

XStream™ OEM RF Module

XStream OEM RF Module

Operation

RF Module Configuration

Appendices



Product Manual v4.2A

For XStream Module Part Numbers:

X09-001...

X24-009...

XH9-001...

X09-009...

X24-019...

XH9-009...

X09-019...

XH9-019...



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XStream OEM RF Module

The XStream OEM RF Module is a drop-in solution that transfers a standard asynchronous serial data stream over-the-air between devices.

This manual contains information critical to basic XStream Module operation. More advanced topics are covered in the “XStream Advanced Programming & Configuration” manual.



Features

Long Range at a Low Cost

9XStream (900 MHz) Range:

- Indoor/Urban: **up to 1500'** (450 m)
- Outdoor line-of-sight: **up to 7 miles** (11 km) w/ dipole antenna
- Outdoor line-of-sight: **up to 20 miles** (32 km) w/ high gain antenna

24XStream (2.4 GHz) Range:

- Indoor/Urban: **up to 600'** (180 m)
- Outdoor line-of-sight: **up to 3 miles** (5 km) w/ dipole antenna
- Outdoor line-of-sight: **up to 10 miles** (16 km) w/ high gain antenna

Receiver sensitivity: **-110 dBm** (900 MHz), **-105 dBm** (2.4 GHz) [-93 dBm is industry average]

Advanced Networking & Security

True Peer-to-Peer (no “master” required), Point-to-Point, Point-to-Multipoint, Multidrop

Retries and Acknowledgements

7 hopping channels, each with over 65,000 available network addresses

Easy-to-Use

FCC & international agency approved

No configuration required

Advanced configurations using standard AT Commands

Transparent Operation (replaces serial wires)

Portable (small form factor & low power)

Software-selectable serial interfacing

MODBUS, \overline{CTS} , \overline{RTS} , \overline{DCD} & \overline{DTR} I/O Support

Support for multiple data formats (parity, start and stop bits, etc.)

XII™ Interference Immunity

Power-saving Sleep Modes

FHSS (Frequency Hopping Spread Spectrum)

Worldwide Acceptance

FCC Certified (USA) [Go to [Appendix A](#) for FCC Requirements]

Systems that contain XStream RF Modems can inherit MaxStream’s FCC Certification

ISM (Industrial, Scientific & Medical) frequency band

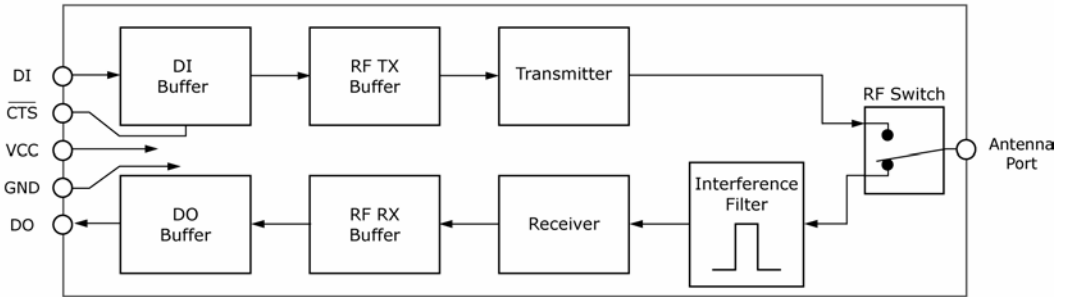
Manufactured under **ISO 9001:2000 registered standards**

9XStream (900 MHz) OEM RF Modules are approved for use in **US, Canada, Australia, Israel** (and more). 24XStream (2.4 GHz) Modules add **EU** (Europe) and other approvals.



Block Diagram

Figure 1. Internal Block Diagram - XStream OEM RF Module



MaxStream’s proprietary XII™ (Interference Immunity Technology) is built into the ‘Interference Filter’ of the block diagram. The filter reduces interference from pagers and cellular.

Module Signal Pinouts

Table 1. J1 Pin Signal Descriptions

(Low-asserted signals distinguished with a horizontal line over signal name.)

Module Pin	Signal Name	I/O	When Active	Description
1	DO2	O*	low	Clear-to-Send ($\overline{\text{CTS}}$) Flow Control
2	DI3 (Power-down)	I*	high	Can be used to enter Sleep Modes that require less power.
3	DO (Data Out)	O*	n/a	Serial Data leaving the data radio modem (to the host)
4	DI (Data In)	I	n/a	Serial data entering the data radio modem (from the host)
5	DI2	I**	low	Request-to-Send ($\overline{\text{RTS}}$) / Enable Binary Commands
6	$\overline{\text{RESET}}$	I*	low	Re-boot data radio modem
7	DO3	O	high	Receive (RX) LED
8	$\overline{\text{TX}}$ / PWR	O	low	$\overline{\text{TX}}$ - Asserted during transmission
			high	PWR - Indicates power is on
9	$\overline{\text{CONFIG}}$	I***	low	Backup method for entering Command Mode. Primary method is with “+++” [See CC Command]
10	VCC	I	-	5 VDC Regulated (± 0.25)
11	GND	-	-	Ground

* Pin utilizes 10K Ω Pull-Up resistor (already installed in the module)

** Pin utilizes 10K Ω Pull-Down resistor (already installed in the module)

*** Pin utilizes 100K Ω Pull-Up resistor (already installed in the module)

Note: When integrating the XStream Module with a Host PC Board, all lines that are not used should be left disconnected (floating).

Table 2. J2 Pin Signal Descriptions

Module Pin	Pin Name
1	reserved
2	GND
3	GND
4	GND

J2 Pins are used primarily for mechanical stability and may be left disconnected.

Signal Pinout Descriptions

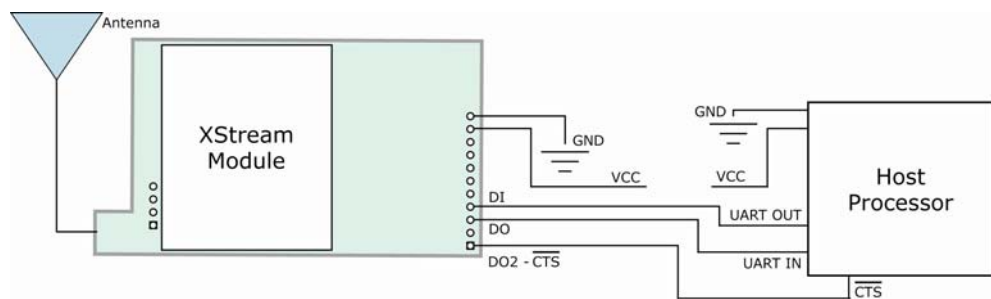
The interface signals are available through the 11-pin header. All pins operate on VCC CMOS levels. Five signals commonly used in MaxStream module applications are:

- DI: pin 4 – Data In
- DO: pin 3 – Data Out
- VCC: pin 10 – Power
- GND: pin 11 – Ground
- DO2-CTS: pin 1 – Data Output 2 - Clear-to-Send

The remaining 6 pins are available for additional functionality. Go to the “XStream Advanced Programming & Configuration” manual for more detailed information about each signal pinout.

