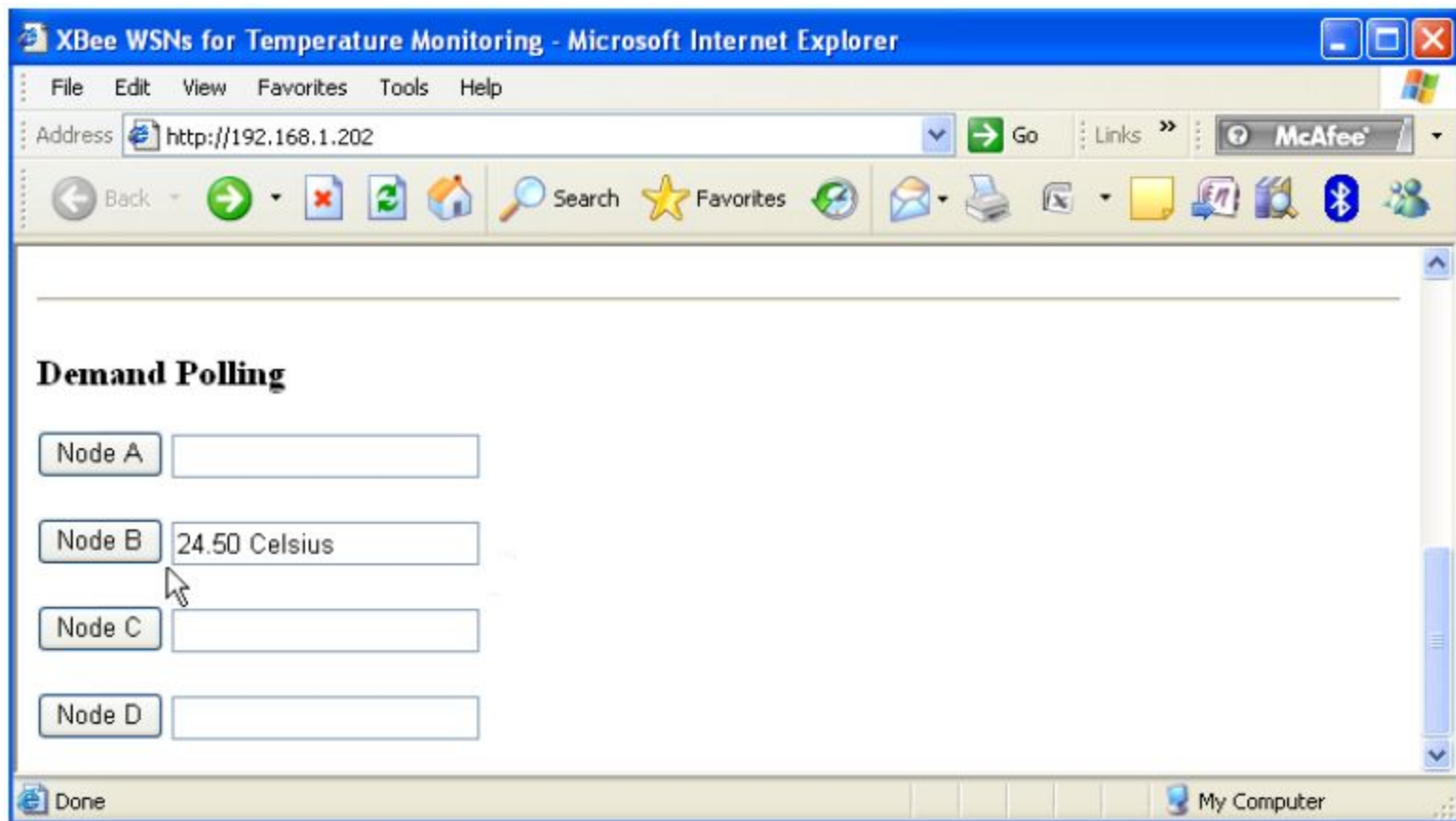
XBee WSNs for Temperature Monitoring

Sensors Name	Time	Address	Voltage Sampling	Temperature	Delay
Node A	15:00	40485a71	627	28.50 Celsius	314 ms
Node B	15:00	40485a76	619	24.50 Celsius	305 ms
Node C	15:00	40485a77	630	30.00 Celsius	297 ms
Node D	15:00	40485a78	622	26.00 Celsius	321 ms

