

RXQ3 Smart Transceiver

Reference Manual

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1 OVERVIEW

This manual describes the operation of the RXQ3 Smart Transceiver.

The module has been designed with the purpose of providing an easy access to radio communications while giving maximum flexibility in the choice of the operating parameters which characterize the RF signal and the packet structure.

To start transmitting data in RF, send a block of bytes at 19200 bps on the RXDATA module pin and your data will be almost immediately "on the air". Any received packet is automatically replicated on the TXDATA module pin.

As your understanding of RF communications increases, you can start to be interested in changing some settings: RF transmission power, channel number, packet length, source or destination address, and so on. In this case, by the simple sequence of characters +++ (called the "escape sequence") you can switch the module from *Data Mode* to *Command Mode* and start exploring different settings of the operating parameters (S-registers) by using the standard AT commands.

After replicating a similar configuration on the remote transceiver, with the ATO command the module exits *Command Mode* to return back to *Data Mode*, and the module is then again ready for new RF communications.

2 TECHNICAL SPECIFICATIONS

This chapter lists the specifications of the RXQ3 Smart Transceiver. It includes:

- electrical characteristics (2.1)
- mechanical specifications (2.2)
- pin description (2.2)

2.1 Electrical characteristics

Under no circumstances must the absolute maximum ratings given in Table 2-1 be violated. Stress exceeding one or more of the limiting values may cause permanent damage to the device.

Table 2-1 Absolute maximum ratings

Parameter	Min	Max	Unit	Notes
Supply voltage (VDD)	-0.3	3.9	V	All supply pins must have the same voltage
Voltage on any digital pin	-0.3	VDD + 0.3 max 3.9	V	
Voltage ramp-up rate		120	kV/ μ s	
Input RF level		10	dBm	
Storage temperature range	-50	150	$^{\circ}$ C	Device not programmed



Caution! ESD sensitive device.

Precaution should be used when handling the device in order to prevent permanent damage.

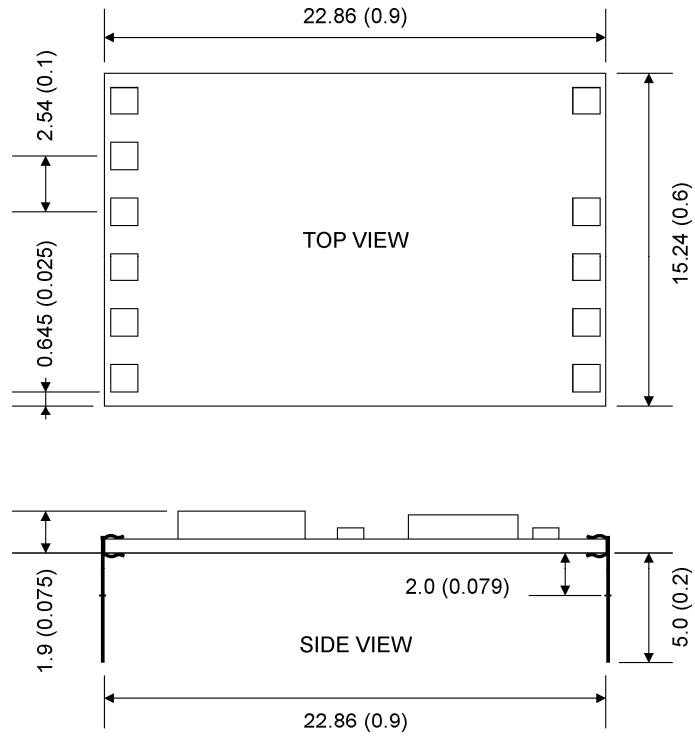
Table 2-2 Operating conditions

Parameter	Min	Typical	Max	Unit	Notes
Operating ambient temperature, T_A	-40		85	°C	
Operating supply voltage (VDD)	2.0		3.6	V	All supply pins must have the same voltage
Timing from SLEEP_REQ low-to-high transition to <i>Sleep Mode</i>		3	5	µs	The module is not transmitting nor receiving data
Timing from SLEEP_REQ high-to-low transition to <i>Data Mode</i>		61		µs	

Table 2-3 DC characteristics

Parameter	Min	Typical	Max	Unit	Notes
Logic "0" input voltage			30	%	Percent of VDD supply (2.0 - 3.6 V)
Logic "1" input voltage	70			%	Percent of VDD supply (2.0 - 3.6 V)
Receive current		20.5		mA	VDD = 3.0 V, 25 °C, 433 MHz
Transmit current		33.5		mA	VDD = 3.0 V, 25 °C, 433 MHz, +10 dBm
		20		mA	VDD = 3.0 V, 25 °C, 433 MHz, 0 dBm
<i>Sleep Mode</i> current		0.7	1.5	µA	VDD = 3.0 V, 25 °C

2.2 Mechanical specifications



All Dimensions in mm (inches)