Application Circuit

Figure 2. Application Circuit – connection to host processor

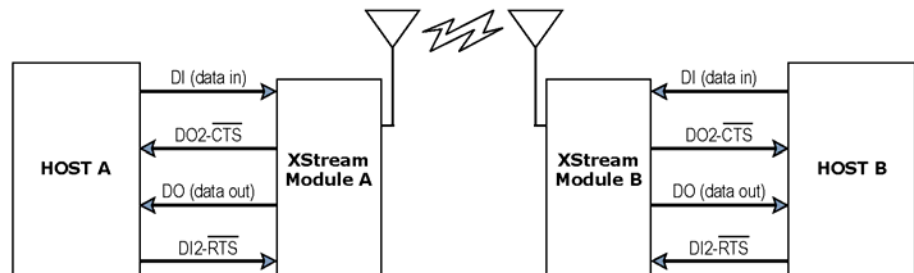


Electrical Characteristics

Timing Specifications

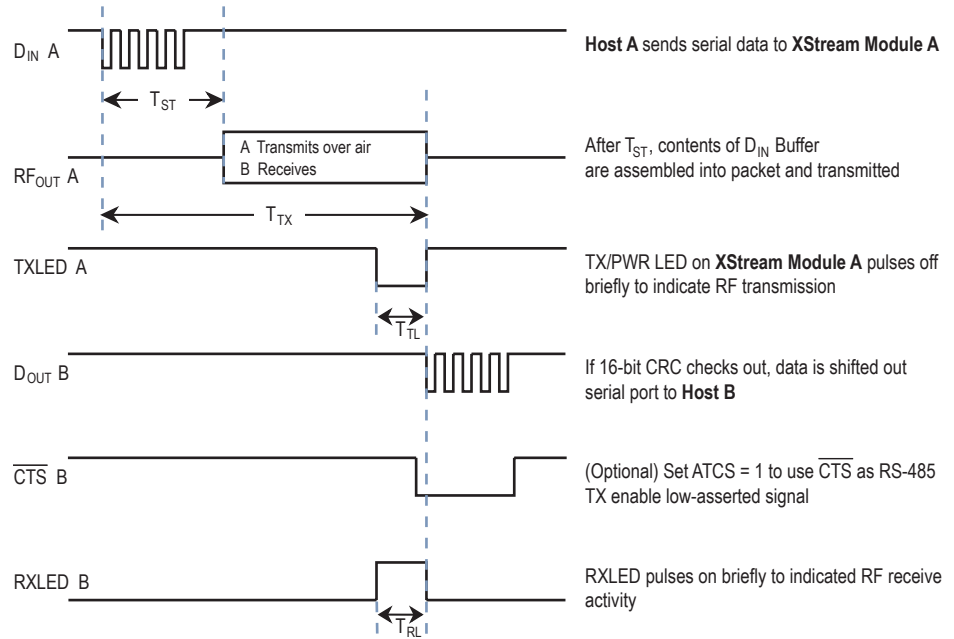
The diagram below shows XStream Modules providing a Wireless link between hosts.

Figure 3. System Block Diagram – Wireless Link between hosts



The RF data flow sequence is initiated when the first byte of data is received into the DI Buffer of the transmitting XStream Module. As long as XStream Module A is not receiving RF data, the data in the DI Buffer is packetized, and then transmitted to XStream Module B.

Figure 4. Timing Specifications (“A” and “B” are associated with Figure 4 on previous page)



XStream Pin Timings

Table 3. AC Characteristics (Symbols correspond with Figures 3 and 4, SY Parameter = 0)

Symbol	Description	19200 Baud Rate (32 byte packet)	19200 timing (B = number of bytes)	9600 Baud Rate (32 byte packet)	9600 Timing (B = number of bytes)
T_{TX}	Latency from the time data is transmitted until received.	54.0 ms	For $0 < B < 64$, $T = 41.6 + (0.4 * B)$ ms For $B > 63$, $T = 66.8$ ms	72.0 ms	For $0 < B < 40$, $T = 46.27 + (0.73 * B)$ ms For $B \geq 39$ bytes, $T = 74.80$ ms
T_{TL}	Time that \overline{TX} /PWR pin is driven low	8.4 ms	For $0 < B < 14$, $T = 3.24 + (0.4 * B)$ ms For $B > 13$, $T = 8.48$ ms	16.8 ms	For $0 < B < 14$, $T = 6.50 + (0.8 * B)$ ms For $B > 13$, $T = 16.80$ ms
T_{RL}	Time that RX LED pin is driven high	13.6 ms	For $0 < B < 65$, $T = 0.79 + (0.408 * B)$ For $B > 64$, $T = 26.9$ ms	25.6 ms	For $0 < B < 37$, $T = 1.63 + (0.794 * B)$ For $B > 36$, $T = 30.2$ ms
T_{ST}	Channel Initialization Time	35.0 ms	35.0 ms	35.0 ms	35.0 ms

Table 4. DC Characteristics (Vcc = 4.75 to 5.25V)

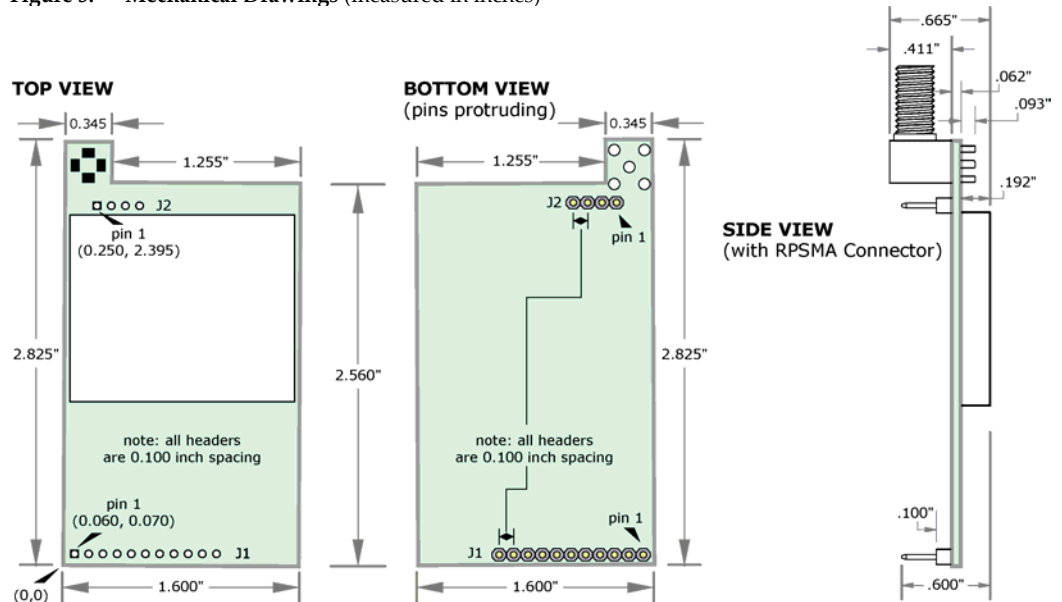
Symbol	Parameter	Condition	Min	Typical	Max	Units
V _{IL}	Input Low Voltage	All Input Signals	-0.5		0.3 * V _{cc}	V
V _{IH}	Input High Voltage	All Except $\overline{\text{RESET}}$ Pin	0.6 * V _{cc}		V _{cc} + 0.5	V
V _{IH2}	Input High Voltage	$\overline{\text{RESET}}$ Pin *	0.9 * V _{cc}		V _{cc} + 0.5	V
V _{OL}	Output Low Voltage	I _{OL} = 20 mA, V _{cc} = 5V			0.7 0.5	V
V _{OH}	Output High Voltage	I _{OH} = -20 mA, V _{cc} = 5V	4.0 2.0			V
I _{IL}	Input Leakage Current I/O Pin	V _{cc} = 5.5V, pin low (absolute value)			3	μA
I _{IH}	Input Leakage Current I/O Pin	V _{cc} = 5.5V, pin high (absolute value)			3	μA
I _{IL2}		$\overline{\text{CTS}}$ (DO2), DO, $\overline{\text{RESET}}$		(V _{cc} - V _I) / 10 **		mA
I _{IL3}		$\overline{\text{CONFIG}}$		(V _{cc} - V _I) / 47 **		mA
I _{IH2}		$\overline{\text{RTS}}$ (DI2)		(V _{cc} - V _I) / 10 **		mA

* Reset pulse must last at least 250 nanoseconds

** V_I = the input voltage on the pin

Mechanical Drawings

Figure 5. Mechanical Drawings (measured in inches)



Operation

Serial Communications

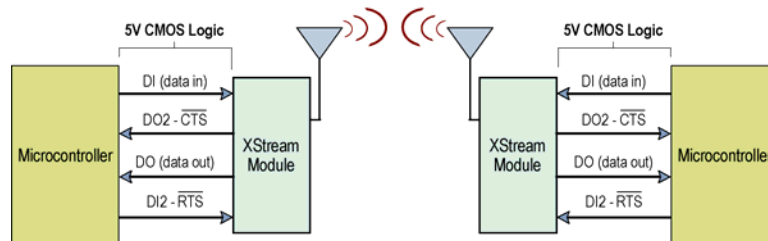
The XStream OEM RF Module interfaces to a host device through a CMOS-level asynchronous serial port. Through its serial port, the XStream Module can communicate directly with any UART-interfaced or RS-232/485/422 device. [Timing specifications illustrated in Figure 4]

UART-Interfaced Data Flow

Devices that have a UART interface can connect directly through the pins of the XStream OEM RF Module as is shown in the figure below.

Figure 6. Data Flow in a UART-interfaced environment

(Low-asserted signals distinguished with horizontal line over signal name.)

