



## **HNM2**

500mW CAT1 Radio Modem

## **USER MANUAL**

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# 1. Introduction

The HNM2 radio modem offers a 500mW RF output 19200 data link with RS232, RS485 or USB interface. It meets the ETSI Category 1 high performance receiver specification to be used where the operation of a SRD may have inherent safety of human life Implications

## Features

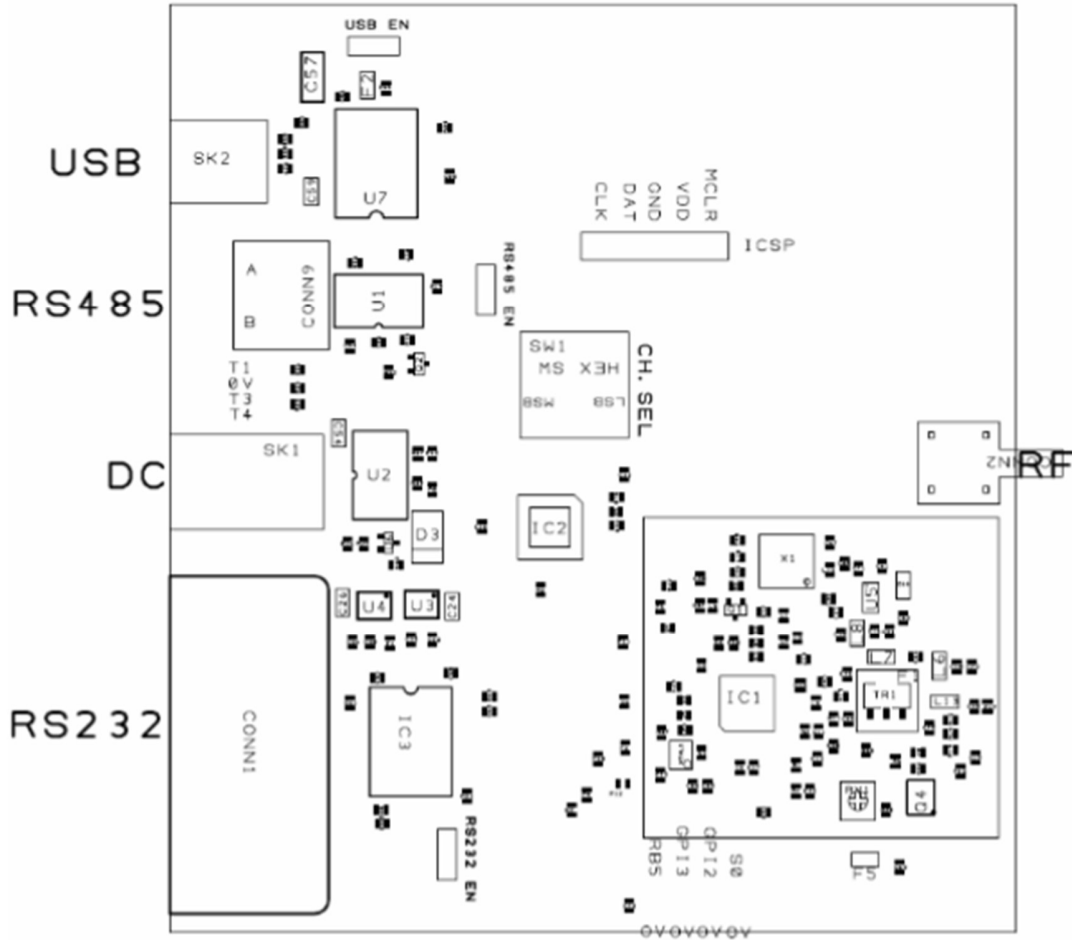
- Standard 458MHz (UK), 869MHz (EU)
- Available from 160MHz to 915MHz
- 12.5/25kHz Narrow Band Multichannel
- Data rates up to 19200kbps
- ETSI EN 300 220-1 Category 1 High performance level receiver
- Point-to-Point, Point-to-Multipoint
- Store and Forward Repeater Mode with Dual Addressing to extend operating range
- Mini USB Type B, RS232 DE9F sockets, RS485 Terminal Block and SPI interfaces
- Range Test Mode

## Technical Specification:

<b>Frequency Range</b>	CH0 : 458.525, CH1 : 458.550,.....CH15 : 458.900MHz
<b>No of manually selectable channels Using channel selector</b>	16 (0 - 15)
<b>Channel Spacing Frequency</b>	25 KHz (dependent on data rate)
<b>Modulation</b>	2-GFSK, 4-GFSK
<b>RF baud Rate</b>	300, 600, 1200, 2400, 4800, 9600, 19200 bps
<b>RF power</b>	+27dBm (500 mW)
<b>Data Interface</b>	RS232, RS485, USB
<b>Serial Data baud rate</b>	600, 1200, 2400,4800, 9600, 19200, 38400bps.
<b>Operating Voltage</b>	6 Vdc - 16 Vdc