2.3 Pin description

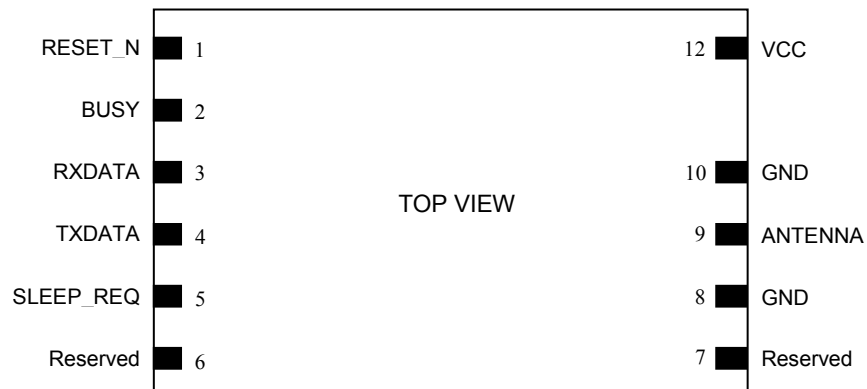


Table 2-4 Pin description

Pin No.	Pin Name	Pin Type	Description
1	RESET_N	Digital Input	Reset, active low
2	BUSY	Digital Output	During transmission of data or when the transceiver is in <i>Sleep Mode</i> , BUSY signal is set to logical level '1'. While BUSY is high, any character received from DTE on RXDATA pin is ignored.
3	RXDATA	Digital Input	Received data from DTE
4	TXDATA	Digital Output	Transmitted data to DTE
5	SLEEP_REQ	Digital Input	In <i>Data Mode</i> , a logical level '1' sets the transceiver in <i>Sleep Mode</i> . In <i>Command Mode</i> , SLEEP_REQ is ignored. SLEEP_REQ should be low minimum 500 µsec before a transition to a high level. This pin must be connected to ground if not used.
6	Reserved	-	Leave unconnected
7	Reserved	-	Leave unconnected
8	GND	Ground	Must be connected to ground
9	ANTENNA	RF Input/Output	Antenna connection
10	GND	Ground	Must be connected to ground
11	-	-	-
12	VDD	Power	Power supply

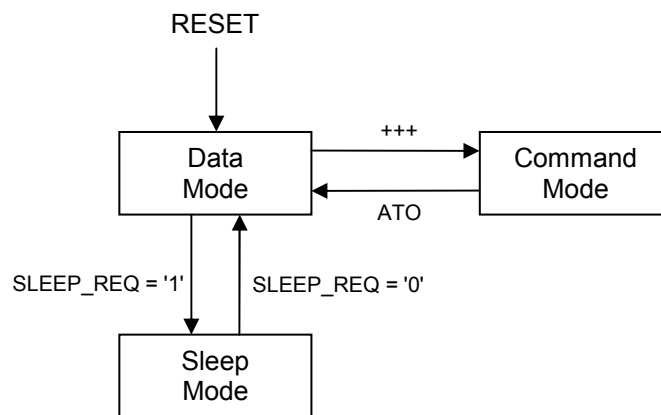
3 MODULE OPERATION

This chapter provides a brief technical description of the main software components of the RXQ3 module. It includes:

- preliminary overview (3.1)
- *Data Mode* (3.2)
- *Command Mode* (3.3)
- *Sleep Mode* (3.4)

3.1 Preliminary overview

RXQ3 module operates in one of three operating modes:



After a hardware reset, the module enters *Data Mode* and remains in this state until an escape sequence +++ is received from DTE (for example a microcontroller) on RXDATA pin or SLEEP_REQ pin is set to logical level '1'.

3.2 Data Mode

In *Data Mode*, any data transmitted from DTE to the module is organized in packets, modulated and then transmitted to the remote transceiver; similarly, any data received from another transceiver is demodulated and sent to DTE.

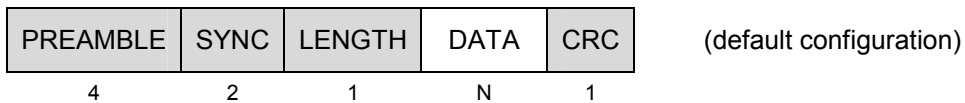
A half-duplex RF communication link is maintained between the local DTE and one or more remote transceivers. The link is configured on the basis of parameters stored in S-Registers:

- radio configuration: S100-103
- address configuration: S110-112
- packet configuration: S120-124

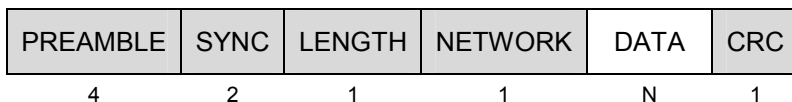
All data received through the RXDATA pin is queued for RF transmission. If the number of characters received from DTE reaches the number specified by S120 (*Maximum packet data length*), or a time interval longer than the threshold fixed by S121 (*Wait time before automatic RF transmission*) has occurred, buffered data is assembled in a packet and transmitted in RF. If a timeout occurs before maximum packet data length has been reached, only buffered characters are transmitted; the packet in this case may be of length less than the value specified in the S120 (*Maximum packet data length*) register.

While the module is transmitting the packet, BUSY pin is set to logical level '1' and any character received from DTE on RXDATA is ignored. After the packet has been transmitted, the buffer is cleared and BUSY pin is set to logical level '0'.

