STX3 Users Manual

Preliminary Release
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1 Introduction

1.1 Purpose

This document describes the physical, electrical, and functional characteristics of the STX3 satellite transmitter module. The information contained in this document is intended to provide the end user with the necessary technical information required to use the module in a custom application.

This document is intended to be used by engineers and technical management and assumes a general knowledge of basic engineering practices by the user.

1.2 Applicable Documents

1.3 Description

The STX 3 is a simplex Satellite transmitter designed to send small packets of user defined data to a network of low earth orbiting (LEO) satellites using the Globalstar simplex satellite network. The received data is then forwarded to a user defined network interface that may be in the form of an FTP host, email account, or HTTP host where the user will interpret the data for further processing.

The STX3 is a surface mount module designed to attach to a user defined host PCB which must provide power, an RF connection to the transmit antenna, and communications with a host processor which will control the operation of the STX3. All electrical connections are provided via the castellated pads on the perimeter of the PCB.

The STX3 is a small, low-profile device with the dimensions shown below.

![Figure 1](dimensions in inches)
2 Application

2.1 Theory of Operation

The STX3 operates on the Globalstar LEO satellite network. LEO (Low Earth Orbit) means that there are a number of satellites in low earth orbit that constantly orbit the planet and can communicate with Globalstar devices that are within range of its current position.

Since the satellite position is constantly changing, simplex devices on the ground will transmit (with no knowledge of any of the satellites locations) and the transmission may be received by one or more satellites. These satellites will then relay the message to the nearest satellite gateway as shown below. Once received by the satellite gateway, the simplex message will be delivered to the simplex gateway where redundant messages are discarded and the data from the message is sent to the OEM via the Internet.
Messages are composed of 1 or more 9-byte payloads. The STX3 can only transmit 9-byte on-air messages, so user payloads greater than 9 bytes will require multiple on-air messages to be transmitted for each user payload.

There are brief periods of time where there is no satellite in range of the simplex transmitters due to obstructions and/or satellite coverage geometry. Since a simplex device has no way of knowing if a transmitted message has been successfully received, the STX3 device is designed to send multiple (redundant) transmissions for each message being sent over the Globalstar network. The default value for the number of redundant transmissions per message is 3. This means that each message sent to the STX3 will be transmitted 3 times. Each transmission will contain the exact same data payload. The redundant transmissions of each message will be sent on a randomized 5-minute nominal interval.

The transmission sequence for a single-packet message using the default setting of 3 redundant transmissions is shown below.
The transmission sequence for a two-packet message using the default setting of 3 redundant transmissions is shown below.

For normal conditions where the transmitter has an open view of the sky, this will result in a better than 99% chance that the message will be received.

### 2.2 Block Diagram

The basic elements of a design utilizing the STX3 simplex transmitter are shown below.
The STX3 provides separate power supply inputs. The digital power supply input (VDIG) is a low power input which powers the digital portion of the STX3. This provides the capability to leave the STX3 in a low power consumption state when the transmitter RF section is idle. The RF power supply input is a high power input which is only required while the STX3 is transmitting a data packet. Since the transmission duty cycle is very low, this supply may be turned off the majority of the time and only active during the transmission of a packet. Due to the random nature of the burst transmissions, and open collector output (PWR_EN) is provided by the STX3 which can directly control the high current supply for VRF. This will ensure that the RF power supply is enabled for the minimum amount of time to complete each transmission. It may also be monitored by the host to determine when each burst has been completed without the need to query the STX3 via the serial host interface.
3 Physical Characteristics