MySQL : OK @192.168.1.2

Refresh Every : Hour

Done My Computer



phpMyAdmin 3.2.5 - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://192.168.1.2 Go Links

Back Search Favorites

phpMyAdmin

Database

http

Node(5)

XBEE

+ Options

			Time	Node_A	Node_B	Node_C	Node_D
<input type="checkbox"/>			08.00	26.50	26.50	27.50	26.00
<input type="checkbox"/>			09.00	27.25	26.75	29.25	27.00
<input type="checkbox"/>			08.00	26.50	26.50	27.50	26.00
<input type="checkbox"/>			09.00	27.25	26.75	29.25	27.00
<input type="checkbox"/>			10.00	27.00	25.25	33.00	26.00
<input type="checkbox"/>			11.00	27.00	25.00	34.50	27.00
<input type="checkbox"/>			12.00	27.50	25.50	34.25	27.25
<input type="checkbox"/>			13.00	28.00	25.50	34.50	28.50
<input type="checkbox"/>			14.00	28.50	24.50	32.50	27.50
<input type="checkbox"/>			15.00	28.00	24.25	30.00	26.00
<input type="checkbox"/>			16.00	27.50	26.25	30.25	26.50

Check All / Uncheck All With selected:

Internet

Comandos Xbee Pro 2.5

Comandos Especiais

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
WR	Write. Write parameter values to non-volatile memory so that parameter modifications persist through subsequent resets. Note: Once WR is issued, no additional characters should be sent to the module until after the "OK\r" response is received. The WR command should be used sparingly. The EM250 supports a limited number of write cycles."	CRE	--	--
WB	Write Binding Table: Writes the current binding table to non-volatile memory.	CRE	--	--
RE	Restore Defaults. Restore module parameters to factory defaults. RE command does not reset the ID parameter.	CRE	--	--
FR	Software Reset. Reset module. Responds immediately with an "OK" then performs a reset ~2 seconds later. Use of the FR command will cause a network layer restart on the node if SC or ID were modified since the last reset.	CRE	--	--
NR	Network Reset. Reset network layer parameters on one or more modules within a PAN. Responds immediately with an "OK" then causes a network restart. All network configuration and routing information is consequently lost. <i>If NR = 0:</i> Resets network layer parameters on the node issuing the command. <i>If NR = 1:</i> Sends broadcast transmission to reset network layer parameters on all nodes in the PAN.	CRE	0 - 1	--