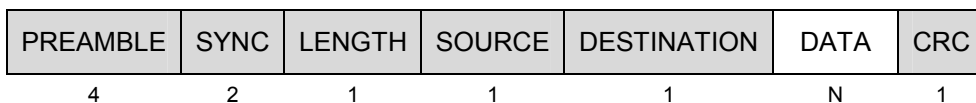
The effective format of packets transmitted in RF depends on the values of S122 (*Address check*) and S123 (*Network check*) registers:



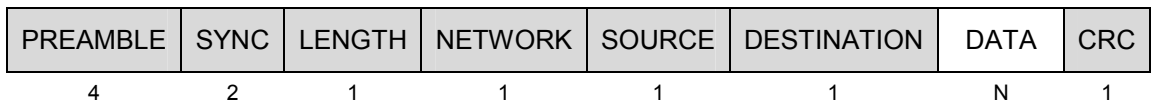
Address check disabled (S122 = 0), network check disabled (S123 = 0).



Address check disabled (S122 = 0), network check enabled (S123 = 1).



Address check enabled (S122 = 1 or 2), network check disabled (S123 = 0).



Address check enabled (S122 = 1 or 2), network check enabled (S123 = 1).

Fields in grey are automatically inserted when the packet is transmitted and removed when the packet is received. If address check is enabled (S122 = 1 or 2), SOURCE field is filled with S110 (*RF source address*) content.

When the buffer of data received from DTE is empty and the module is not transmitting data in RF, any packet received from a remote transmitter is sent out the TXDATA pin to DTE.

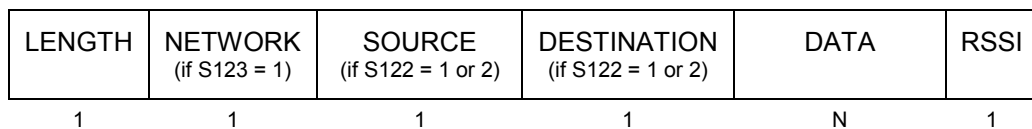
If network check is enabled (S123 = 1), only packets with NETWORK field equal to S112 (*Network identifier*) are forwarded to DTE, otherwise the packet is discarded.

If address check is enabled (S122 = 0), only packets with DESTINATION field equal to S110 (*RF Source address*) are forwarded to DTE, otherwise the packet is discarded.

Depending on the value of the S124 register (*Format of packets sent to DTE*), the received packet is forwarded to DTE in one of two formats:



Only payload data (S124 = 0).



Extended format (S124 = 1).

3.3 Command Mode

The module enters *Command Mode* upon the receipt of the escape sequence consisting of three consecutive characters matching the contents of S2 (*Escape character*). Default character is '+'.
A pause, the length of which is set by S12 (*Escape guard time*), must be used before and after an escape sequence is issued. This pause prevents the modem from interpreting the escape sequence as data.

After the escape sequence has been recognized, the module sends the OK response out the TXDATA pin. From that moment, the module is in *Command Mode* and any characters received on the RXDATA pin are interpreted as commands for the module to execute.

AT commands are issued to the module to control the module's operation and software configuration, and can only be entered while the module is in *Command Mode*.

A command line always starts with the 'AT' prefix and terminates with the character defined by S3 (*Carriage Return character*).

A command line always starts with the 'AT' prefix and terminates with the character defined by S3 (*Carriage Return character*).

Upon receiving the ATO (Return to *Data Mode*) command, the module responds with the OK message and returns to *Data Mode*.

3.4 *Sleep Mode*

In *Sleep Mode* the module is in a state of low-power consumption.

To enter *Sleep Mode* from *Data Mode*, all of the following conditions must be met:

- the module is not transmitting data
- no packets have been received from remote transceivers
- DTE has asserted SLEEP_REQ pin

When going in *Sleep Mode*, BUSY pin is asserted and any characters received on RXDATA pin is ignored.

When SLEEP_REQ is cleared from DTE, the module clears the BUSY pin and returns to *Data Mode*.

4 **AT COMMANDS SET**

This chapter describes the operation of the AT commands supported by the RXQ3 module. It includes:

- AT command guidelines (4.1)
- AT command set summary (4.2)
- Result codes summary (4.3)
- Basic AT commands (4.4)
- AT& commands (4.5)
- AT+ commands (4.6)

4.1 **AT command guidelines**

AT commands are issued to the RXQ3 module to control the module's operation and software configuration. AT commands can only be entered while the modem is in *Command Mode*.

A command consists of a prefix "AT" or "at", a body optionally followed by a parameter, and the termination character defined by the S3 register (*Carriage Return character*), default character being the ASCII character 13 (CR).

After processing a valid command the module responds with the OK message. For an invalid command or if the RXQ3 module receives more than 40 characters, an ERROR message is sent to DTE.

The module enters *Command Mode* upon the receipt of the escape sequence '+++*'* while in *Data Mode*. The escape character '+' may be changed by configuring the S2 register (*Escape character*).

The module returns back to *Data Mode* upon the receipt of the ATO command.