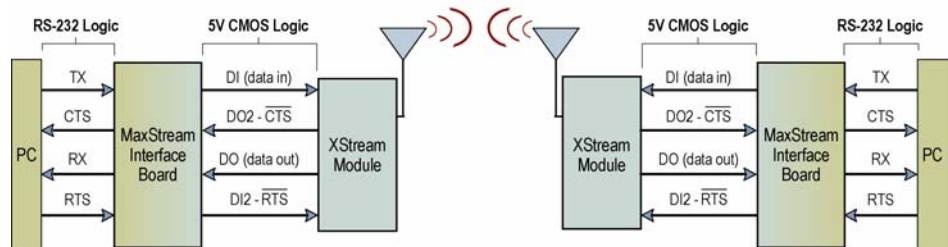


RS-232 and RS-485/422 Data Flow

Wiring the XStream Module to a host device serial port enables the host device to communicate wirelessly. To transmit, the host device simply sends serial data through the serial port of the RS-232/485 RF modem or interface board. The XStream Radio Modem then converts the data into FCC-approved RF data. Once transmitted, the RF data can be detected by receiving XStream Radio Modems, checked for data integrity and then sent to a receiving device.

Figure 7. Data Flow in RS-232 and RS-485/422 environments

(Low-asserted signals distinguished with a horizontal line over signal name.)

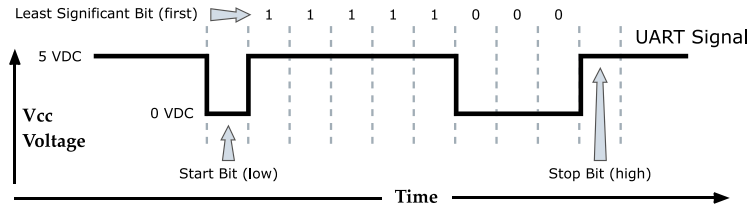


Serial Data

Data enters the MaxStream OEM RF Module through the DI Pin (pin 4) as an asynchronous serial signal. The signal should idle high when no data is being transmitted.

The UART performs tasks (such as timing and parity checking) needed for communication. Serial communication consists of two UARTs which must be configured with compatible parameters (baud rate, parity, start bits, stop bits, data bits) to have successful communication. Each data packet consists of a start bit (low), 8 data bits (least significant bit first) and a stop bit (high). The following figure illustrates the serial bit pattern of data passing through the module.

Figure 8. UART data packet 0x1F (decimal number “31”) as transmitted through the XStream Module
Data Format is 8-N-1 (8 bits - No Parity - 1 Stop Bit)



In the example above, the XStream Module transfers 8 bits over-the-air. The start and stop bits of the UART signal are not transmitted, but are regenerated by the receiving module.

The MaxStream OEM RF Modules support the following data formats [See [NB \(Parity\) Command](#)]:

- 8-none-1 or 7-any-1
- 8-even-1
- 8-odd-1
- 8-mark-1
- 8-space-1

DI (Data In) Buffer

Once serial data has entered the XStream Module through the Data In (DI) Pin, the data is stored in the DI Buffer until it can be transmitted.

Once the first byte of data enters the DI Buffer, the module begins to initialize the RF channel (unless RF data is being received). In the case where the module is receiving RF data, the serial data is stored in the DI Buffer. When the DI Buffer has only 17 bytes of memory left, the XStream Module de-asserts (high) \overline{CTS} to signal to the host device to stop sending data. \overline{CTS} re-asserts once the DI Buffer has at least 35 bytes available in memory. Once in the DI Buffer, the data is packetized for transmission. [Packet structures are broken down below.]

Interfacing Hardware

MaxStream, Inc. developed proprietary interface boards (MaxStream Product numbers: XIB-R for RS-232/485 & XIB-U for USB interfacing) to facilitate the connection between XStream OEM RF Modules and serial devices. Many integrators develop their own interfacing circuitry; others use MaxStream's Interface Boards. In either case, the following sections illustrate how to interface with XStream OEM RF Modules by illustrating properties of the MaxStream XIB-R Interface Board.

XStream Development Kit (RS-232/485/422)

The XStream Development Kit (RS-232) includes the hardware and software needed for a robust Wireless link.

Table 5. XStream Development Kit (RS-232/485) Contents

Item	Qty.	Description	Part Number
Quick Start Guide	1	Quickly familiarizes users with some of the XStream Module's most important functions. The guide provides step-by-step instructions on how to make a Wireless link and test its ability to transport data over varying ranges and conditions.	MD0007
CD	1	CD includes documentation and configuration software	MD0010
XStream OEM RF Module (w/ attached wire antenna)	1	Module comes with fixed RF Data (baud) rates up to 19200 bps	Part numbers listed in appendix C
XStream OEM RF Module (w/ RPSMA antenna port)	1	Module comes with fixed RF Data (baud) rates up to 19200 bps	Part numbers listed in appendix C
Antenna (RPSMA)	1	Reverse Polarity SMA half-wave dipole antenna	Depends on frequency
MaxStream Interface Board	2	Supplies regulated 5V DC power to module and provides signal-level conversion for interfacing with PC RS-232 serial ports or RS-485/422 devices	XIB-R
Serial Loopback Adapter	1	Connects to the female RS-232 (DB-9) serial connector of the MaxStream Interface Board and can be used to configure the radio modem to function as a repeater (for range testing)	JD2D3-CDL-A
NULL Modem Adapter (male-to-male)	1	Connects to the female RS-232 (DB-9) serial connector of the MaxStream Interface Board and can be used to connect the radio modem to another DCE (female DB9) device	JD2D2-CDN-A
NULL Modem Adapter (female-to-female)	1	Used to bypass radios to verify serial cabling is functioning properly	JD3D3-CDN-A
Male DB-9 to RJ-45 Adapter	1	Facilitates adapting the DB-9 Connector of the MaxStream Interface Board to a CAT5 cable (male DB9 to female RJ45)	JE1D2-CDA-A
Female DB-9 to RJ-45 Adapter	1	Facilitates adapting the DB-9 Connector of the MaxStream Interface Board to a CAT5 cable (female DB9 to female RJ45)	JE1D3-CDA-A
9V AC Power Adapter	2	Wall-based transformer with US 2-prong plug	JP4P2-9V4-6F
9V Battery Clip (6")	1	Allows Interface Board to be remotely powered by a 9V battery	JP2P3-C2C-4I
RS-232 Cable (6')	2	Straight-through serial cable that connects interface board (DCE) to a PC (DTE)	JD2D3-CDS-6F

MaxStream Interface Board (Part Number: XIB-R)

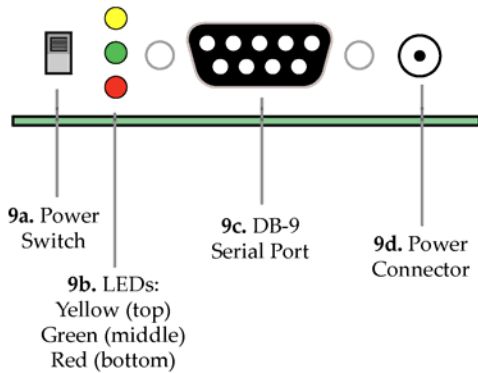
The MaxStream Interface board was developed to provide means of connecting the XStream Module to any system having an RS-232 or RS-485/422 connection. Since the XStream Module requires signals to enter at CMOS voltages, one of the main functions of the interface board is to convert signals between CMOS levels (5 VDC regulated) and RS-232 levels (-12 to +12V). The MaxStream Interface Board includes the following built-in features:

- DIP Switch
- Configuration Switch
- Power Switch
- LEDs
- DB-9 Connector
- Power Connector

MaxStream also supports USB and Ethernet interfacing. Call (801-765-9885) or visit www.maxstream.net for more information.

XIB-R Interface Board Components & Features

Figure 9. Front View



9a. Power Switch

Move Power Switch to the ON (up) position to power the XStream module assembly (XIB-R interface board + RF Module).

9b. LEDs

The LED indicators visualize diagnostic status information. The radio modem's status is represented as follows:

- **Yellow** (top LED) = Serial Data Out (to host)
- **Green** (middle) = Serial Data In (from host)
- **Red** (bottom) = Power/TX Indicator (Red light is on when modem is powered, pulses off/on briefly during RF transmission)



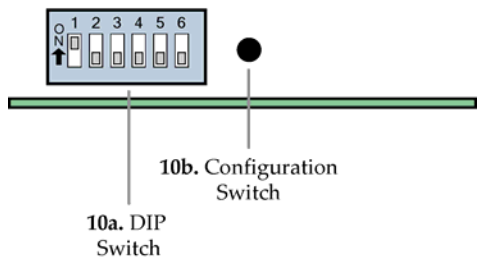
9c. DB-9 Serial Port

Standard female DB-9 (RS-232) DCE connector – This connector can be also used for RS-485 and RS-422 connections.

9d. Power Connector

7-18 VDC Power Connector (Center positive, 5.5/2.1mm) – Power can also be supplied through Pin 9 of the DB-9 Serial Port [9c].