Figure 5  Top View
Figure 6 Recommended PCB footprint layout (dimensions in inches)
<table>
<thead>
<tr>
<th>PIN</th>
<th>NAME</th>
<th>TYPE</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CTS</td>
<td>Output</td>
<td>5V tolerant, weak internal pull-up, may be pulled up to 5V max external</td>
</tr>
<tr>
<td>2</td>
<td>RTS</td>
<td>Input</td>
<td>5V tolerant, weak internal pull-up</td>
</tr>
<tr>
<td>3</td>
<td>RESERVED</td>
<td>No Connect</td>
<td>Do NOT connect</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connect</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>No Connect</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>RESERVED</td>
<td>No Connect</td>
<td>Do NOT connect</td>
</tr>
<tr>
<td>7</td>
<td>VRF</td>
<td>Power In</td>
<td>2.0 to 5.0 Volts, 500 mA max load @ 3.3V</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>RFOUT</td>
<td>Output</td>
<td>50 ohm single ended antenna connection, use impedance matched trace</td>
</tr>
<tr>
<td>15</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>RESERVED</td>
<td>No Connect</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>RESERVED</td>
<td>No Connect</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>RESERVED</td>
<td>No Connect</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>PWR_EN</td>
<td>Output</td>
<td>Open collector output to control VRF supply</td>
</tr>
<tr>
<td>25</td>
<td>NC</td>
<td>No Connect</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>TxD</td>
<td>Output</td>
<td>5V tolerant, weak internal pull-up, may be pulled up to 5V max external</td>
</tr>
<tr>
<td>27</td>
<td>RxD</td>
<td>Input</td>
<td>5V tolerant, weak internal pull-up</td>
</tr>
<tr>
<td>28</td>
<td>Test2</td>
<td>Input</td>
<td>5V tolerant, weak internal pull-up</td>
</tr>
<tr>
<td>29</td>
<td>Test1</td>
<td>Input</td>
<td>5V tolerant, weak internal pull-up</td>
</tr>
<tr>
<td>30</td>
<td>RESERVED</td>
<td>No Connect</td>
<td>Do NOT connect</td>
</tr>
<tr>
<td>31</td>
<td>RESET</td>
<td>Input</td>
<td>Only drive with open collector, no external voltage to be applied</td>
</tr>
<tr>
<td>32</td>
<td>VDIG</td>
<td>Power In</td>
<td>3.0 to 5.0 Volts, 50 mA max load @ 3.3V</td>
</tr>
</tbody>
</table>

**Operating Temperature Range**  
-40 to +85 °C

**Digital Power Supply Operational Voltage**  
2.0 to 5.0 Volts

**RF Power Supply Voltage**  
3.0 to 5.0 Volts
### Operational Modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep Mode</td>
<td>Vcc is applied to the unit, no transmissions are pending, no serial activity</td>
</tr>
<tr>
<td>Active Mode</td>
<td>The STX3 is active and responding to the serial port but is not transmitting</td>
</tr>
<tr>
<td>Standby Mode</td>
<td>The STX3 is inactive between transmission bursts, but is not transmitting</td>
</tr>
<tr>
<td>Transmit Mode</td>
<td>The unit is transmitting an RF packet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX output power</td>
<td>25º C, 50 ohm load, Vcc = 3.3 volts</td>
<td>18</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output power tolerance</td>
<td>25º C, Vcc = 3.3 volts</td>
<td>±1</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output power tolerance</td>
<td>-40-85º C, Vcc = 3.3 volts</td>
<td>±2</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Transmit mode supply current</td>
<td>25º C, 50 ohm load, Vcc = 3.3 volts</td>
<td>350</td>
<td>400</td>
<td>450</td>
<td>mA</td>
</tr>
<tr>
<td>Active mode supply current</td>
<td>25º C, Vcc = 3.3 volts</td>
<td>36</td>
<td></td>
<td></td>
<td>uA</td>
</tr>
<tr>
<td>Standby mode supply current</td>
<td>25º C, Vcc = 3.3 volts</td>
<td>10</td>
<td></td>
<td></td>
<td>uA</td>
</tr>
<tr>
<td>Sleep mode supply current</td>
<td>25º C, Vcc = 3.3 volts</td>
<td>6</td>
<td></td>
<td></td>
<td>uA</td>
</tr>
</tbody>
</table>

4 Application Programming Interface

4.1 Serial Port

A half-duplex (0-3.0V) TTL asynchronous serial port (UART) is the primary interface to the user equipment. The serial port operates with the serial parameters of 9600bps, 8 data bits, no parity, 1 stop bit.

The RX data input and the RTS inputs are 5V tolerant. The TX data and CTS outputs are 0-3.0V TTL.

RS232 input levels are not supported. RS232 data must be converted to TTL before being sent to the unit.

Each command from the DTE to the modem (STX) is sent in a serial packet. Upon receiving the command, the modem answers to the DTE and, if applicable, executes the command.

In order to wake up the modem (STX) from sleep mode and to indicate the end of the serial packet, each serial packet must be framed by activating RTS before the first byte of the command and deactivating RTS after the last byte of the command.
4.2 Serial Packet Mode

This mode is the legacy mode of operation as implemented in the STX2 which consists of binary data packets.