Example of command session, with some comments added on the right column:

```
the module is in data mode

+++ escape sequence (not displayed on DTE)

OK the module is now in command mode
AT&F0 restore factory defaults
OK command accepted
ATS101? reading current RF channel (S101 register)
000

OK
ats101=26 changing S101 from 0 to channel 26
OK
ATS101? reading current RF channel (S101 register)
026

OK
AT&W save configuration in flash memory
OK
ATO returning to data mode
```

4.2 AT command set summary

Tables 4-1, 4-2, and 4-3 presents a summary of the AT commands supported by the RXQ3 module.

Table 4-1 Basic AT commands

Command	Description	Factory default	Values
ATE	Command echo	1	0-1
ATF	On-line data character echo command	1	0-1
ATO	Return to <i>Data Mode</i>	-	-
ATQ	Quiet result codes control	0	0-1
ATV	Result code format	1	0-1
ATZ	Soft reset and restore	-	-

Table 4-2 AT& commands

Command	Description	Values
AT&F	Restore saved configuration	0-1
AT&T	Self-test command	1-3
AT&V	Display current configuration	-
AT&W	Store current configuration	-

Table 4-3 AT+ commands

Command	Description	Factory default	Values
AT+CLAC	List available AT commands	-	-
AT+GMI	Manufacturer identification	-	-
AT+GMM	Model identification	-	-
AT+GMR	Revision identification	-	-
AT+IPR	Serial link data rate	19200	9600 14400 19200 38400 57600

4.3 Result codes

The RXQ3 module responds to commands received from the DTE in the form of result codes. The result codes that the RXQ3 module can send to DTE are described in Table 4-4.

Result codes are available in one of two forms: alphabetic or numeric. The alphabetic (or "verbose") response is given when ATV1 is selected, the numeric response is given when V0 is selected.

If result messages are suppressed (ATQ1 command), nothing is returned to DTE.

Table 4-4 Result codes

Verbose	Numeric	Description
OK	0	Acknowledges the execution of a command line.
CONNECT	1	The module has moved from <i>Command Mode</i> to <i>Data Mode</i> .
ERROR	4	Invalid command.

4.4 Basic AT commands

4.4.1 ATE - Command echo

Syntax

ATE<value>

Description

Enables or disables echo of characters to the DTE while in *Command Mode*.

Defined Values

0	Disable command echo.
1	Enable command echo. (Factory default)

Result Codes

OK	If value = 0 or 1.
ERROR	Otherwise.

4.4.2 ATF - On-line data character echo command

Syntax

ATF<value>

Description

Enables or disables the echo of characters to the DTE while in *Data Mode*.

Defined Values

0	Enable on-line data character echo.
1	Disable on-line data character echo. (Factory default)

Result Codes

OK	If value = 0 or 1.
ERROR	Otherwise.

4.4.3 ATO - Return to *Data Mode*

Syntax

ATO

Description

Exit *Command Mode* and reenter *Data Mode*.

Result Code

CONNECT

4.4.4 ATQ - Quiet result codes control

Syntax

ATQ<value>

Description

Enables or disables the sending of result codes to the DTE.

Defined Values

- | | |
|---|---|
| 0 | Enable result codes to the DTE. (Factory default) |
| 1 | Disable result codes to the DTE. |

Result Codes

- | | |
|-------|--------------------|
| OK | If value = 0 or 1. |
| ERROR | Otherwise. |

4.4.5 ATV - Result code format

Syntax

ATV<value>

Description

Selects either verbose or numeric response codes

Defined Values

- | | |
|---|---|
| 0 | Display result codes as digits. |
| 1 | Display result codes as text. (Factory default) |

Result Codes

OK	If value = 1
0	If value = 0
ERROR	If value is not recognized and previous setting was V0
4	If value is not recognized and previous setting was V1

4.4.6 ATZ - Soft reset and restore**Syntax**

ATZ

Description

The transceiver performs a soft reset and restore last saved user profile or, if not yet available, the factory default configuration.

Result Code

OK

4.5 AT& commands**4.5.1 AT&F - Restore saved configuration****Syntax**

AT&F<value>

Description

Sets S-register values to factory defaults or to last saved configuration.

Defined Values

0	Resets S-registers to factory default values.
1	Set S-registers to last saved configuration.

Result Codes

OK	If value = 0 or 1.
ERROR	Otherwise.

4.5.2 AT&T - Self-test command

Syntax

AT&T<value>

Description

Performs diagnostic tests on the transceiver. Register S18 (*Test timeout*) content specifies the number of seconds the test is performed before returning back to *Command Mode*. If S18 = 0, the test is performed for ever. Except for the local digital loopback, the test may be also terminated by sending any character on RXDATA pin.

Defined Values

- | | |
|---|--|
| 1 | Local digital loopback. Any character received on RXDATA pin is sent back on TXDATA pin. |
| 2 | RSSI sampling. RSSI is continuously measured and sent to DTE as a dBm value. |
| 3 | Carrier. Transmission of a fixed carrier. |

Result Codes

- | | |
|---------|---------------------------|
| CONNECT | If value = 1, 2 or 3. |
| ERROR | Otherwise. |
| OK | When test has terminated. |

4.5.3 AT&V - Display current configuration

Syntax

AT&V

Description

Display the current transceiver configuration.