Node types that support the command: C = Coordinator, R = Router, E = End Device

Comandos de Endereçamento

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
DH ²	Destination Address High. Set/Get the upper 32 bits of the 64-bit destination address. When combined with DL, it defines the destination address used for transmission. 0x000000000000FFFF is the broadcast address for the PAN. DH is not supported in API Mode. 0x0000000000000000 is the Coordinator's 16-bit network address.	CRE	0 - 0xFFFFFFFF	0
DL ²	Destination Address Low. Set/Get the lower 32 bits of the 64-bit destination address. When combined with DH, DL defines the destination address used for transmission. 0x000000000000FFFF is the broadcast address for the PAN. DL is not supported in API Mode. 0x0000000000000000 is the Coordinator's 16-bit network address.	CRE	0 - 0xFFFFFFFF	0xFFFF(Coordinator) 0 (Router/End Device)
MY	16-bit Network Address. Get the 16-bit network address of the module.	CRE	0 - 0xFFFE [read-only]	0xFFFE
MP	16-bit Parent Network Address. Get the 16-bit parent network address of the module.	E	0 - 0xFFFE [read-only]	0xFFFE
NC	Number of Children. Read the number of end device children that have joined to the device. This command returns the number of child table entries currently in use.	CR	0 - 8	read-only
SH	Serial Number High. Read high 32 bits of the RF module's unique IEEE 64-bit address. 64-bit source address is always enabled.	CRE	0 - 0xFFFFFFFF [read-only]	factory-set
SL	Serial Number Low. Read low 32 bits of the RF module's unique IEEE 64-bit address. 64-bit source address is always enabled.	CRE	0 - 0xFFFFFFFF [read-only]	factory-set
NI	Node Identifier. Stores a string identifier. The register only accepts printable ASCII data. In AT Command Mode, a string can not start with a space. A carriage return ends the command. Command will automatically end when maximum bytes for the string have been entered. This string is returned as part of the ND (Node Discover) command. This identifier is also used with the DN (Destination Node) command.	CRE	20-Byte printable ASCII string	ASCII space character (0x20)
DD	Device Type Identifier. Stores a device type value. This value can be used to differentiate multiple XBee-based products.	CRE	0 - 0xFFFFFFFF [read-only]	0x20000
ZA ²	ZigBee Application Layer Addressing. Set/read the Zigbee application layer addressing enabled attribute. If enabled, data packets will use the SE, DE, and CI commands to address Zigbee application layer source and destination endpoints, and the cluster ID fields in all data transmissions. ZA is only supported in the AT firmware.	CRE	0 - 1	0
SE ²	Source Endpoint. Set/read the ZigBee application layer source endpoint value. If ZigBee application layer addressing is enabled (ZA command), this value will be used as the source endpoint for all data transmissions. SE is only supported in AT firmware. The default value 0xE8 (Data endpoint) is the Digi data endpoint	CRE	1 - 0xEF	0xE8

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
DE ²	Destination Endpoint. Set/read Zigbee application layer destination ID value. If ZigBee application layer addressing is enabled (ZA command), this value will be used as the destination endpoint all data transmissions. DE is only supported in AT firmware. The default value (0xE8) is the Digi data endpoint.	CRE	0 - 0xEF	1 - 0xEF
CI ²	Cluster Identifier. Set/read Zigbee application layer cluster ID value. If ZigBee application layer addressing is enabled (ZA command), this value will be used as the cluster ID for all data transmissions. CI is only supported in AT firmware. The default value 0x11 (Transparent data cluster ID).	CRE	0 - 0xFF	0x11
BI ²	Binding Table Index. Set/read the binding table index value. If this value is set to a valid binding table index, the addressing information at that index in the binding table will be used for all data transmissions. BI is only supported in AT firmware	CRE	0 - 0xFF	0xFF

Rede

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
CH	Operating Channel. Read the channel number used for transmitting and receiving between RF modules. Uses 802.15.4 channel numbers. A value of 0 means the device has not joined a PAN and is not operating on any channel.	CRE	0, 0x0B-0x1A (XBee) 0, 0x0C – 0x18 (XBee-PRO)	[read-only]
ID	PAN ID. Set/Get the PAN (Personal Area Network) ID. Coordinator - Set the preferred Pan ID. Set ID = 0xFFFF to auto-select. Router / End Device - Set the desired Pan ID. When the device searches for a Coordinator, it attempts to only join to a parent that has a matching Pan ID. Set ID = 0xFFFF to join a parent operating on any Pan ID. Changes to ID should be written to non-volatile memory using the WR command.	CRE	0 - 0x3FFF, 0xFFFF	0x0234 (291d)
BH	Broadcast Hops. Set/Read the maximum number of hops for each broadcast data transmission. Setting this to 0 will use the maximum number of hops.	CRE	0 - 0x20	0
OP	Operating PAN ID. Read the PAN (Personal Area Network) ID. The OP value reflects the operating PAN ID that the module is running on. If ID < 0xFFFF, OP will equal ID.	CRE	0 - 0x3FFF	[read-only]
NT	Node Discover Timeout. Set/Read the amount of time a node will spend discovering other nodes when ND or DN is issued.	CRE	0x20 - 0xFF [x 100 msec]	0x3C (60d)
NO	Network Discovery options. Set/Read the options value for the network discovery command. The options bitfield value can change the behavior of the ND (network discovery) command and/or change what optional values are returned in any received ND responses or API node identification frames. Options include: 0x01 = Append DD value (to ND responses or API node identification frames) 002 = Local device sends ND response frame when ND is issued.	CRE	0 - 0x03 [bitfield]	0
ND	Node Discover. Discovers and reports all RF modules found. The following information is reported for each module discovered. MY<CR> SH<CR> SL<CR> NI<CR> (Variable length) PARENT_NETWORK ADDRESS (2 Bytes)<CR> DEVICE_TYPE<CR> (1 Byte: 0=Coord, 1=Router, 2=End Device) STATUS<CR> (1 Byte: Reserved) PROFILE_ID<CR> (2 Bytes) MANUFACTURER_ID<CR> (2 Bytes) <CR> After (NT * 100) milliseconds, the command ends by returning a <CR>. ND also accepts a Node Identifier (NI) as a parameter (optional). In this case, only a module that matches the supplied identifier will respond. If ND is sent through the API, each response is returned as a separate AT_CMD_Response packet. The data consists of the above listed bytes without the carriage return delimiters. The NI string will end in a "0x00" null character. The radius of the ND command is set by the BH command.	CRE	optional 20-Byte NI or MY value	--