4.2.1 Serial Packet Format

<table>
<thead>
<tr>
<th>Preamble (1 byte)</th>
<th>Length (1 byte)</th>
<th>Command (1 byte)</th>
<th>Data (variable length)</th>
<th>CRC (2 bytes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preamble</td>
<td>Fixed pattern 0xAA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>Total number of bytes in the serial packet including the preamble</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Command</td>
<td>Command type (See Table 5 Serial Packet Type). Responses to commands carry the same command type as the command that initiated the answer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td>Data associated with the command or answer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRC</td>
<td>16 bit CRC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7 Serial Packet Format

4.2.2 Serial Packet Commands

For all serial packet commands as described below:

- AA is the Preamble.
- NN is the Length.
- XX is an unspecified byte value
- CLSB is the least significant CRC byte
- CMSB is the most significant CRC byte
• If an improperly formatted command is received, the STX3 will return a NAK response: 
  AA 05 FF A1 CB

4.2.2.1  Send Data (0x00)

The Send Data command requests the STX3 to send from 1 to 144 data bytes over the Globalstar Simplex network.

0x00

<table>
<thead>
<tr>
<th>header</th>
<th>len</th>
<th>cmd</th>
<th>payload 1</th>
<th>payload 2</th>
<th>payload 3</th>
<th>..</th>
<th>payload N</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>NN</td>
<td>00</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>CLSB</td>
<td>CMSB</td>
</tr>
</tbody>
</table>

Example Command:  AA 0E 00 01 02 03 04 05 06 07 08 09 BE E8

Response:  AA 05 00 D9 C4

The example above commands the STX3 to send 9 bytes of user defined data over the Globalstar Simplex network. If the STX3 receives a properly formatted Send Data command, it returns an acknowledge response as shown above. If the command is not properly formatted, it will return the NAK response AA 05 FF A1 CB.

4.2.2.2  Query Electronic Serial Number (ESN) (0x00)

The Electronic Serial Number command requests the STX3 to respond with the units Electronic Serial Number (ESN).

0x01

<table>
<thead>
<tr>
<th>header</th>
<th>len</th>
<th>Cmd</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>05</td>
<td>01</td>
<td>50</td>
<td>D5</td>
</tr>
</tbody>
</table>

Command:  AA 05 01 50 D5

Response:

<table>
<thead>
<tr>
<th>header</th>
<th>len</th>
<th>Cmd</th>
<th>ESN</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>09</td>
<td>01</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
</tr>
</tbody>
</table>

Example Response:  AA 09 01 00 23 18 60 86 7A

Where the ESN returned is 2300000.

4.2.2.3  Abort Transmission (0x03)

The Abort Transmission command requests the STX3 to abort the current message transmit sequence over the Globalstar Simplex network.

0x03

<table>
<thead>
<tr>
<th>header</th>
<th>len</th>
<th>Cmd</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Command: AA 05 03 42 F6
Response: AA 05 03 42 F6

### 4.2.2.4 Query Bursts Remaining (0x04)

The Query Bursts Remaining command requests the STX3 to return the current number of bursts remaining in the current message transmit sequence over the Globalstar Simplex network.

0x04

```
<table>
<thead>
<tr>
<th>header</th>
<th>len</th>
<th>cmd</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>05</td>
<td>04</td>
<td>FD</td>
<td>82</td>
</tr>
</tbody>
</table>
```

Command: AA 06 04 00 F4 33
Response:

```
<table>
<thead>
<tr>
<th>Header</th>
<th>Len</th>
<th>04</th>
<th>count</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>05</td>
<td>04</td>
<td>XX</td>
<td>CC</td>
<td>CC</td>
</tr>
</tbody>
</table>
```

Example Response: AA 06 04 00 F4 33
Where the bursts remaining returned is: 0

### 4.2.2.5 Query Firmware Version (0x05)

The Query Firmware Version command requests the STX3 to return the current firmware version.