Result Code

- | | |
|----|---------------|
| OK | In all cases. |
|----|---------------|

Example

```
AT&V
E1 F1 Q0 V1
S002:043 S003:013 S004:010 S005:008 S012:250 S018:010
S100:002 S101:000 S102:001 S103:001
S110:000 S111:000 S112:038
S120:080 S121:200 S122:000 S123:000 S124:000
```

```
S200: -10 dBm
S201: 14 °C
S202: 3356 mV
```

```
OK
```

4.5.4 AT&W - Store current configuration

Syntax

```
AT&W
```

Description

Stores current configuration in flash memory. Minimum 1000 write/erase cycles are guaranteed to be successful.

Result Code

```
OK          In all cases.
```

4.6 AT+ commands

4.6.1 AT+CLAC - List available AT commands

Syntax

```
AT+CLAC
```

Description

Displays a list of all supported AT commands.

Result Codes

```
OK          In all cases.
```

Example

```
AT+CLAC
-----
Supported AT commands:
-----
ATE(0-1)
ATF(0-1)
ATO
ATQ(0-1)
ATS(2-5,12,18,100-103,110-112,120-124,200-202)
ATV(0-1)
ATZ
AT&T(1-3)
AT&V
AT&W
AT+CLAC
AT+GMI
```

```
AT+GMM
AT+GMR
AT+IPR(9600,14400,19200,38400,57600)
-----
OK
```

4.6.2 AT+GMI - Manufacturer identification

Syntax

```
AT+GMI
```

Description

Displays the manufacturer identification string.

Result Codes

OK In all cases.

Example

```
AT+GMI
www.telecontrolli.com
OK
```

4.6.3 AT+GMM - Model identification

Syntax

```
AT+GMM
```

Description

Displays the model identification string. Last three digits identify the specific RXQ3 model.

Result Codes

OK In all cases.

Example

```
AT+GMM
RXQ3-433
OK
```

4.6.4 AT+GMR - Revision identification

Syntax

AT+GMR

Description

Displays the firmware version and release date (YYYYMMDD format).

Result Codes

OK In all cases.

Example

```
AT+GMR  
1.0 20090430
```

```
OK
```

4.6.5 AT+IPR - Serial link data rate

Syntax

AT+IPR<value>

Description

Set the data rate at which the RXQ3 module will accept commands and transfer data. If the parameter value is correct, the change in data rate takes into effect after the result code is sent to DTE.

Defined Values

9600	9600 bit/sec
14400	14400 bit/sec
19200	19200 bit/sec (factory default)
38400	38400 bit/sec
57600	57600 bit/sec

Result Codes

OK If value = 9600, 14400, 19200, 38400, or 57600.
ERROR Otherwise.

Example

```
AT+IPR?
```

```
+IPR: 19200
```

```
OK
```

```
AT+ipr=9600
```

```
OK
```

```
after OK the DTE rate is fixed to 9600 bit/sec
```

5 **S-REGISTERS**

S-registers allow control over specific transceiver operations. This chapter describes the S-registers supported by the RXQ3 module. It includes:

- S-registers summary (5.1)
- standard S-registers (5.2)
- address configuration registers (5.3)
- packet management registers (5.4)
- read-only registers (5.5)

5.1 **S-registers summary**

S-registers allow control over specific RXQ3 module operations.

The current setting of each S-register may be displayed using the `ATS<r>?` command, where `<r>` is the S-register whose setting is to be displayed.

The `ATS<r>=<n>` command may be used to set the value of S-register `<r>` to `<n>`, where `<n>` is a decimal value in the range 0 to 255.

If the command is accepted, the RXQ3 module responds with the OK message, otherwise the ERROR message is returned to DTE.

Any changes to S-registers are lost when the device is powered down. The AT&W command saves current configuration in non-volatile memory and makes any changes persistent.

S-registers are summarized in Tables 5-1, 5-2, 5-3, 5-4, and 5-5 along with their default values.

Table 5-1 Standard S-registers

Register	Description	Range	Factory default
S2	Escape character	0-255	43
S3	Carriage Return (CR) character	0-127	13
S4	Line Feed (LF) character	0-127	10
S5	Backspace (BS) character	0-32	8
S12	Escape guard time	0-255	50
S18	Test timeout	0-255	10

Table 5-2 Radio configuration

Register	Description	Range	Factory default
S100	RF band	1-4	2 or 3
S101	RF channel	0-255	0
S102	RF output power level	1-6	1
S103	Radio settings	1-4	1

S100 factory default depends on the RXQ3 model:

- 2, for the RXQ3-433 model
- 3, for the RXQ3-868 model

Table 5-3 Address configuration

Register	Description	Range	Factory default
S110	RF source address	0-255	0
S111	RF destination address	0-255	0
S112	Network identifier	0-255	0

Table 5-4 Packet management

Register	Description	Range	Factory default
S120	Maximum packet data length	1-240	80
S121	Wait time before automatic RF transmission	1-255	200
S122	Address check	0-2	0
S123	Network check	0-1	0
S124	Format of packets sent to DTE	0-1	0

Table 5-5 Read-only registers

Register	Description
S200	RSSI of last received packet
S201	Temperature
S202	Supply voltage

5.2 Standard S-registers

5.2.1 S2 - Escape character

Description

S2 holds the decimal value of the ASCII character used as the escape character in the escape sequence. The default value corresponds to an ASCII +. The escape sequence allows the modem to exit *Data Mode* and to enter *Command Mode*. A value over 127 disables the escape process, i.e. no escape character will be recognized.