AT Command	Name and Description	Node Type ¹	Parameter Range	Default																
DN	<p>Destination Node. Resolves an NI (Node Identifier) string to a physical address (case-sensitive). The following events occur after the destination node is discovered:</p> <p><AT Firmware></p> <ol style="list-style-type: none">1. DL & DH are set to the extended (64-bit) address of the module with the matching NI (Node Identifier) string.2. OK (or ERROR)\r is returned.3. Command Mode is exited to allow immediate communication <p><API Firmware></p> <ol style="list-style-type: none">1. The 16-bit network and 64-bit extended addresses are returned in an API Command Response frame. <p>If there is no response from a module within (NT * 100) milliseconds or a parameter is not specified (left blank), the command is terminated and an "ERROR" message is returned. In the case of an ERROR, Command Mode is not exited. The radius of the DN command is set by the BH command.</p>	CRE	up to 20-Byte printable ASCII string	-																
SC	<p>Scan Channels. Set/Read the list of channels to scan.</p> <p>Coordinator - Bit field list of channels to choose from prior to starting network.</p> <p>Router/End Device - Bit field list of channels that will be scanned to find a Coordinator/Router to join.</p> <p>Changes to SC should be written using WR command.</p> <p>Bit (Channel):</p> <table><tr><td>0 (0x0B)</td><td>4 (0x0F)</td><td>8 (0x13)</td><td>12 (0x17)</td></tr><tr><td>1 (0x0C)</td><td>5 (0x10)</td><td>9 (0x14)</td><td>13 (0x18)</td></tr><tr><td>2 (0x0D)</td><td>6 (0x11)</td><td>10 (0x15)</td><td>14 (0x19)</td></tr><tr><td>3 (0x0E)</td><td>7 (0x12)</td><td>11 (0x16)</td><td>15 (0x1A)</td></tr></table> <p>Note: Setting SC to include more than 12 continuous channels could cause data to be received on incorrect frequencies due to crosstalk issues with the EM250 at certain power levels. See Appendix E for details.</p> <p>Changing SC may result in not being able to communicate with long-range '-PRO' modules from Digi</p>	0 (0x0B)	4 (0x0F)	8 (0x13)	12 (0x17)	1 (0x0C)	5 (0x10)	9 (0x14)	13 (0x18)	2 (0x0D)	6 (0x11)	10 (0x15)	14 (0x19)	3 (0x0E)	7 (0x12)	11 (0x16)	15 (0x1A)	CRE	<p>XBee 1 - 0xFFFF [bitfield]</p> <p>XBee-PRO 2 - 0x3FFE [bitfield] (bits 0, 14, 15 not allowed)</p>	0x1FFE
0 (0x0B)	4 (0x0F)	8 (0x13)	12 (0x17)																	
1 (0x0C)	5 (0x10)	9 (0x14)	13 (0x18)																	
2 (0x0D)	6 (0x11)	10 (0x15)	14 (0x19)																	
3 (0x0E)	7 (0x12)	11 (0x16)	15 (0x1A)																	