0x05

```
<table>
<thead>
<tr>
<th>header</th>
<th>Len</th>
<th>cmd</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>05</td>
<td>05</td>
<td>74</td>
<td>93</td>
</tr>
</tbody>
</table>
```

Command: AA 05 05 74 93
Response:

```
<table>
<thead>
<tr>
<th>header</th>
<th>Len</th>
<th>04</th>
<th>FW major</th>
<th>FW minor</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>08</td>
<td>05</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>CC</td>
</tr>
</tbody>
</table>
Example Response:  AA 08 05 01 00 07 57 44

Where the firmware version returned is:  1.07

4.2.2.6  Setup (0x06)

The Setup command requests the STX3 to use the specified current setup parameters. These are stored in non-volatile memory.

0x06
Command:

```
<table>
<thead>
<tr>
<th>header</th>
<th>len</th>
<th>RF channel</th>
<th># of Bursts</th>
<th>Interval Min</th>
<th>Interval Max</th>
<th>RESERVED</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>0E</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>CC</td>
<td>CC</td>
</tr>
</tbody>
</table>
```

Where:

- **RF channel**: Valid values are: 0 = Channel A, 1 = Channel B, 2 = Channel C, 3 = Channel D
- **# of bursts**: Valid values are: 0x01 thru x14 (1 to 20 bursts)
- **Minimum Burst Interval**: Units of 5 seconds. Valid values are: 0x01 thru 0x3C (5 to 300 seconds)
- **Maximum Burst Interval**: Units of 5 seconds. Valid values are: 0x02 thru 0x78 (10 to 600 seconds)

Example Command:  AA 0E 06 00 00 00 00 00 03 18 30 00 CE 9C

Where the setup information is:

- **RF channel**: 00  Channel A
- **# of bursts**: 03  3 bursts per message
- **Minimum Burst Interval**: 18  0x18 = 24, 24 x 5 = 120 seconds
- **Maximum Burst Interval**: 30  0x30 = 48, 48 x 5 = 240 seconds

4.2.2.7  Query Setup (0x07)

The Query Setup command requests the STX3 to return the current setup parameters.

0x07
Command:  AA 05 07 66 B0
Response:

<table>
<thead>
<tr>
<th>header</th>
<th>len</th>
<th>04</th>
<th>RESERVED</th>
<th>RF channel</th>
<th># of Bursts</th>
<th>Interval Min</th>
<th>Interval Max</th>
<th>RESERVED</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>0E</td>
<td>07</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>CC</td>
<td>CC</td>
</tr>
</tbody>
</table>

Where:

- **RF channel**: Valid values are: 0 = Channel A, 1 = Channel B, 2 = Channel C, 3 = Channel D
- **# of bursts**: Valid values are: 0x01 thru x14 (1 to 20 bursts)
- **Minimum Burst Interval**: Units of 5 seconds. Valid values are: 0x01 thru 0x3C (5 to 300 seconds)
- **Maximum Burst Interval**: Units of 5 seconds. Valid values are: 0x02 thru 0x78 (10 to 600 seconds)

Example Response: **AA 0E 07 00 23 18 60 00 03 18 30 00 5D 60**

Where the setup information returned is:

- **RF channel**: 00 Channel A
- **# of bursts**: 03 3 bursts per message
- **Minimum Burst Interval**: 18 0x18 = 24, 24 x 5 = 120 seconds
- **Maximum Burst Interval**: 30 0x30 = 48, 48 x 5 = 240 seconds

**4.2.2.8 Query Hardware Version (0x09)**

The Query Hardware Version command requests the STX3 to return the current hardware version information.

0x07

<table>
<thead>
<tr>
<th>header</th>
<th>len</th>
<th>Cmd</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>05</td>
<td>09</td>
<td>18</td>
<td>59</td>
</tr>
</tbody>
</table>

Command: **AA 05 09 18 59**

Response:

<table>
<thead>
<tr>
<th>header</th>
<th>len</th>
<th>04</th>
<th>Device Code</th>
<th>Board Rev</th>
<th>CPU Rev</th>
<th>Radio Rev</th>
<th>CRC1</th>
<th>CRC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>0A</td>
<td>09</td>
<td>00</td>
<td>01</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>CC</td>
</tr>
</tbody>
</table>

- 0x07
Where:

- **Device Code**: Always 1 for STX3
- **Board Revision**: STX3 hardware revision
- **CPU Revision**: STX3 CPU revision
- **Radio Revision**: STX3 radio revision

Example Response: **AA 0A 09 00 01 00 8E 62 E5 5E**

Where the revision information returned is:

- **Board Revision**: 00
- **CPU Revision**: 8E
- **Radio Revision**: 62
4.3 Example CRC calculation routines for serial packets

The following example is written in the C programming language where:

\[ \text{int} = 32 \text{ bits}, \ \text{short} = 16 \text{ bits}, \ \text{char} = 8 \text{ bits} \]