Figure 10. Back View



10a. DIP Switch

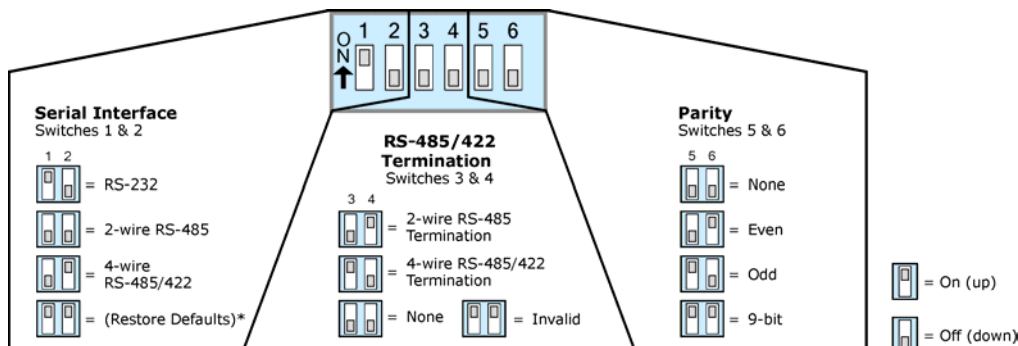
DIP Switch automatically configures the XStream OEM RF Module to operate in different modes. Each time the module assembly (XIB-R interface board + the RF Module) is powered-on, intelligence on the XIB-R interface board programs the module according to the positions of the DIP Switch. [See Figure 11 below for DIP Switch settings]

NOTE: In cases where AT Commands should not be sent each time the module assembly is powered-on, the processor must be disabled by populating J7 on the XIB-R interface board.

10b. Configuration Switch

Configuration Switch provides an alternate way of entering into "AT Command Mode". To enter AT Command Mode at the radio modem's default baud rate, hold the Configuration Switch down while simultaneously powering on the module using the Power Switch [9a].

Figure 11. MaxStream XIB-R Interface Board DIP Switch Settings



* The "(Restore Defaults)" setting, for switches 1 & 2, can be used to restore module parameters to their default states. Once switches are in position, reset occurs during next the power-up.

RF Module Configuration

Command Mode

To set or read module parameters, the module must first enter “Command Mode”, a state in which incoming characters are interpreted as commands.

AT Commands

To enter AT Command Mode:

1. Send the 3-character command sequence “+++” and observe guard times before and after the command characters. [See “Default AT Command Mode Sequence” below.]
[OR]
2. Assert (low) the $\overline{\text{CONFIG}}$ pin* and turn the power going to the module off then back on. (If using a MaxStream XIB-R Interface Board, the same result can be achieved by keeping the configuration switch pressed while turning the power switch off and then on again.)

IMPORTANT: * Do not tie $\overline{\text{CONFIG}}$ pin to the microprocessor.

Default AT Command Mode Sequence (for transitioning module to Command Mode):

- No characters sent for one second [see BT (Guard Time Before) Command]
- Input three (3) plus characters (“+++”) within one second [see CC (Command Sequence Character) Command.]
- No characters sent for one second [see AT (Guard Time After) Command.]

To Exit Command Mode:

1. If no valid AT Commands are received within the time specified by CT (Command Mode Timeout) Command, the Module automatically returns to Idle Mode.
[OR]
2. Send ATCN (Exit Command Mode) Command.

Binary Commands

DI2 pin (Pin 5) must be asserted in order to send binary commands to an XStream Module. When asserted, the pin recognizes commands anytime during transmission or reception of data. A minimum time delay of 100 ms (after the stop bit of the command byte has been sent) must be observed before DI2 pin can be de-asserted. The command executes after all parameters associated with the command have been sent. If all parameters are not received within 0.5 seconds, the module returns to Idle Mode. **Note:** When parameters are sent, they are always two bytes long with the least significant byte sent first.

Commands can be queried for their current value by sending the command logically ORed with the value 0x80 (hexadecimal) with DI2 pin asserted. When the binary value is sent (with no parameters), the current value of the parameter is sent back through the DO pin.

IMPORTANT: For the XStream Module to recognize binary commands, RT (DI2 Configuration) Command must be issued.

AT Commands (Short Reference)

The following table lists commands available to XStream Modules. Tables listed in subsequent pages of this chapter contain more detailed entries of the same commands. If still more information is needed, refer to the “XStream Advanced Programming and Configuration” manual.

AT Commands issued without a parameter value will return the currently stored parameter.

Table 6. XStream AT Commands (Short Reference)
Modems expect numerical values in hexadecimal. “d” denotes decimal equivalents.

AT Command	Binary Command	AT Command Name	Range	Command Category	# Bytes Returned	Factory Default
AT	0x05 (5d)	Guard Time After	0x02 – 0xFFFF (x 100 ms)	AT Command Mode Options	2	0x0A (10d)
BD	0x15 (21d)	Baud Rate	0 – 6	Serial Interfacing	1	RF data rate
BT	0x04 (4d)	Guard Time Before	0 – 0xFFFF (x 100 ms)	AT Command Mode Options	2	0x0A (10d)
CC	0x13 (19d)	Command Sequence Character	0x20 – 0x7F	AT Command Mode Options	1	0x2B (“+”)
CD v 4.29D*	0x28 (40d)	DO3 Configuration	0 - 3	Serial Interfacing	1	0
CN	0x09 (9d)	Exit AT Command Mode	none	AT Command Mode Options	n/a	none
CS v 4.27D*	0x1F (31d)	DO2 Configuration	0 – 4	Serial Interfacing	1	0
CT	0x06 (6d)	AT Command Mode Timeout	0x02 – 0xFFFF (x 100 ms)	AT Command Mode Options	2	0xC8 (200d)
DT	0x00 (0d)	Destination Address	0 – 0xFFFF	Networking	2	0
E0	0x0A (10d)	Echo Off	none	AT Command Mode Options	n/a	none
E1	0x0B (11d)	Echo On	none	AT Command Mode Options	n/a	none
ER	0x0F (15d)	Receive Error Count.	0 – 0xFFFF	Diagnostic	2	0
FH	0x0D (13d)	Force Wake-up Initializer	none	Sleep (Low Power)	n/a	none
FL	0x07 (7d)	Software Flow Control	0 – 1	Serial Interfacing	1	0
FT v 4.27B*	0x24 (36d)	Flow Control Threshold	0x0 – 0xFF (bytes)	Serial Interfacing	2	varies
GD	0x10 (16d)	Receive Good Count	0 – 0xFFFF	Diagnostic	2	0
HP	0x11 (17d)	Hopping Channel	0 – 6	Networking	1	0
HT	0x03 (3d)	Time before Wake-up Initializer	0 – 0xFFFF (x 100 ms)	Sleep (Low Power)	2	0xFFFF
ID v 4.27C*	0x27 (39d)	Modem VID	0 – 0xFFFF (Read-only)	Networking	2	none
LH	0x0C (12d)	Wake-up Initializer Timer	0 – 0xFF (x 100 ms)	Sleep (Low Power)	1	1
MK	0x12 (18d)	Address Mask	0 – 0xFFFF	Networking	2	0xFFFF
NB v 4.27B*	0x23 (35d)	Parity	0 – 4	Serial Interfacing	1	0
PC v 4.22*	0x1E (30d)	Power-up Mode	0 – 1	AT Command Mode Options	1	0
PW v 4.22*	0x1D (29d)	Pin Wake-up	0 – 1	Sleep (Low Power)	1	0
RE	0x0E (14d)	Restore Defaults	None	(Special)	n/a	none
RN v 4.22*	0x19 (25d)	Delay Slots	0 – 0xFF (slots)	Networking	1	0
RO v 4.2AA*	0x21 (33d)	Time before Transmission	0 – 0xFFFF (x 0.2 ms)	Serial Interfacing	2	0x20 (32d)
RP v 4.2AA*	0x22 (34d)	RSSI PWM Timer	0 - 0x7F (x 100 ms)	Diagnostic	1	0
RR v 4.22*	0x18 (24d)	Retries	0 – 0xFF	Networking	1	0
RS v 4.22*	0x1C (28d)	RSSI	0x06 – 0x36 (Read-only)	Diagnostic	1	none
RT	0x16 (22d)	DI2 Configuration	0 - 2	Serial Interfacing	1	0
SH v 4.27C*	0x25 (37d)	Serial Number High	0 – 0xFFFF (Read-only)	Diagnostic	2	none
SL v 4.27C*	0x26 (38d)	Serial Number Low	0 – 0xFFFF (Read-only)	Diagnostic	2	none
SM	0x01 (1d)	Sleep Mode	0 – 8	Sleep (Low Power)	1	0
ST	0x02 (2d)	Time before Sleep	0x10 – 0xFFFF (x 100 ms)	Sleep (Low Power)	2	0x64 (100d)
SY	0x17 (23d)	Time before Initialization	0 – 0xFF (x 100 ms)	Networking	1	0 (disabled)
TR v 4.22*	0x1B (27d)	Transmit Error Count	0 – 0xFFFF	Diagnostic	2	0
TT v 4.22*	0x1A (26d)	Streaming Limit	0 – 0xFFFF [0 = disabled]	Networking	2	0xFFFF
VR	0x14 (20d)	Firmware Version	0 x 0xFFFF (Read-only)	Diagnostic	2	none
WR	0x08 (8d)	Write	none	(Special)	n/a	none

* Firmware version in which the command was introduced. All subsequent firmware versions also support the command.

