



## RF-SDS      Serial ↔ Ethernet Multi-Channel RF Transceiver

The RF-SDS subassembly is a radio transceiver acting as a Serial Device Server, which externally connects a remote serial RF transceiver to an Ethernet network (TCP/IP). The RF-SDS is connected to a PC's ethernet port with a cross-over type ethernet cable, or it is connected to a hub/router with a straight through type Ethernet cable. The software provided with the unit creates a virtual COM port by mapping the specified COM port number to the IP address of the RF-SDS (MAC—IP mapping is also possible). This makes accessing the device server with a custom application very simple. The embedded radio transceiver of the RF-SDS allows for half duplex communication at data rates up to 38,400 bps, and offers 10 different operating channels on the 433MHz and 868MHz models, and offers 169 operating channels on the 900MHz model. Output power can also be user programmed to -8, -2, +4 or +10dBm. The operating channels and output power are user programmable through a series of simple AT commands sent to the device over the network when the RF-SDS in command mode. Monitoring of channel occupation can also be performed through simple commands sent to the device. The serial data rate is configured via two jumpers SP1 and SP2, which are located on the circuit board.



### Features

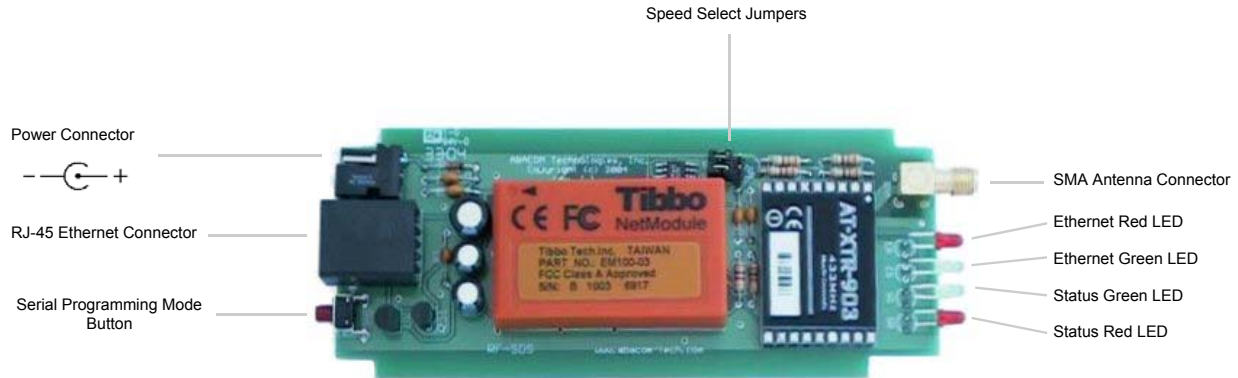
- RJ-45 Ethernet connection
- Wide Supply Range: 8V – 28V
- 3 selectable data rates: 9600, 19200 and 38400 bps
- 10 selectable operating channels: 433-434MHz model and 868MHz model
- 169 selectable operating channels: 902-928MHz model
- User adjustable output power from -8 to +10dBm
- -104dBm sensitivity
- Transparent data throughput
- Uses Internet Protocol (IP)
- Can be connected direct to a PC's Ethernet adaptor via a cross-over Ethernet cable or

connected to a hub/router as a stand-alone device

- LED indicators for Ethernet activity and to indicate the status of the device
- Available with or without an enclosure
- Fully compatible with the RF-232 radio-transceiver, RF-USB radio transceiver and the AT-XTR-903 embedded radio transceiver modules

### Typical Applications

- Data transferring from remote locations to a LAN or WAN
- Data acquisition
- Device or instruments monitoring
- Remote control applications



## Technical Characteristics

Absolute Limits and Operating Parameters	
Ethernet Interface	10BaseT Ethernet
Operating Temperature	-10 °C to +70 °C
Storage Temperature	-30 °C to +100 °C

	Min.	Typ.	Max.	Units
<b>DC values</b>				
Current (idle)		81		mA
Current (rx mode)		68		mA
Current (tx mode @ -8 dBm)		68		mA
Current (tx mode @ 10 dBm)		84		mA
<b>RF</b>				
Modulation Type		GFSK		
Frequency Band	433.05 to 434.87			MHz
Rx Sensitivity		-104		dBm
Tx Max Power Output	-8		10	dBm
<b>Performance</b>				
Input Bit Rate <sup>1</sup>	9600, 19200 and 38400			bps
Outdoor range		200 / 600		M / Ft
Available Channels			169	
Channel Spacing		153.6		KHz
<b>Timing</b>				
TX to RX			20	ms
RX to TX			20	ms
<b>Default Values (without user programming)<sup>2</sup></b>				
Operating Channel		433.96		MHz
Tx Output Power		10		dBm

<sup>1</sup> Input signal consists of 1 start bit, 8 data bits and 1 stop bit, no parity.

<sup>2</sup> Default values are factory configured. May be changed with AT command programming.