```c
unsigned short crc16_lsb(unsigned char *pData, int length)
{
    unsigned char i;
    unsigned short data, crc;

    crc = 0xFFFF;

    if (length == 0)
        return 0;

    do
    {
        data = (unsigned int)0x00FF & *pData++;
        crc = crc ^ data;

        for (i = 8; i > 0; i--)
        {
            if (crc & 0x0001)
                crc = (crc >> 1) ^ 0x8408;
            else
                crc >>= 1;
        }
    } while (--length);

    crc = ~crc;

    return (crc);
}
```

**USAGE:** calculate the CRC for a message and update the message CRC

```c
unsigned short crc = crc16_lsb(msg, msg[1]-2);
msg[msg[1]-2] = (unsigned char) (crc&0xFF);
msg[msg[1]-1] = (unsigned char) (crc>>8);
```
The following example is written in the Java programming language:

```java
char crc16_lsb(byte pData[], int length)
{
    int pData_i = 0;
    char s1, s2;
    
    byte i;
    char data, crc;
    
    crc = (char) 0xFFFF;
    if (length == 0)
        return 0;
    do
    {
        data = (char)((char)0x00FF & pData[pData_i++]);
        crc = (char)(crc ^ data);
        for (i = 8; i > 0; i--)
        {
            if ((crc & 0x0001) != 0)
                crc = (char)((crc >> 1) ^ 0x8408);
            else
                crc >>= 1;
        }
    } while (--length != 0);
    crc = (char)~crc;
    return (crc);
}

USAGE: calculate the CRC for a message and update the message CRC
byte msg[]; int len;
char crc = crc16_lsb(msg, len - 2);
msg[len - 2] = (byte)((short)crc & (short)0xff);
msg[len - 1] = (byte)((short)crc >> 8);```
4.4 AT commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Response</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT</td>
<td></td>
<td>This command is used to check communication between the module and the host.</td>
</tr>
<tr>
<td></td>
<td>OK</td>
<td>STX3 is ready for normal operation</td>
</tr>
<tr>
<td></td>
<td>ERROR</td>
<td>STX3 is not ready for operation, an error condition exists</td>
</tr>
</tbody>
</table>

AT+GSN?  
AT+CGSN?
+GSN: <n-nnnnnnn>  
ERROR  
Request product serial number identification
Unable to retrieve ESN

AT+GMM?  
AT+CGMM?
+GMM: STX3  
Request model identification (hardware version).

AT+GMI?  
AT+CGMI?
+GMI: GLOBALSTAR  
Request manufacturer identification

AT+GMR?  
AT+CGMR?
+GMR: <MM.mm>  
MM=Major Revision, mm=Minor Revision
Example: +GMR: 01.00  
ERROR  
Unable to retrieve revision identification

AT+CMGS=<hhhh..hh>  
Send message up to 144 data bytes specified by hexadecimal string
Example: AT+CMGS=AA5511A53311A53311

OK  
Message Burst In Progress
ERROR  
Invalid message or modem error

AT+CMGSL=<Lat,NS,Lng,EW,hhhhhh>  
Send location message with 3 data bytes specified by hexadecimal string.
Lat: ddmn.mmmmm
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dd: decimal degrees, mm.mmm  minutes</td>
<td>ns: hemisphere (N/S)</td>
</tr>
<tr>
<td>lnr: ddd.mmm</td>
<td>ew: hemisphere (E/W)</td>
</tr>
<tr>
<td>hhhhhh: hexadecimal value of 3 byte payload</td>
<td>example: AT+CMGSL=3025.9857,N,09005.2182,W,A53311</td>
</tr>
<tr>
<td>OK</td>
<td>message burst in progress</td>
</tr>
<tr>
<td>error</td>
<td>invalid message or modem error</td>
</tr>
<tr>
<td>AT+CANX</td>
<td>cancel running transmission</td>
</tr>
<tr>
<td>ok</td>
<td>command ok (This command will never return an error.  If no transmission is running, it will simply do nothing. This makes it possible for user code to just blindly send this command before any command to transmit if desired.)</td>
</tr>
<tr>
<td>AT+CGNTR?</td>
<td>request the remaining number of total packet transmissions remaining in a running burst. The value returned by this query will represent the number of packets in the message times the number of burst transmissions remaining. For example, if two transmissions remain in the burst of a 4 packet message, a value of 8 will be returned. If no burst is in progress, a value of 0 will be returned. This command will never return an error.</td>
</tr>
<tr>
<td>+CGNTR: &lt;n&gt;</td>
<td>n= number of packets left in the burst</td>
</tr>
<tr>
<td>example: +CGNTR: 8</td>
<td></td>
</tr>
<tr>
<td>AT+CFDC=&lt;channel number&gt;</td>
<td>set the default channel. valid values are 0 – 3.</td>
</tr>
<tr>
<td>ok</td>
<td>command ok, channel was successfully set.</td>
</tr>
<tr>
<td>error</td>
<td>error. Typically means channel number is out of range.</td>
</tr>
<tr>
<td>AT+CBNT=&lt;Number of tries&gt;</td>
<td>set number of transmissions in burst. &lt;Number of tries&gt; = the number of transmissions in the burst. Range must be 1 – 16. Value may be sent in decimal or hex format. hex is indicated with a leading “0x”.</td>
</tr>
</tbody>
</table>
### OK