SD	<p>Scan Duration. Set/Read the scan duration exponent. Changes to SD should be written using WR command.</p> <p>Coordinator - Duration of the Active and Energy Scans (on each channel) that are used to determine an acceptable channel and Pan ID for the Coordinator to startup on.</p> <p>Router / End Device - Duration of Active Scan (on each channel) used to locate an available Coordinator / Router to join during Association.</p> <p>Scan Time is measured as: (# Channels to Scan) * (2 ^ SD) * 15.36ms - The number of channels to scan is determined by the SC parameter. The XBee can scan up to 16 channels (SC = 0xFFFF).</p> <p>Sample Scan Duration times (13 channel scan):</p> <p>If SD = 0, time = 0.200 sec</p> <p>SD = 2, time = 0.799 sec</p> <p>SD = 4, time = 3.190 sec</p> <p>SD = 6, time = 12.780 sec</p>	CRE	0 - 7 [exponent]	3
NJ	<p>Node Join Time. Set/Read the time that a Coordinator/Router allows nodes to join. This value can be changed at run time without requiring a Coordinator or Router to restart. The time starts once the Coordinator or Router has started. The timer is reset on power-cycle or when NJ changes.</p>	CR	0 - 0x40, 0xFF [x 1 sec]	0xFF (always allows joining)
JV	<p>Channel Verification. Set/Read the channel verification parameter. If JV=1, and the network is an open network (NJ=0xFF), a router will verify the coordinator is on its operating channel when joining or coming up from a power cycle. If a coordinator is not detected, the router will leave its current channel and attempt to join a new PAN. If JV=0, the router will continue operating on its current channel even if a coordinator is not detected.</p>	R	<p>0 - Channel verification disabled</p> <p>1 - Channel verification enabled</p>	0
AR	<p>Aggregate Routing Notification. Set/read time between consecutive aggregate route broadcast messages. If used, AR should be set on only one device to enable many-to-one routing to the device. Setting AR to 0 only sends one broadcast</p>	CR	0 - 0xFF	0xFF
AI	<p>Association Indication. Read information regarding last node join request:</p> <p>0x00 - Successful completion - Coordinator started or Router/End Device found and joined with a parent.</p> <p>0x21 - Scan found no PANs</p> <p>0x22 - Scan found no valid PANs based on current SC and ID settings</p> <p>0x23 - Valid Coordinator or Routers found, but they are not allowing joining (NJ expired)</p> <p>0x27 - Node Joining attempt failed (typically due to incompatible security settings)</p> <p>0x2A - Coordinator Start attempt failed</p> <p>0xFF - Scanning for a Parent</p> <p>0x2B - Checking for an existing coordinator</p>	CRE	0 - 0xFF [read-only]	--

Segurança

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
EE	Encryption Enable. Set/Read the encryption enable setting.	CRE	0 - Encryption disabled 1 - Encryption enabled	0
EO	Encryption Options. Configure options for encryption. Unused option bits should be set to 0. Options include: 0x01 - Send the security key unsecured over-the-air during joins 0x02 - Use trust center	CRE	0 - 0xFF	
KY	Encryption Key. Set the 128-bit AES encryption key. This command is read-only; KY cannot be read.	CRE	0 - 0xFFFFFFFFFFFFFFFF	0

Interface RF

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
PL	Power Level. Select/Read the power level at which the RF module transmits conducted power.	CRE	XBee (boost mode disabled) 0 = -8 dBm 1 = -4 dBm 2 = -2 dBm 3 = 0 dBm 4 = +2 dBm XBee-PRO 4 = 18 dBm XBee-PRO (International Variant) 4 = 10dBm	4
PM	Power Mode. Set/read the power mode of the device. Enabling boost mode will improve the receive sensitivity by 1dB and increase the transmit power by 2dB Note: Enabling boost mode on the XBee-PRO will not affect the output power. Boost mode imposes a slight increase in current draw. See section 1.2 for details.	CRE	0-1, 0= Boost mode disabled, 1= Boost mode enabled.	1
DB	Received Signal Strength. This command reports the received signal strength of the last received RF data packet. The DB command only indicates the signal strength of the last hop. It does not provide an accurate quality measurement for a multihop link. DB can be set to 0 to clear it.			