AT Commands (Long Reference)

XStream AT Commands in this section are organized into the following command categories:

- AT Command Mode Options
- Diagnostic
- Networking
- Serial Interfacing
- Sleep (Low Power)

Each AT Command is further described in the “XStream Advanced Programming & Configuration” manual. [Located on the MaxStream CD and on the web: www.maxstream.net]

Table 7. XStream AT Commands (Long Reference – Sorted by Command Category)
Modems expect numerical values in hexadecimal. “d” denotes decimal equivalents.

Command Category	AT Command	Binary Command	AT Command Description	Parameters	# Bytes Returned	Factory Default
(Special)	WR	0x08 (8d)	Write. Write parameters to radio modem’s non-volatile memory for changes to persist through next power-up or reset.	none	n/a	none
	RE	0x0E (14d)	Restore Defaults. Restore radio modem parameters to the factory default configuration.	none	n/a	none
AT Command Mode Options	AT	0x05 (5d)	Guard Time After. Set required DI pin silent time after the Command Sequence Characters of the AT Command Mode Sequence (BT+ CC + AT). The silent time is used to prevent inadvertent entrance into AT Command Mode.	Range: 0 – 0xFFFF (x 100 ms)	2	0x0A (10d)
	BT	0x04 (4d)	Guard Time Before. Set required DI pin silent time before the Command Sequence Characters of the Command Mode Sequence (BT+ CC + AT). The silent time is used to prevent inadvertent entrance into AT Command Mode.	Range: 0 – 0xFFFF (x 100 ms)	2	0x0A (10d)
	CC	0x13 (19d)	Command Sequence Character. Set the ASCII character to be used between Guard Times of the AT Command Mode Sequence (BT+ CC + AT). The AT Command Mode Sequence enters the radio modem to AT Command Mode (from Idle Mode).	Range: 0x20 – 0x7F	1	0x2B (plus sign (+) in ASCII)
	CN	0x09 (9d)	Exit AT Command Mode. Explicitly exit AT Command Mode and return modem to Idle Mode.	none	n/a	none
	CT	0x06 (6d)	AT Command Mode Timeout. Set time period of inactivity (no valid commands received) after which the radio modem automatically exits from Command Mode and returns to Idle Mode.	Range: 0x02 – 0xFFFF (x 100 ms)	2	0xC8 (200d)
	E0	0x0A (10d)	Echo Off. Turn off local echo in AT Command Mode.	none	n/a	none
	E1	0x0B (11d)	Echo On. Turn on local echo in AT Command Mode.	none	n/a	none
	PC v 4.22*	0x1E (30d)	Power-up Mode. Select initial mode of operation after power-up, reset and wake from pin sleep. Parameter value ‘1’ causes the radio modem to power directly to AT Command Mode instead of Idle Mode (default).	Range: 0 – 1 0 = Power-up to Idle Mode 1 = Power-up to AT Command Mode	1	0
Diagnostic	ER	0x0F (15d)	Receive Error Count. Number of RF Packets detected by the receiver but not sent out the DO pin of radio modem due to bit errors. ((May be written to clear count)	Range: 0 – 0xFFFF	2	0
	GD	0x10 (16d)	Receive Good Count. Number of RF Packets successfully received. (May be written to clear count)	Range: 0 – 0xFFFF	2	0
	RP v 4.2AA*	0x22 (34d)	RSSI PWM Timer. Set/Read PWM (Pulse Width Modulation) time. Enables output on the config pin (pin 9 of the OEM RF Module) to show signal strength of RF packets for duration of RP time.	Range: 0 – 0x7F (x 100 ms)	1	0 [disabled]

* Firmware version in which the AT Command was introduced. All subsequent firmware versions also support the command.

Table 7 (continued). XStream AT Commands (Long Reference – Sorted by Command Category)

Command Category	AT Command	Binary Command	AT Command Description	Parameters	# Bytes Returned	Factory Default
Diagnostic (continued)	RS v 4.22*	0x1C (28d)	RSSI. (Receive Signal Strength Indicator) Read the signal level of last good RF Packet received. Larger numbers indicate stronger signals.	Range: 0x06 – 0x36 (Read-only)	1	none
	SH v 4.27C*	0x25 (37d)	Serial Number High. Read High 16 bits of unique serial number of radio modem.	0 – 0xFFFF (Read-only)	2	none
	SL v 4.27C*	0x26 (38d)	Serial Number Low. Read Low 16 bits of unique serial number of radio modem.	0 – 0xFFFF (Read-only)	2	none
	TR v 4.22*	0x1B (27d)	Transmit Error Count. Number of RF packets sent with no ACK packet received. (When RR > 0).	Range: 0 – 0xFFFF	2	0
	VR	0x14 (20d)	Firmware Version. Read firmware version currently loaded on radio modem.	0 x 0xFFFF (Read-only)	2	none
Networking	DT	0x00 (0d)	Destination Address. Set the address that identifies the destination of the RF packet. Only radio modems having matching addresses can communicate with each other. If source addressing is disabled (MY = 0xFFFF), DT serves as both source and destination address.	Range: 0 – 0xFFFF	2	0
	HP	0x11 (17d)	Hopping Channel. Select hopping channel on which radio modem communicates. These channels are not non-interfering.	Range: 0 - 6	1	0
	ID v 4.27C*	0x27 (39d)	Modem VID. Read radio modem VID (Vendor Identification Number). Only radio modems with matching VIDs can communicate with each other.	Range: 0 – 0xFFFF (Read-only)	2	none
	MK	0x12 (18d)	Address Mask. Set address mask to configure local and global address space.	Range: 0 – 0xFFFF	2	0xFFFF (65535d)
	RN v 4.22*	0x19 (25d)	Delay Slots. Specify maximum number of delay slots used for random back-off algorithm after transmission failure.	Range: 0 – 0xFF (slots)	1	0
	RR v 4.22*	0x18 (24d)	Retries. Set maximum number of RF Packet delivery attempts. Receiving modem(s) must also have RR set to a non-zero value.	Range: 0 – 0xFF	1	0 [disabled]
	SY	0x17 (23d)	Time before Initialization. Set mode that allows RF packets to be received with a shorter RF Initializer. Warning: This command is only useful in a limited number of applications. Please see XStream Advanced manual before using.	Range: 0 – 0xFF (x 100 ms)	1	0 [disabled]
	TT v 4.22*	0x1A (26d)	Streaming Limit. Set maximum number of continuous bytes transmitted by one radio modem before forcing a delay that allows other radio modems to transmit.	Range: 0 – 0xFFFF	2	0xFFFF (65535d)
Serial Interfacing	BD	0x15 (21d)	Baud Rate. Set serial data rate (baud rate at which radio modem interfaces with host). Serial data rate is different than RF data rate which is the baud rate at which data is transmitted over-the-air. If serial data rate is set higher than the RF data rate, CTS may need to be observed in order to prevent DI buffer overrun.	Range: 0 – 6 0 = 1200 bps 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 38400 6 = 57600	1	Set to equal modem's fixed RF data rate.
	CD v 4.29D*	0x28 (40d)	DO3 Configuration. Redefines the RX LED I/O line – pin 7 of the OEM RF Module.	Range: 0 – 2 0 = RX LED 1 = static high 2 = static low	1	0
	CS v 4.27D*	0x1F (31d)	DO2 Configuration. Select behavior of Digital Output 2 (DO2 is the CTS signal and pin 1 of OEM RF Module).	Range: 0 – 4 0 = normal RS-232 CTS 1 = RS-485 enable low 2 = static high 3 = RS-485 enable high 4 = static low	1	0
	FL	0x07 (7d)	Software Flow Control. Enable serial software flow control (XON/XOFF) on the radio modem. (Hardware flow control (CTS) is on by default.)	Range: 0 - 1 0 = disable 1 = enable	1	0
	FT v 4.27B*	0x24 (36d)	Flow Control Threshold. Assert CTS or XOFF when FT bytes are in the receiver DO buffer.	Range: 0 - Receive buffer size (bytes)	2	DO buffer size less 0x11 bytes

* Firmware version in which the AT Command was introduced. All subsequent firmware versions also support the command.