## Data Rate Configuration

The data rate is selected by setting the jumpers located on the circuit board which are labeled SP1 and SP2. The following truth table shows the possible combinations:

SP1	SP2	I/O Data Rate
N	N	9600
I	N	19200
N	I	38400
I	I	TEST Mode

Note — I: jumper IS installed, N: jumper NOT installed

A different degree of redundancy and protection is associated with the RF packet according to the selected speed. This means that slower data rate results in a higher level of reliability and/or longer communication distance.

## Loading the RF-SDS Software

The RF-SDS is designed around the EM100 ethernet module from TIBBO Technology. The latest version of the Device Server Toolkit must be downloaded from [www.tibbo.com/downloads.php](http://www.tibbo.com/downloads.php) and installed by following the on-screen prompts. The most up-to-date version of the EM100 Device Server firmware is also available on the aforementioned website.

### IMPORTANT NOTE:

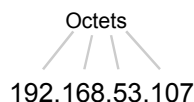
Included in the "Device Server Toolkit" is detailed documentation on the operation of the EM100 embedded ethernet module applies directly to the RF-SDS transceiver's operation. This information has therefore not been duplicated in this manual but should be considered as an important part of the RF-SDS manual.

## Connecting the RF-SDS to a Network or a PC

The RF-SDS can be connected directly to a hub or router via a straight through Ethernet cable. Connecting the RF-SDS to a hub or router in this way will make it a stand-alone device that can be accessed from anywhere on the network. The number of RF-SDS subassemblies that can be connected to the network at one time is limited only by the number of available IP addresses and the number of operating channels available on the given frequency band. The RF-SDS can also be connected directly to the network adaptor of a PC. To connect directly to a PC, a cross-over Ethernet cable must be used.

## Setting an IP and Programming Other Network Properties

In order for the RF-SDS to be able to communicate with a computer on the network, its IP address must be a part of the same net. For a Class A network (an IP whose first octet begins between 1 and 126) only the first octet must be the same and the remaining numbers can be chosen to uniquely identify the RF-SDS. For a Class B network (an IP whose first octet begins between 128 and 191) the first 2 octets must be the same, while the last two octets uniquely identify the RF-SDS. For a Class C network (an IP whose first octet begins between 192 and 223) the first three octets must be the same and the last octet is the unique identifier for the RF-SDS. The manual that contains all the information about programming the RF-SDS with different network properties is: <http://docs.tibbo.com/index.html?firmware.htm> under the Device Server Application Firmware link. For the Device Server Toolkit software manual refer to <http://docs.tibbo.com/index.html?software.htm>.



## Quick Setup

To establish a link between a PC on the network and the RF-SDS, the unit must be powered, connected to the network and the Device Server Toolkit software must be installed on that PC. Connect one device at a time to set the IP address. After this is done, as many units as required, may be connected to the network at the same time. To set the IP and create a connection, open up the DS Manager program and there will be a list of devices that are connected to the network. From this window you can change the device settings or the IP address of any device by selecting one of them and clicking the appropriate button on the right. When setup of the RF-SDS is complete, close DS Manager and open up the Connection Wizard. Using this, follow the on-screen prompts to create a Virtual Serial Port (VSP) that links the IP address to a COM port. Once a VSP has been created, it is accessible from Hyper Terminal or any other terminal program. For more detailed information regarding the software and setting up a Serial Device Server (SDS), consult the software documentation at <http://docs.tibbo.com/index.html?software.htm>.

## Compatibility With Other RF Devices in the Field

The RF-SDS transceiver is designed to communicate with a remote serial device. It is compatible with the RF-USB transceiver, the RF-232 transceiver and the AT-XTR-903 radio transceiver modules. When used in conjunction with these devices, it allows any computer on the network to communicate wirelessly with the remote device in the field that is not directly connected to the network. Conversely, the remote serial device in the field will “radio-link” information to the RF-SDS network device, making it accessible from virtually anywhere on the local network or a wide area network such as the internet.

## Command Mode (RF Section)

Putting the RF module in command mode allows the user to configure the main parameters which change the module's operating conditions, such as selecting a new operating frequency channel or setting the RF output power to a desired value. Programming is carried out via simple AT commands. To enter the command mode, the following data string must be sent to the unit via the network, and all subsequent commands are also sent via the network:

- 3 consecutive ASCII plus characters (+++) without pauses.

Within 35ms, the module will respond with **OK<CR><LF>** string to confirm it is in Command mode. (<CR> represents 'Carriage Return') (<LF> represents 'Line Feed')

Programming information is stored in 16 available registers (from 1 to 16). Some of these are available only for read operations, whilst others are available for read/write operations.

The syntax to read a value stored in a register is as follows:

**ATSx<CR><LF>** (x= register 1, ..., 16)

Assuming that the command was issued correctly, the answer to this command is the value of the contents of the register. For a command issued with errors, the following answer is returned:

**ERROR<CR><LF>**

To change the value of parameter in a register, the following syntax is used:

**ATSx=Y<CR><LF>** (x= 1, ..., 16) , Y= value to be inserted

A command issued correctly will receive **OK<CR><LF>** response. If the command contained a syntax error or if the value that was entered to be written is an unacceptable parameter for that register, an **ERROR<CR><LF>** response will be received.