Interface Serial (I/O)

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
AP ²	API Enable. Enable API Mode. The AP parameter is only applicable when using modules that contain the following firmware versions: 1.1xx (coordinator), 1.3xx (router/end device)	CRE	1 - 2 1 = API-enabled 2 = API-enabled (w/escaped control characters)	1
AO ²	API Options. Configure options for API. Current options select the type of receive API frame to send out the Uart for received RF data packets.	CRE	0 - Default receive API indicators enabled 1 - Explicit Rx data indicator API frame enabled (0x91)	0
BD	Interface Data Rate. Set/Read the serial interface data rate for communication between the module serial port and host. Any value above 0x07 will be interpreted as an actual baud rate. When a value above 0x07 is sent, the closest interface data rate represented by the number is stored in the BD register.	CRE	0 - 7 (standard baud rates) 0 = 1200 bps 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 38400 6 = 57600 7 = 115200 0x80 - 0x38400 (non-standard rates)	3

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
NB	Serial Parity. Set/Read the serial parity setting on the module.	CRE	0 = No parity 1 = Even parity 2 = Odd parity 3 = Mark parity	0
RO	Packetization Timeout. Set/Read number of character times of inter-character silence required before packetization. Set (RO=0) to transmit characters as they arrive instead of buffering them into one RF packet.	CRE	0 - 0xFF [x character times]	3
D7	DIO7 Configuration. Select/Read options for the DIO7 line of the RF module.	CRE	0 = Disabled 1 = CTS Flow Control 3 = Digital input 4 = Digital output, low 5 = Digital output, high 6 = RS-485 transmit enable (low enable) 7 = RS-485 transmit enable (high enable)	1
D6	DIO6 Configuration. Configure options for the DIO6 line of the RF module.	CRE	0 - Disabled 1 - RTS Flow Control	0

P1	DIO11 Configuration. Configure options for the DIO11 line of the RF module.	CRE	0 - Unmonitored digital input 3- Digital input, monitored 4- Digital output, default low 5- Digital output, default high	0
P2	DIO12 Configuration. Configure options for the DIO12 line of the RF module.	CRE	0 - Unmonitored digital input 3- Digital input, monitored 4- Digital output, default low 5- Digital output, default high	0

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
P3	DIO13 Configuration. Set/Read function for DIO13. This command is not yet supported.	CRE	0, 3-5 0 – Disabled 3 – Digital input 4 – Digital output, low 5 – Digital output, high	
D0	AD0/DIO0 Configuration. Select/Read function for AD0/DIO0.	CRE	0-5 0 – Disabled 1 - Node identification button enabled 2 - Analog input, single ended 3 – Digital input 4 – Digital output, low 5 – Digital output, high	1
D1	AD1/DIO1 Configuration. Select/Read function for AD1/DIO1.	CRE	0, 2-5 0 – Disabled 2 - Analog input, single ended 3 – Digital input 4 – Digital output, low 5 – Digital output, high	0
D2	AD2/DIO2 Configuration. Select/Read function for AD2/DIO2.	CRE	0, 2-5 0 – Disabled 2 - Analog input, single ended 3 – Digital input 4 – Digital output, low 5 – Digital output, high	0