Table 7 (continued). XStream AT Commands (Long Reference– Sorted by Command Category)

Command Category	AT Command	Binary Command	AT Command Description	Parameters	# Bytes Returned	Factory Default
Serial Interfacing (continued)	NB v 4.27B*	0x23 (35d)	Parity. Select parity format. Settings 0-4 transfer only 8 bits out the antenna port and generate the parity bit on the receiving radio modem side.	Range: 0 – 4 0 = 8-none-1 or 7-any-1 1 = 8-even-1 2 = 8-odd-1 3 = 8-mark-1 4 = 8-space-1	1	0
	RO v 4.2AA*	0x21 (33d)	Time before Transmission. Begin RF transmission after DI silent time of RO. TX begins when RO criteria are met.	Range: 0 – 0xFFFF (x 0.2 ms) (0 = Disabled)	2	20 (32d)
	RT	0x16 (22d)	DI2 Configuration. Select function for Digital Input 2 (RTS / CMD signal - pin 5 of OEM RF Module).	Range: 0 - 2 0 = Disabled 1 = Binary commands 2 = RTS flow control	1	0
Sleep (Low Power)	FH	0x0D (13d)	Force Wake-up Initializer. Force Wake-up Initializer to be sent on next transmission.	none	n/a	none
	HT	0x03 (3d)	Time before Wake-up Initializer. Set time period of inactivity (no serial or RF data is sent or received) before a Wake-up Initializer is sent. Base station tracks awake-status of remote radios. HT of base radio should be set shorter than ST of remote radios.	Range: 0 – 0xFFFF (x 100 ms)	2	0xFFFF [no initializer will be sent]
	LH	0x0C (12d)	Wake-up Initializer Timer. Set time of the Wake-up Initializer used to wake remote radios that are in cyclic sleep. Length of Wake-up Initializer should be longer than that of the remote modem's cyclic sleep cycle (SM 3 - 8).	Range: 0 – 0xFF (x 100 ms)	1	1
	PW v 4.22*	0x1D (29d)	Pin Wake-up. Enable pin wake-up from Cyclic Sleep Mode.	Range: 0 – 1 0 = disabled 1 = enabled	1	0
	SM	0x01 (1d)	Sleep Mode. Specify Sleep Mode settings.	Range: 0 – 8 0 = No sleep 1 = Pin Sleep 2 = Serial Port Sleep 3 = Cyclic 0.5 seconds 4 = Cyclic 1 seconds 5 = Cyclic 2 seconds 6 = Cyclic 4 seconds 7 = Cyclic 8 seconds 8 = Cyclic 16 seconds	1	0
	ST	0x02 (2d)	Time before Sleep. Set time period of inactivity (no serial or RF data is sent or received) before activating Sleep Mode. Use with Cyclic Sleep and Serial Port Sleep. (see SM Command)	Range: 0x10 – 0xFFFF (x 100 ms)	2	0x64 (100d)

* Firmware version in which the AT Command was introduced. All subsequent firmware versions also support the command.

Configuration Software

X-CTU Software

X-CTU is MaxStream-provided software used to interface with and configure XStream OEM RF Modules. The software application is organized into the following four tabs:

- **PC Settings** tab - Setup PC serial ports to interface with an XStream Module assembly
- **Range Test** tab – Test XStream Module's range and monitor packets sent and received
- **Terminal** tab – Configure and read XStream Module parameters using AT Commands
- **Modem Configuration** tab – Configure and read any XStream Radio Modem parameters

Figure 12. X-CTU User Interface (PC Settings, Range Test, Terminal & Module Configuration tabs)

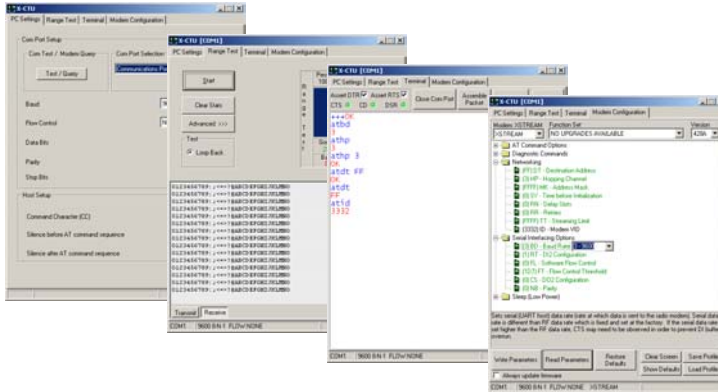
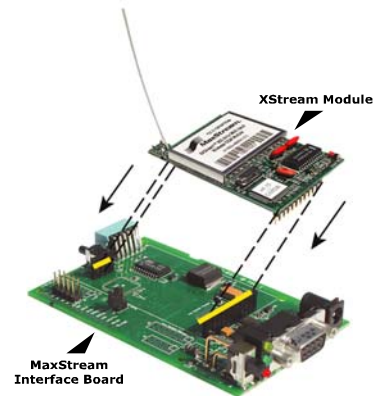


Figure 13. Module Assembly



Install X-CTU software

Double-click the "setup_X-CTU.exe" file and follow prompts of the installation screens. This file is located in the 'software' folder of the MaxStream CD and also under the 'Downloads' section of the following web page: www.maxstream.net/helpdesk/

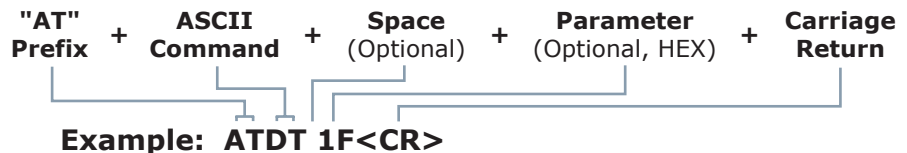
Using X-CTU software

In order to use the X-CTU software, a module assembly (an XStream Module mounted to a MaxStream Interface Board) must be connected to the serial port of a PC. The baud rate and parity settings of the serial port ("PC Settings" tab) must match those of the module (BD (Baud Rate) and NB (Parity) Commands on the "Modem Configuration" tab).

Serial Communications Software

A terminal program has been built into the X-CTU Software. Other terminal programs such as "HyperTerminal" can also be used. When issuing AT Commands through a terminal program interface, use the following syntax:

Figure 14. Syntax for sending AT Commands:



NOTE: To read a parameter value stored in a register, leave the parameter field blank.

Example issues DT Command to change destination address of the module to "0x1F". WR (Write) Command would also have to be issued in order to save the new value to the module's non-volatile (long term) memory.

Appendix A: Agency Certifications

FCC Certification

The MaxStream XStream OEM RF Module complies with Part 15 of the FCC Rules. In order to inherit MaxStream’s FCC Certification, compliance requires the following be stated:

FCC ID: **OUR9XSTREAM** (for 900 MHz) or **OUR-24XSTREAM** (for 2.4 GHz)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

OEM Labeling Requirements

Label Warning

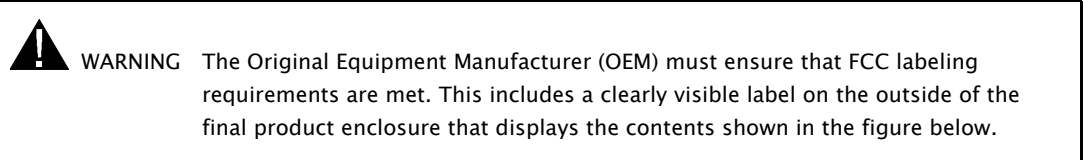


Figure 15. Required FCC Label for OEM products containing 9XStream (900 MHz) OEM RF Module

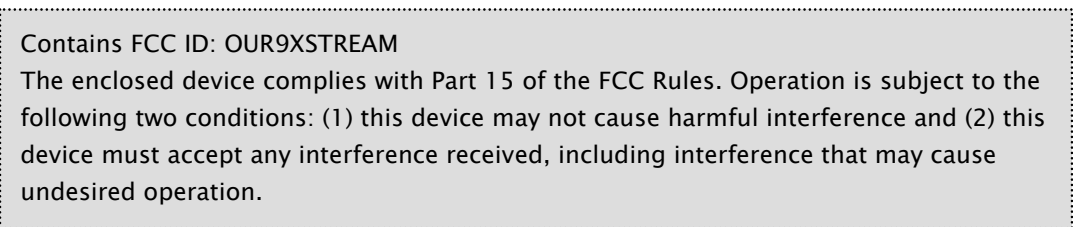
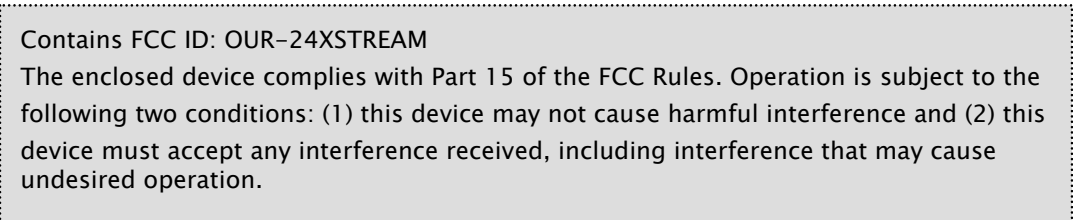


Figure 16. Required FCC Label for OEM products containing 24XStream (2.4 GHz) OEM RF Module



FCC Notices

Adherence to the following is required:

IMPORTANT: The 9XStream (900 MHz) and 24XStream (2.4 GHz) OEM Modules have been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Changes or modifications not expressly approved by MaxStream could void the user's authority to operate the equipment.