All the values written into registers are volatile and will be lost when the module is powered OFF, unless they were previously saved into the EEPROM memory available in the embedded microprocessor. In this case, the modified values will be non-volatile and will be retained even if the module's power supply is cycled.

The command for non-volatile saving of ALL the values in register is:

**ATWR<CR><LF>**

To exit Command Mode and return the transceiver to normal operating , the following command is issued:

**ATCC<CR><LF>**

When in Command mode, it is possible to include multiple commands in a single command line by separating each command by a comma (,) operator. With following command line, for example, register 3 is set to value 2, the change is permanently saved and the Command Mode is exited:

**Example:   ATS3=2,WR,CC <CR><LF>**  
**OK<CR><LF>**

As shown in the above example, the prefix -AT- is only used once in the beginning of the command of line and not required for the following commands which are separated with the comma operator.

Command chaining is possible only for write operations. If used in read operations, an "ERROR" message will be returned as in the following example:

**Example:   ats1,cc <CR><LF>**  
**ERROR <CR><LF>**

Commands are not case sensitive, so either uppercase or lowercase characters may be used.

Refer to **Appendix A.** for details on register values and possible configurations.

## Appendix A – Register Programming

Different operating characteristics of the transceiver, such as RF channel selection, RF emitted power, etc..., can be programmed by the user through setting special parameters in 16 available registers. The following information provides the meaning and programming possibilities for each register. The current AT-XTR-903 transceiver modules implement 4 out of 16 registers - registers 1,2,3 and 16. Only these registers will be described, the remaining registers are reserved for possible future enhancements.

### Register 1 - FREQUENCY BAND

This register is READ ONLY and will supply information relating to the module's operating RF band. The AT-XTR-903 transceiver modules are available in three different models, 433MHz, 868MHz and 915MHz .

Command	Values	Read (R) / Write (W)
ATS1	0 =433-434 MHz	R
	1 =868-870 MHz	
	2 =902-928 MHz	

#### Example 1: Reading the operational band of the module

```
+++OK<CR><LF>
ATS1<CR><LF>
0<CR><LF>          (note: 0 = 433-434MHz band)
```

#### Example 2:

```
+++OK<CR><LF>
ATS1=2<CR><LF>
NO ACCESS<CR><LF>
```

Syntax Error: This register is available for Read only!

### Register 2 – RF CHANNEL

This register is available for read and write operations. It allows to get feed backs of the RF frequency (channel) setting for both receiving and transmitting circuits. Makes it possible to "write" a different frequency (channel).

Command	Values	Read (R)/ Write (W)
ATS2	0 = 433.19 MHz 1 = 433.34 MHz 2 = 433.50 MHz 3 = 433.65 MHz 4 = 433.80 MHz 5 = 433.96 MHz 6 = 434.11 MHz 7 = 434.27 MHz 8 = 434.42 MHz 9 = 434.57 MHz	R/W

**Example 1: Reading the configured RF channel (433,5 MHz)**

```
+++OK<CR><LF>  
ATS2<CR><LF>  
2<CR><LF>
```

**Example 2: Selecting channel 8 as the operating frequency (434,42 MHz)**

```
+++OK<CR><LF>  
ATS2=8<CR><LF>  
OK<CR><LF>
```

**Register 3 – EMITTED RF POWER**

This register is available for read and write operations. With the read command, feedback is given about the RF output power emitted from the module's transmitter section. The write command and enables the user to configure the transmitter section for the preferred RF output power.

Command	Values	Read (R)/ Write (W)
ATS3	0 = - 8 dBm 1 = - 2 dBm 2 = + 4 dBm 3=+10 dBm	R/W

**Example 1: Reading the configured RF output power (-2 dBm)**

```
+++OK<CR><LF>  
ATS3<CR><LF>  
1<CR><LF>
```

**Example 2: Setting RF output power to +10 dBm**

```
+++OK<CR><LF>  
ATS3=3<CR><LF>  
OK<CR><LF>
```

**Register 16 – RSSI (Received Strength Signal Indicator)**

The register is read only and will supply a numeric value proportional to the RF Field Strength sensed from the receiving circuitry. The range of possible values returned from the register are 0 through 9. Reading register 16 starts a process of analysis of the RF channel that the module is programmed to operate on. This routine has a fixed duration of 200ms and the analysis result is given after this period. The analysis period should be allowed to run its course without interruption through issuing another command. The signal strength command is useful for determining possible channel occupation or for setting up the link in conjunction with the TEST mode.

Command	Values	Read (R)/ Write (W)
ATS16	0 = Minimum Field Strength 1 2 3 4 5 6 7 8 9 = Maximum Field Strength	R

**Example 1: Reading Field Strength (strong received signal)**

```
+++OK<CR><LF>
ATS16<CR><LF>
9<CR><LF>
```

**Example 2: Reading Field Strength (very weak or no received signal)**

```
+++OK<CR><LF>
ATS16<CR><LF>
0<CR><LF>
```

**Example 3: Syntax Error: register is read only!**

```
+++OK<CR><LF>
ATS16=3<CR><LF>
ERROR<CR><LF>
```

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