Note: This register value is not stored with the AT&W command.

Range

0-255 ASCII decimal

Default setting

43 ASCII +

5.2.2 S3 - Carriage Return (CR) character

Description

S3 sets the character used to terminate command line and result codes.

Note: This register value is not stored with the AT&W command.

Range

0-127 ASCII decimal

Default setting

13 ASCII Carriage Return (CR)

5.2.3 S4 - Line Feed (LF) character

Description

S4 sets the character recognized as a line feed. The Line Feed control character is output after the Carriage Return control character if verbose result codes are used

Note: This register value is not stored with the AT&W command.

Range

0-127 ASCII decimal

Default setting

10 ASCII Line Feed (LF)

5.2.4 S5 - Backspace (BS) character**Description**

S5 sets the character recognized as a backspace. When the echo command is enabled, the transceiver echoes back to the local DTE the Backspace character, an ASCII space character and a second Backspace character; this means a total of three characters are transmitted each time the modem processes the Backspace character.

Note: This register value is not stored with the AT&W command.

Range

0-32 ASCII decimal

Default setting

8 ASCII Backspace (BS)

5.2.5 S12 - Escape guard time**Description**

S12 sets the value in 0.02 seconds increments for the required pause after the escape sequence.

Range

0-255 multiples of 0.02 seconds

Default setting

50 1 second

5.2.6 S18 - Test timeout

Description

S18 sets the length of time, in seconds, that the modem conducts a test (commanded by AT&Tn) before returning to *Command Mode*. If this register value is zero, the test will not automatically terminate; the test can be terminated by issuing a character, except for the local digital loopback test, which is never terminated.

Range

0-255 seconds

Default setting

10 seconds

5.3 Radio configuration registers

5.3.1 S100 - RF band

Description

S100 sets the base frequency at which the RXQ3 module operates.

Note: RXQ3-433 model can be used also in the 315 MHz band (S100 = 1); RXQ3-868 model can be used also in the 915 MHz band (S100 = 4). The RXQ3 module does not check if the chosen band is appropriate to the model used.

Range

Table 5-1 Register S100 values

Value	Description
1	314.00 MHz
2	433.15 MHz
3	868.05 MHz
4	902.50 MHz

Default setting

2 433.15 MHz, for the RXQ3-433 model

3 868.05 MHz, for the RXQ3-868 model

5.3.2 S101 - RF channel

Description

S101 sets the RF operating channel used by the RXQ3 module to make his RF communications with other RXQ3 modules. In order to establish a communication, the remote transceiver must be configured with the same channel number. Different channels can be used to prevent transceivers in one set of devices from listening to transmissions of transceivers belonging to other set of devices.

The RF frequency can be computed using the formula:

$$\text{Frequency} = \text{Base Frequency} + \text{Channel Number} * \text{Channel Spacing}$$

where Channel Spacing is specified in the following table.

Table 5-2 Channel Spacing

Value	Band setting
100 kHz	If S100 = 1, 2 or 3
250 kHz	If S100 = 4

Note: Developers must check if the RF frequency associated with the values chosen for S100 (*RF Band*) and S101 (*RF Channel*) registers is compatible with regulations of the country where the final product will operate.

Range

0-255 decimal

Default setting

0 channel

5.3.3 S102 - RF output power level

Description

S102 sets the RF output power level.

Range**Table 5-3 Register S102 values**

Value	Description
1	+10 dBm
2	+5 dBm
3	0 dBm
4	-10 dBm
5	-20 dBm
6	-30 dBm

Default setting

1 +10 dBm

5.3.4 S103 - Radio settings**Description**

S103 sets one of the preconfigured radio settings available on the RXQ3 module. S103 value can be chosen independently of S100 (*RF Band*) and S101 (*RF Channel*) registers.

Range**Table 5-4 Register S103 values**

Value	Data Rate	Modulation	RX Bandwidth	Sensitivity
1	4.8 kbps	GFSK	100 kHz	-108 dBm
2	10 kbps	GFSK	100 kHz	-104 dBm
3	38.4 kbps	GFSK	100 kHz	-102 dBm
4	76.8 kbps	GFSK	232 kHz	-94 dBm

Default setting

1 4.8 kbps, GFSK

5.4 Address configuration registers

5.4.1 S110 - RF source address

Description

S110 sets the 8-bit source address. Value 0 is used for broadcast messages.

If S122 = 1 (enable address check, no broadcast), S110 value is inserted into packets transmitted in RF; only payload data of packets received with a destination address exactly equal to S110 are sent to DTE.

If S122 = 2 (enable address check, broadcast), S110 value is inserted into packets transmitted in RF; only payload data of packets received with a destination address equal to S110 or equal to 0 are sent to DTE.