D3	AD3/DIO3 Configuration. Select/Read function for AD3/DIO3.	CRE	0, 2-5 0 – Disabled 2 – Analog input, single ended 3 – Digital input 4 – Digital output, low 5 – Digital output, high	0
D4	DIO4 Configuration. Select/Read function for DIO4.	CRE	0, 3-5 0 – Disabled 3 – Digital input 4 – Digital output, low 5 – Digital output, high	0
D5	DIO5 Configuration. Configure options for the DIO5 line of the RF module.	CRE	0 = Disabled 1 = Associated indication LED 3 = Digital input 4 = Digital output, default low 5 = Digital output, default high	1
LT	Assoc LED Blink Time. Set/Read the Associate LED blink time. If the Associate LED functionality is enabled (D5 command), this value determines the on and off blink times for the LED when the module has joined a network. If LT=0, the default blink rate will be used (500ms coordinator, 250ms router/end device). For all other LT values, LT is measured in 10ms.	CRE	0x14 - 0xFF (200 - 2550 ms)	0
D8	DIO8 Configuration. Set/Read function for DIO8. This command is not yet supported.	CRE	0, 3-5 0 – Disabled 3 – Digital input 4 – Digital output, low 5 – Digital output, high	

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
PR	Set/read the bit field that configures the internal pull-up resistor status for the I/O lines. "1" specifies the pull-up resistor is enabled. "0" specifies no pullup.(30k pull-up resistors) Bits: 0 - DIO4 (Pin 11) 1 - AD3 / DIO3 (Pin 17) 2 - AD2 / DIO2 (Pin 18) 3 - AD1 / DIO1 (Pin 19) 4 - AD0 / DIO0 (Pin 20) 5 - RTS / DIO6 (Pin 16) 6 - DTR / Sleep Request / DIO8 (Pin 9) 7 - DIN / Config (Pin 3) 8 - Associate / DIO5 (Pin 15) 9 - On/Sleep / DIO9 (Pin 13) 10 - DIO12 (Pin 4) 11 - PWM0 / RSSI / DIO10 (Pin 6) 12 - PWM1 / DIO11 (Pin 7)	CRE	0 - 0x1FFF	0 - 0x1FFF
RP	RSSI PWM Timer. Time RSSI signal will be output after last transmission. When RP = 0xFF, output will always be on.	CRE	0 - 0xFF [x 100 ms]	0x28 (40d)
CB	Commissioning Pushbutton. This command can be used to simulate commissioning button presses in software. The parameter value should be set to the number of button presses to be simulated. For example, sending the ATCB1 command will execute the action associated with 1 commissioning button press. (See D0 command).	CRE		

Comandos de Diagnóstico

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
VR	Firmware Version. Read firmware version of the module.	CRE	0 - 0xFFFF [read-only]	Factory-set
HV	Hardware Version. Read hardware version of the module.	CRE	0 - 0xFFFF [read-only]	Factory-set
%V	Supply Voltage. Reads the voltage on the Vcc pin. To convert the reading to a mV reading, divide the read value by 1023 and multiply by 1200. A %V reading of 0x8FE (2302 decimal) represents 2700mV or 2.70V.	CRE	-	-

Comandos opção AT

AT Command	Name and Description	Node Type ¹	Parameter Range	Default
CT ²	Command Mode Timeout. Set/Read the period of inactivity (no valid commands received) after which the RF module automatically exits AT Command Mode and returns to Idle Mode.	CRE	2 - 0x028F [x 100 ms]	0x64 (100d)
CN ²	Exit Command Mode. Explicitly exit the module from AT Command Mode.	CRE	--	--
GT ²	Guard Times. Set required period of silence before and after the Command Sequence Characters of the AT Command Mode Sequence (GT + CC + GT). The period of silence is used to prevent inadvertent entrance into AT Command Mode.	CRE	1 - 0x0CE4 [x 1 ms] (max of 3.3 decimal sec)	0x3E8 (1000d)
CC ²	Command Sequence Character. Set/Read the ASCII character value to be used between Guard Times of the AT Command Mode Sequence (GT + CC + GT). The AT Command Mode Sequence enters the RF module into AT Command Mode. CC command is only applicable when using modules that contain the following "AT Command" firmware versions: 8.0xx (Coordinator), 8.2xx (Router), 8.4xx (End Device)	CRE	0 - 0xFF	0x2B ('+' ASCII)