Command OK, number of tries successfully set.

### ERROR

Unable to set number of tries. Most likely reason is that the number requested was out of range. Must be 1 – 16.

---

**AT+CBNT?**

Request number of tries setting for bursts.

+CBNT: <n>

<n> = number of tries set for bursts.

---

**AT+CBTMIN=<seconds>**

Set the minimum time between transmissions in the burst in seconds. Acceptable range is 5 – 300 seconds. Value will be truncated by the device to the nearest divisible of 5. For example, if the number 207 is sent, the device will set the minimum to 205 seconds. Number may be sent in decimal or HEX format. HEX is indicated by a leading “0x”.

OK

Command accepted and time set.

ERROR

Time not set, most likely reason is the number was out of range.

---

**AT+CBTMIN?**

Query the minimum time between transmissions in the burst.

+CBTMIN: <n>

Minimum time between transmissions in a burst, in seconds.

---

**AT+CBTMAX=<seconds>**

Set the maximum time between transmissions in the burst in seconds. Acceptable range is <CBTMIN> – 600 seconds. Value will be truncated by the device to the nearest divisible of 5. For example, if the number 532 is sent, the device will set the minimum to 530 seconds. Number may be sent in decimal or HEX format. HEX is indicated by a leading “0x”.

OK

Command accepted and time set.

ERROR

Time not set, most likely reason is the number was out of range.

---

**AT+CBTMAX?**

Query the maximum time between transmissions in the burst.

+CBTMAX: <n>

Maximum time between transmissions in a burst, in seconds.

---

**AT+BDREV?**

Query the board revision of the STX3

+BDREV: <n>

Board revision. TBD if this will even be implemented for the STX3, if unimplemented, will always return 0.

---

**AT+PRREV?**

Query the processor (CPU) revision of the Globalstar ASIC.

+PRREV: <n>

Processor revision.

---

**AT+RAREV?**

Query the “radio” revision (revision of the transmitter side of the Globalstar ASIC).
5 Test Modes

The STX3 provides several test modes intended to aid in manufacturing testing and certification testing.

All test modes are activated by grounding selective pins on the STX3 prior to applying power. Once power is applied, the STX3 will sample the states of the pins and based on the states of the pins, the STX3 will enter the selected test mode. For normal operation these pins must be left floating or in a high (logic 1) state.

The following tables define the different test modes available in the STX3.

<table>
<thead>
<tr>
<th>TEST1</th>
<th>TEST2</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td><strong>Mod Mode</strong> (continuous transmission) - A test packet is continuously transmitted. The test packet shall comply with the Air Interface Packet format with a user information equal to the hex stream 0x80AAF0F0F0AAF0F0F0F0F0 where the most significant bit is transmitted first</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td><strong>Test Packet</strong> - The test packet shall comply with the Air Interface Packet format with a user information equal to the hex stream 0x80AAF0F0F0AAF0F0F0F0F0 where the most significant bit is transmitted first</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td><strong>CW mode</strong> - An un-modulated carrier is continuously transmitted.</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Normal Operation</td>
</tr>
</tbody>
</table>
The channels are selected via the Rx and RTS pins as follows:

<table>
<thead>
<tr>
<th>RX</th>
<th>RTS</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>B</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>C</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>D</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Channel specified in the flash setup. To specify channel A, it must be the default channel specified in the flash setup. See <strong>Setup</strong> command for details.</td>
</tr>
</tbody>
</table>