Range

Table 5-5 Register S110 values

Value	Description
0	Broadcast address
1-255	Target address

Default setting

0 source address

5.4.2 S111 - RF destination address

Description

S111 sets the 8-bit destination address. Value 0 is used for broadcast messages.

If S122 = 1 or 2 (enable address check), S111 value is inserted into packets transmitted in RF.

Range

Table 5-6 Register S111 values

Value	Description
0	Broadcast address
1-255	Target address

Default setting

0 destination address

5.4.3 S112 - Network identifier**Description**

S112 sets the network identifier.

If S123 = 1 (enable network check), S112 value is inserted into packets transmitted in RF; only payload data of packets received with a network identifier equal to S112 are sent to DTE.

Range

0-255 decimal

Default setting

0 network identifier

5.5 Packet management registers**5.5.1 S120 - Maximum packet data length****Description**

S120 sets the maximum length of packets to be transmitted or received.

Any packet received in RF with a length higher than S120 is automatically discarded.

When RXQ3 module is assembling data received from DTE, a packet is transmitted in RF if the number of characters received is equal to S120 or after a time interval longer than S121 (*Wait time before automatic transmission*) has been passed.

Range

1-240 decimal

Default setting

80 characters

5.5.2 S121 - Wait time before automatic RF transmission

Description

S121 sets the maximum wait time before data received from DTE are automatically transmitted in a RF packet.

When RXQ3 module is assembling data received from DTE, a packet is transmitted in RF if the number of characters received is equal to S120 (*Maximum packet data length*) or after a time interval longer than S121 has been passed.

Range

1-255 milliseconds

Default setting

200 milliseconds

5.5.3 S122 - Address check

Description

S122 enables or disables address check.

When a packet is ready to be transmitted, and S122 = 1 or 2, source and destination address are added at the beginning of the packet sent in RF.

After a packet has been received and S122 = 1, payload data is transferred to DTE only if destination address of the received packet is equal to S110 (*Source address*).

After a packet has been received and S122 = 2, payload data is transferred to DTE only if destination address of the received packet is equal to S110 (*Source address*) or equal to 0 (broadcast address).

Range

Table 5-6 Register S122 values

Value	Description
0	Disable address check
1	Enable address check, no broadcast messages
2	Enable address check, accept broadcast messages

Default setting

0 address check disabled

5.5.4 S123 - Network check

Description

S123 enables or disables network check.

When a packet is ready to be transmitted, and S123 = 1, network address is added at the beginning of the packet sent in RF.

After a packet has been received, and S123 = 1, payload data is transferred to DTE only if network identifier of the received packet is equal to S112 (*Network identifier*).

Range

Table 5-8 Register S123 values

Value	Description
0	Disable network check
1	Enable network check

Default setting

0 network check disabled

5.5.5 S124 - Format of packets sent to DTE

Description

S124 sets the format to be used when received packets data are sent to DTE.

Table 5-9 S124 = 0 (only payload data)

Nr. of bytes	Description
N	Payload data

Table 5-10 S124 = 1 (extended format)

Nr. of bytes	Description
1	Length of message
1	Network identifier (only if S123 = 1)
1	Source address (only if S122 = 1 or 2)
1	Destination address (only if S122 = 1 or 2)
N	Payload data
1	RSSI, in dBm

Range

Table 5-11 Register S124 values

Value	Description
0	Only payload data
1	Extended format

Default setting

0 only payload data

5.6 Read-only registers

5.6.1 S200 - RSSI of last received packet

Description

S200 returns an ASCII string reporting the RSSI value of the last received packet. Before the first radio packet has been received, the module returns the string "n.a." in place of the RSSI value.

S200 is a read only register.

Example

```
ATS200?  
n.a.  
  
OK  
ATS200?  
-20 dBm
```

5.6.2 S201 - Temperature

Description

S201 returns an ASCII string reporting the chip internal temperature.

The analog temperature sensor is not calibrated. Please refer to device data sheet for more information about the error in calculated temperature.

S201 is a read only register.

Example

```
ATS201?  
18 °C  
  
OK
```

5.6.3 S202 - Supply voltage

Description

S202 returns an ASCII string reporting the chip supply voltage, expressed in millivolts.

S202 is a read only register.

Example

```
ATS202?  
3356 mV
```

```
OK
```

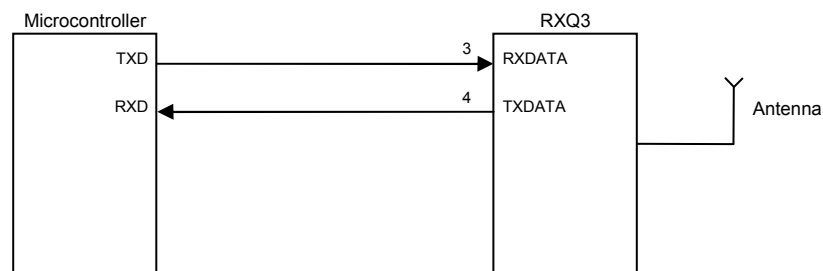
6 Design guidelines

This chapter provides some application circuits for the RXQ3 Smart Transceiver. It includes:

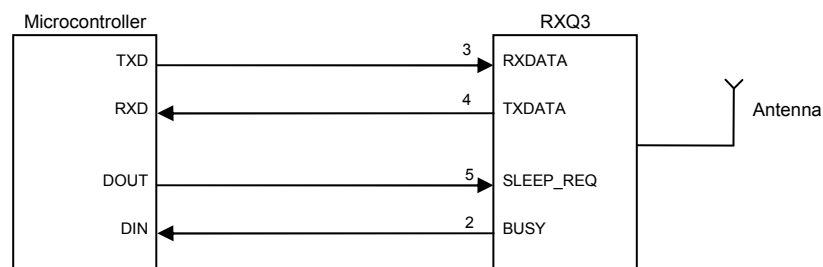
- connecting to a microcontroller (6.1)
- connecting to the RS-232 interface (6.2)
- connecting to the USB interface (6.3)

6.1 Connecting to a microcontroller

Example of minimal connection of the module to a microcontroller using only two wires. The microcontroller wait the time needed to transmit the RF packet before sending a new packet.

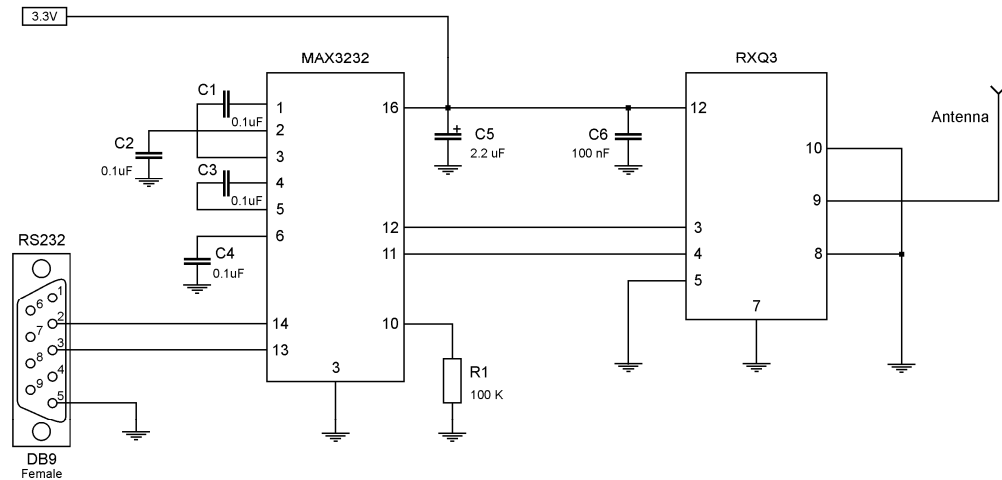


Example of complete connection to a microcontroller. SLEEP_REQ is used to put the module in *Sleep Mode*. BUSY pin is high when the module is transmitting data or has entered *Sleep Mode*. The microcontroller sends data when BUSY is low.



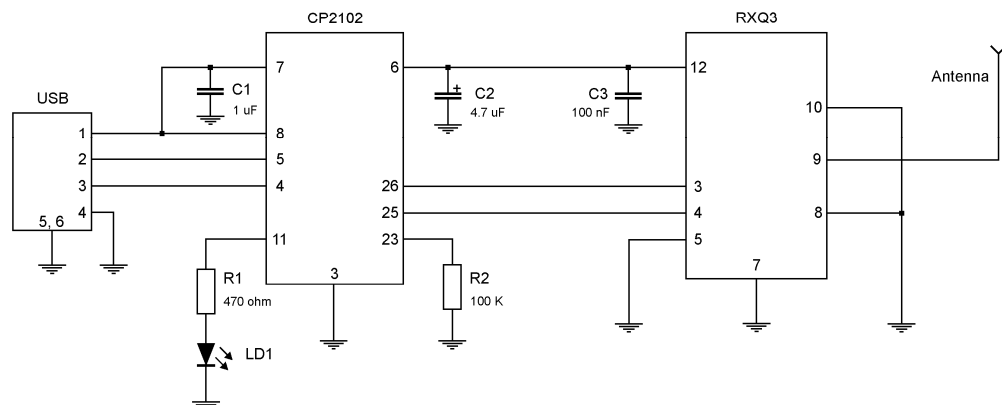
6.2 Connecting to the RS-232 interface

Example of connection of the RXQ3 Smart Transceiver to a PC using the RS-232 interface. The RS-232 line driver/receiver is needed to translate TTL levels on RXQ3 to RS-232 levels to the DB9 connector.



6.3 Connecting to the USB interface

Example of connection of the RXQ3 Smart Transceiver to a PC using the USB interface. CP2102 USB-to-UART Bridge Controller from Silicon Laboratories is used to convert serial data to the USB format, and to power the RXQ3 module. A software driver from Silicon Laboratories must be installed on the PC.



7 References

- [1] ITU-T Recommendation V.250 (2003), Serial asynchronous automatic dialling and control.
- [2] Telecontrolli, "Antenna design considerations", Application note.
- [3] Texas Instruments (2008), CC1110Fxx data sheet.

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