Comandos Sleep

AT Command	Name and Description	Node Type [†]	Parameter Range	Default
SM	Sleep Mode Sets the sleep mode on the RF module	RE	0-Sleep disabled 1-Pin sleep enabled 4-Cyclic sleep enabled Note: When SM=0, the device operates as a router. When SM changes to a non-zero value, the router leaves the network and rejoins as an end device. Only end devices can sleep	0
SN	Number of Sleep Periods. Sets the number of sleep periods to not assert the On/Sleep pin on wakeup if no RF data is waiting for the end device. This command allows a host application to sleep for an extended time if no RF data is present	RE	1 - 0xFFFF	1
SP	Sleep Period. This value determines how long the end device will sleep at a time, up to 28 seconds. (The sleep time can effectively be extended past 28 seconds using the SN command.) On the parent, this value determines how long the parent will buffer a message for the sleeping end device. It should be set at least equal to the longest SP time of any child end device.	CRE	0x20 - 0xAF0 x 10ms (Quarter second resolution)	0x20
ST	Time Before Sleep Sets the time before sleep timer on an end device. The timer is reset each time serial or RF data is received. Once the timer expires, an end device may enter low power operation. Applicable for cyclic sleep end devices only.	RE	1 - 0xFFFFE (x 1ms)	0x1388 (5 seconds)
SO Command	Sleep Options. Configure options for sleep. Unused option bits should be set to 0. Sleep options include: 0x02 - Always wake for ST time 0x04 - Sleep entire SN * SP time Sleep options should not be used for most applications. See Sleep Mode chapter for more information.	E	0 - 0xFF	0

Outras Ferramentas

- [XCTU](#)
- [API Xbee C](#)
- [XBee SDK Documentation](#)
- [Python Xbee](#)
- [Xbee-api C++](#)

```
// Create an XBee object at the top of your sketch
XBee xbee = XBee();

// Start the serial port
Serial.begin(9600);

// Tell XBee to use Hardware Serial. It's also possible to use SoftwareSerial
xbee.setSerial(Serial);

// Create an array for holding the data you want to send.
uint8_t payload[] = { 'H', 'i' };

// Specify the address of the remote XBee (this is the SH + SL)
XBeeAddress64 addr64 = XBeeAddress64(0x0013a200, 0x403e0f30);

// Create a TX Request
ZBTxRequest zbTx = ZBTxRequest(addr64, payload, sizeof(payload));

// Send your request
xbee.send(zbTx);
```



Radio Modules



Name: RT1-R2D2
Function: ZigBee Router API
Port: COM1 - 9600/8/N/1/H - AP11
MAC: 0013A20040A198CD

4 remote modules


Name: CO-YODA
Function: ZigBee Coordinator API
MAC: 0013A20040A9E78B

Name: RT1-WINDU
Function: ZigBee Router API
MAC: 0013A20040A9527D

Name: RT2-OB1-WAN
Function: ZigBee Router API
MAC: 0013A20040A9E883

Name: RT4-LUKE
Function: ZigBee Router API
MAC: 0013A20040A9E756

Name: BAYMAX
Function: XBee DigiMesh 2.4
Port: COM6 - 9600/8/N/1/H - AT
MAC: 0013A20040D2B039


Radio Configuration [RT1-R2D2 - 0013A20040A198CD]



Read



Write



Default



Update



Profile



Parameter



Product family: XBP24BZ7

Function set: ZigBee Router API

Firmware version: 23A7

▼ Networking

Change networking settings

i	ID PAN ID	C3B0	
i	SC Scan Channels	7FFF	Bitfield
i	SD Scan Duration	3	exponent
i	ZS ZigBee Stack Profile	0	
i	NJ Node Join Time	FF	x 1 sec
i	NW Network Watchdog Timeout	0	x 1 minute
i	JV Channel Verification	Enabled [1]	
i	JN Join Notification	Disabled [0]	
i	OP Operating PAN ID	C3B0	
i	OI Operating 16-bit PAN ID	5EE9	
i	CH Operating Channel	F	
i	NC Number of Re...ing Children	C	

▼ Addressing

Change addressing settings

i	SH Serial Number High	13A200	
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Referências

[XBee Wireless Sensor Networks for Temperature Monitoring](#)

[XBee-2.5-Manual](#)

<https://www.digi.com/>

[xbec-arduino](#)