IMPORTANT: OEMs must test their final product to comply with unintentional radiators (FCC section 15.107 and 15.109) before declaring compliance of their final product to Part 15 of the FCC Rules.

IMPORTANT: The XStream OEM RF Modules have been certified for remote and base radio applications. If the XStream will be used for portable applications, the device must undergo SAR testing.

NOTE:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Antenna Warning



WARNING: This device has been tested with Reverse Polarity SMA connectors with the antennas listed in Tables 8 & 9 of Appendix A. When integrated in OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas not listed in the tables must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).

9XStream (900 MHz) Approved Antenna List

Table 8. Antennas approved for use with 9XStream (900 MHz) OEM RF Modules

Manufacturer	Part Number	Type	Gain	Application	Minimum Separation Distance
*	*	Yagi	6.2 dBi	Fixed/Mobile **	20cm
*	*	Yagi	7.2 dBi	Fixed/Mobile **	20cm
MaxStream	A09-Y8	Yagi	8.2 dBi	Fixed/Mobile **	20cm
*	*	Yagi	9.2 dBi	Fixed/Mobile **	20cm
*	*	Yagi	10.2 dBi	Fixed/Mobile **	20cm
MaxStream	A09-Y11 (FCC pending)	Yagi	11.2 dBi	Fixed/Mobile **	20cm
MaxStream	A09-F2	Omni Direct.	2.2 dBi	Fixed **	20cm
MaxStream	A09-F5	Omni Direct.	5.2 dBi	Fixed **	20cm
MaxStream	A09-F8	Omni Direct.	8.2 dBi	Fixed **	20cm
*	*	Omni Direct.	9.2 dBi	Fixed **	20cm
*	*	Omni Direct.	7.2 dBi	Fixed **	20cm
MaxStream	A09-M7	Omni Direct.	7.2 dBi	Fixed **	20cm
MaxStream	A09-H	1/2 wave antenna	2.1 dBi	Fixed/Mobile **	20cm
MaxStream	A09-HBMM-P5I	1/2 wave antenna	2.1 dBi	Fixed/Mobile **	1cm
MaxStream	A09-QBMM-P5I	1/4 wave antenna	1.9 dBi	Fixed/Mobile **	1cm
*	*	1/4 wave integrated wire antenna	1.9 dBi	Fixed/Mobile **	1cm

* FCC-approved antennas not inventoried by MaxStream – Contact MaxStream (801) 765-9885 for more information.

** Can be approved for portable applications if integrator gains approval through SAR testing

Over 100 additional antennas that have been tested and are approved for use with MaxStream 900 MHz Radio Modems (including “Mag Mount”, “Dome”, “Multi-path” and “Panel” antennas). Because of the large number of approved antennas, MaxStream requests that you send specific information about an antenna you would like to use with the modem and MaxStream will evaluate whether the antenna is covered under our FCC filing. Contact MaxStream at (801) 765-9885.

MaxStream radio modems are pre-FCC approved for use in fixed base station and mobile applications. As long as the antenna is mounted at least 20 cm (8 in) from nearby persons, the application is considered a mobile application. If the antenna will be mounted closer than 20 cm to nearby persons, then the application is considered “portable” and requires an additional test be performed on the final product. This test is called the Specific Absorption Rate (SAR) testing and measures the emissions from the radio modem and how they affect the person.

RF Exposure



WARNING: For Portable Antenna Applications: This equipment is approved only for mobile and base station transmitting devices, separation distances of (i) 20 centimeters or more for antennas with gains < 6 dBi or (ii) 2 meters or more for antennas with gains \geq 6 dBi should be maintained between the antenna of this device and nearby persons during operation. To ensure compliance, operation at distances closer than this is not recommended.

The preceding statement must be included as a CAUTION statement in manuals for OEM products to alert users on FCC RF Exposure compliance.

In order to fulfill the FCC Certification requirements, the OEM must comply with FCC regulations:

1. The system integrator must ensure that the text on the external label provided with this device is placed on the outside of the final product [Figure 17].
2. The 9XStream OEM RF Module (900 MHz) may be used only with Approved Antennas that have been tested with this module. [Table 8]

24XStream (2.4 GHz) Approved Antenna List

Table 9. Antennas approved for use with 24XStream (2.4 GHz) OEM RF Modules

Manufacturer	Part Number	Type	Gain	Application	Minimum Separation Distance
*	*	Yagi	6 dBi	Fixed **	2m
*	*	Yagi	8.8 dBi	Fixed **	2m
*	*	Yagi	9 dBi	Fixed **	2m
*	*	Yagi	10 dBi	Fixed **	2m
*	*	Yagi	11 dBi	Fixed **	2m
*	*	Yagi	12 dBi	Fixed **	2m
*	*	Yagi	12.5 dBi	Fixed **	2m
*	*	Yagi	13.5 dBi	Fixed **	2m
*	*	Yagi	15 dBi	Fixed **	2m
*	*	Omni Direct	2.1 dBi	Mobile/Fixed **	20cm
*	*	Omni Direct	3 dBi	Mobile/Fixed **	20cm
*	*	Omni Direct	5 dBi	Mobile/Fixed **	20cm
*	*	Omni Direct	7.2 dBi	Fixed	2m
*	*	Omni Direct	8 dBi	Fixed	2m
*	*	Omni Direct	9.5 dBi	Fixed **	2m
*	*	Omni Direct	10 dBi	Fixed **	2m
*	*	Omni Direct	12 dBi	Fixed **	2m
*	*	Omni Direct	15 dBi	Fixed **	2m
MaxStream	A24-P8	Panel	8.5 dBi	Fixed **	2m
MaxStream	A24-P13	Panel	13 dBi	Fixed **	2m
*	*	Panel	14 dBi	Fixed **	2m
*	*	Panel	15 dBi	Fixed **	2m
*	*	Panel	16 dBi	Fixed **	2m
MaxStream	A24-P19	Panel	19 dBi	Fixed **	2m
MaxStream	A24-HABMM-P6I	Dipole	2.1 dBi	Mobile/Fixed **	20cm
MaxStream	A24-HBMM-P6I	Dipole	2.1 dBi	Mobile/Fixed **	20cm
MaxStream	A24-HABSM	Dipole	2.1 dBi	Mobile/Fixed **	20cm
MaxStream	A24-QABMM-P6I	Monopole	1.9 dBi	Mobile/Fixed **	20cm
*	A24-Q1	Monopole	1.9 dBi	Mobile/Fixed **	20cm
*	*	Monopole	1.9 dBi	Mobile/Fixed **	20cm

* FCC-approved antennas not inventoried by MaxStream – Contact MaxStream (801) 765-9885 for more information.

** Can be approved for portable applications if integrator gains approval through SAR testing

RF Exposure



WARNING: For Portable Antenna Applications: This equipment is approved only for mobile and base station transmitting devices, separation distances of (i) 20 centimeters or more for antennas with gains < 6 dBi or (ii) 2 meters or more for antennas with gains \geq 6 dBi should be maintained between the antenna of this device and nearby persons during operation. To ensure compliance, operation at distances closer than this is not recommended.

The preceding statement must be included as a CAUTION statement in manuals for OEM products to alert users on FCC RF Exposure compliance.

In order to fulfill the FCC Certification requirements, the OEM must comply with FCC regulations:

1. The system integrator must ensure that the text on the external label provided with this device is placed on the outside of the final product [Figure 18].
2. The 24XStream (2.4 GHz) OEM RF Module may be used only with Approved Antennas that have been tested with this module. [Table 9]

European Compliance (2.4 GHz only)

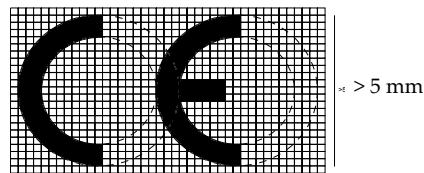
The 24XStream has been certified for several European countries. For a complete list, go to www.maxstream.net.

If the 24XStream modules are incorporated into a product, the manufacturer must ensure compliance of the final product to the European harmonized EMC and low-voltage/safety standards. A Declaration of Conformity must be issued for each of these standards and kept on file as described in Annex II of the R&TTE Directive. Furthermore, the manufacturer must maintain a copy of the XStream user manual documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. Changes or modifications not expressly approved by MaxStream could void the user's authority to operate the equipment.

OEM Labeling Requirements

The 'CE' marking must be affixed to a visible location on the OEM product.

Figure 17. CE Label Requirements



The CE mark shall consist of the initials "CE" taking the following form:

- If the CE marking is reduced or enlarged, the proportions given in the above graduated drawing must be respected.
- The CE marking must have a height of at least 5mm except where this is not possible on account of the nature of the apparatus.
- The CE marking must be affixed visibly, legibly, and indelibly.

Furthermore, since the usage of the 2400 – 2483.5 MHz band is not harmonized throughout Europe, the Restriction sign must be placed to the right of the 'CE' marking as shown below. See the R&TTE Directive, Article 12 and Annex VII for more information

Figure 18. CE Label Required on OEM Equipment



Restrictions

France – France imposes restrictions on the 2.4 GHz band. Go to www.art-telecom.fr or contact MaxStream for more information.

Norway – Norway prohibits operation near Ny-Alesund in Svalbard. More information can be found at the Norway Posts and Telecommunications site (www.npt.no).

24XStream Declarations of Conformity

MaxStream has issued Declarations of Conformity for the 24XStream modules concerning emissions, EMC and safety. These files are located in the 'documentation' folder of the MaxStream CD.

Important Note

MaxStream does not list the entire set of requirements that must be met for each country. MaxStream customers assume full responsibility for learning and meeting the required guidelines for each country in their distribution market. For more information relating to European compliance of an OEM product incorporating the 24XStream module, contact MaxStream, or refer to the following web sites:

CEPT ERC 70-03E – Technical Requirements, European restrictions and general requirements: Available at www.ero.dk/

R&TTE Directive – Equipment requirements, placement on market: Available at www.ero.dk/

Notifications and Required Information

Since the 2.4 GHz band is not harmonized throughout Europe, a notification must be sent to each country prior to shipping product according to Article 6.4 of the R&TTE Directive. A list of national contacts for most European countries may be found at www.ero.dk/.

The following technical data (relating to the 24XStream) is often required in filling out a notification form.

- Frequency Band: 2400 – 2483.5 MHz
- Modulation: Frequency Shift Keying
- Channel Spacing: 400 kHz
- ITU Classification: 400KF1D
- Output Power: 100 mW EIRP
- Notified Body Number: 0891

Contact MaxStream (801) 765-9885 if additional information is required.

Table 10. Antennas approved for use with 24XStream (2.4 GHz) OEM RF Modules in Europe

Manufacturer	Part Number	Type	Gain	Application	Minimum Separation Distance
MaxStream	A24-HABMM-P6I	Dipole	2.1 dBi	Mobile/Fixed *	20cm
MaxStream	A24-HBMM-P6I	Dipole	2.1 dBi	Mobile/Fixed *	20cm
MaxStream	A24-HABSM	Dipole	2.1 dBi	Mobile/Fixed *	20cm
MaxStream	A24-QABMM-P6I	Monopole	1.9 dBi	Mobile/Fixed *	20cm
MaxStream	A24-QBMM-P6I	Monopole	1.9 dBi	Mobile/Fixed *	20cm
MaxStream	A24-Q1	Monopole	1.9 dBi	Mobile/Fixed *	20cm

* Can be approved for portable applications if integrator gains approval through SAR (Specific Absorption Rate) testing.

Appendix B: Specifications

XStream OEM RF Module Specifications

Table 11. XStream OEM RF Module Specifications

Specification	9XStream (900 MHz) Module	24XStream (2.4 GHz) Module
Performance		
Indoor/Urban Range	Up to 1500' (450 m)	Up to 600' (180 m)
Outdoor LOS Range	Up to 7 miles (11 km) w/ dipole antenna Up to 20 miles (32 km) w/ high-gain antenna	Up to 3 miles (5 km) w/ dipole antenna Up to 10 miles (16 km) w/ high-gain antenna
Serial Data Throughput	9600 bps	19200 bps
RF Data Rate (Baud)	10,000 bps	20,000 bps
Transmit Power Output	100 mW (20 dBm)	50 mW (17 dBm)
Receiver Sensitivity	-110 dBm	-107 dBm
General		
Frequency	902-928 MHz	2.4000-2.4835 GHz
Spread Spectrum	Frequency Hopping, Wide band FM modulator	
Network Topology	Peer-to-Peer, Point-to-Multipoint, Point-to-Point, Multidrop	
Channel Capacity	7 hop sequences share 25 frequencies	
Serial Data Interface	RS-232/422/485	
I/O Data Rate	Software selectable 1200 - 57600 bps	
Power Requirements		
Supply Voltage	5 VDC (± 0.25 V) regulated	
Transmit Current	150 mA	
Receive Current	50 mA	
Power Down Current	< 26 μ A	
Physical Properties		
Module Board Size	1.600" x 2.825" x 0.350" (4.06 cm x 6.86 cm x 0.89 cm)	
Weight	0.8 oz (24 g)	
Connector	11-pin & 4-pin, 0.1" spaced male Berg-type headers	
Operating Temperature	0 to 70° C (commercial), -40 to 85° C (industrial)	
Antenna		
Integrated Wire (optional)	¼ wave monopole, 3" (7.62 cm) length, 1.9 dBi Gain	
Connector (optional)	Reverse-polarity SMA or MMCX	
Impedance	50 ohms unbalanced	
Certifications (visit www.MaxStream.net for complete list)		
FCC Part 15.247	OUR9XSTREAM	OUR-24XSTREAM
Industry Canada (IC)	4214A-9XSTREAM	4214A 12008
Europe	N/A	ETSI, CE

Appendix C:

Additional Information

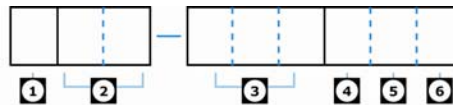
1 Year Warranty

XStream OEM RF Modules from MaxStream, Inc. (the "Product") are warranted against defects in materials and workmanship under normal use, for a period of 1-year from the date of purchase. In the event of a product failure due to materials or workmanship, MaxStream will repair or replace the defective product. For warranty service, return the defective product to MaxStream, shipping prepaid, for prompt repair or replacement.

The foregoing sets forth the full extent of MaxStream's warranties regarding the Product. Repair or replacement at MaxStream's option is the exclusive remedy. THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND MAXSTREAM SPECIFICALLY DISCLAIMS ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MAXSTREAM, ITS SUPPLIERS OR LICENSORS BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT, FOR ANY LOSS OF USE, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS, OR OTHER INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT, TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES. THEREFOR, THE FOREGOING EXCLUSIONS MAY NOT APPLY IN ALL CASES. This warranty provides specific legal rights. Other rights which vary from state to state may also apply.

XStream OEM RF Module Part Numbers

Figure 19. XStream OEM RF Module Part Numbers Key



Divisions of the XStream OEM RF Module part number:

<p>1 MaxStream Product Family X = XStream XC = XCite</p> <p>2 Operating Frequency 09 = 902-928 MHz 24 = 2.4000-2.4835 GHz H9 = 923 MHz (Australia and Israel)</p> <p>3 Fixed RF Data Rate (Baud) 001 = 1200 Baud 009 = 9600 019 = 19200</p>	<p>4 Wire Antenna N = No Wire Antenna W = Wire Antenna</p> <p>5 Connector N = No Connector M = MMCX Connector S = RPSMA Connector</p> <p>6 Module Temperature Rating C = Commercial: 0 to 70° C I = Industrial: -40 to 85° C, Conformal Coated T = Tested Industrial: -40 to 85° C, Conformal Coated & 100% tested</p>
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For example: X09-009NSC
 (XStream 900 MHz Module, 9600 Baud, No Wire Antenna, RPSMA Connector, Commercial Rating)

Appendix D: Troubleshooting & FAQs

Contact MaxStream

Free and unlimited technical support is included with every MaxStream Radio Modem sold.

Please use the following resources for additional support:

Documentation:	www.maxstream.net/helpdesk/download.php
Technical Support:	Phone. (866) 765-9885 U.S. & Canada (801) 765-9885 Worldwide
	Live Chat. www.maxstream.net
	E-Mail. rf-xperts@MaxStream.net

MaxStream office hours are 8:00 am – 5:00 pm [U.S. Mountain Standard Time]