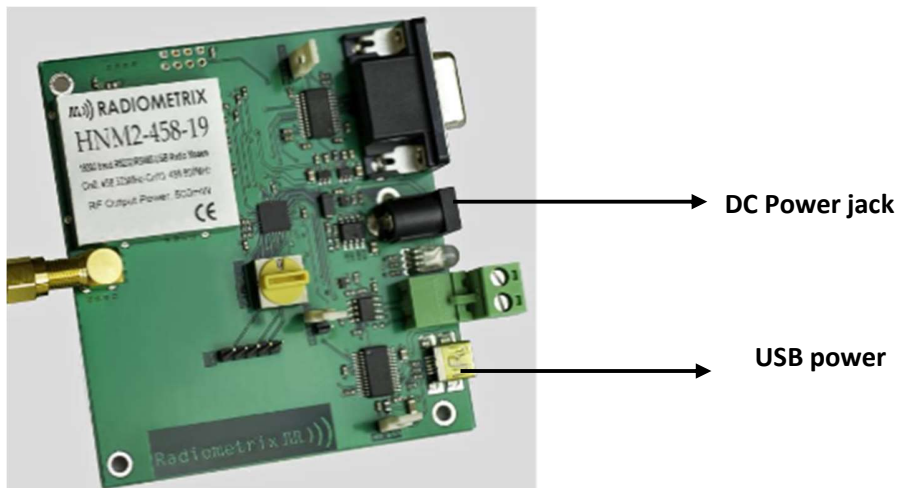
## 2. Connection Details:

### 2.1 PCB Layout



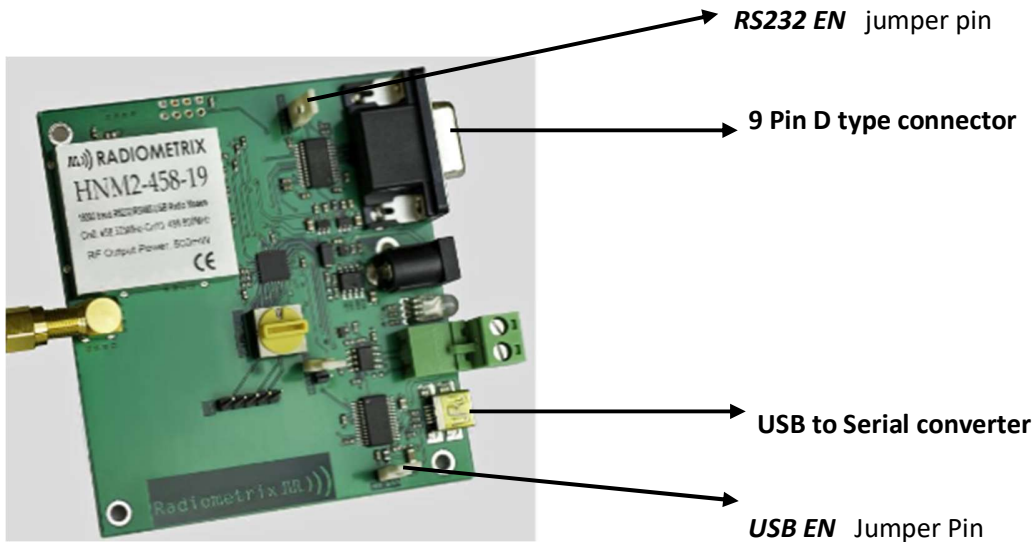
### 2.2 Power Connections:

HNM2 requires DC supply voltage range from +6Vdc to +16Vdc. Power can be supplied through DC jack or mini USB port.



### 2.3 Serial Ports

HNM2 has serial ports that provides the data connection between HNM2 Modem and host devices.



There are two ways to enable the Serial port In HNM3.

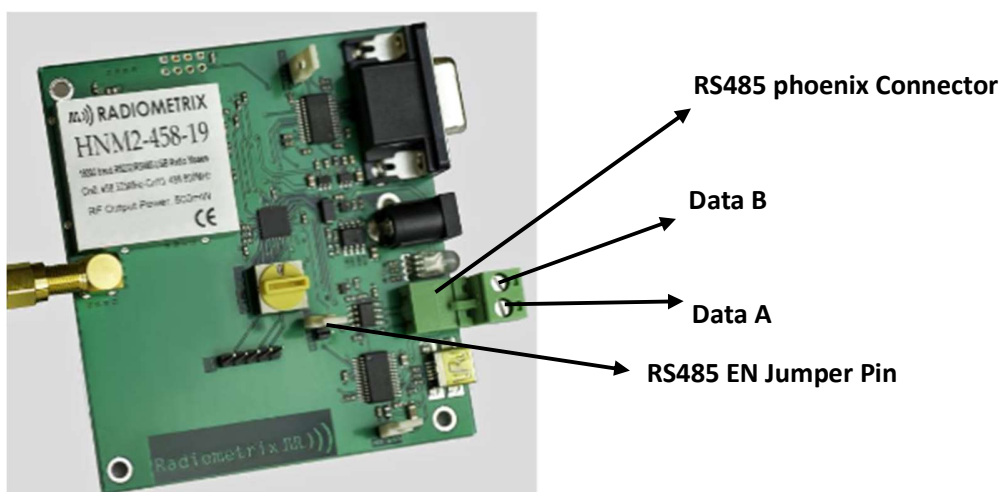
USB to serial port – To enable this connection USB EN jumper pin should be connected.

9 Pin Female D type Connector – To Enable this connection, RS232 EN pin should be connected

**Note: At any time ONLY One of these connection should be used**

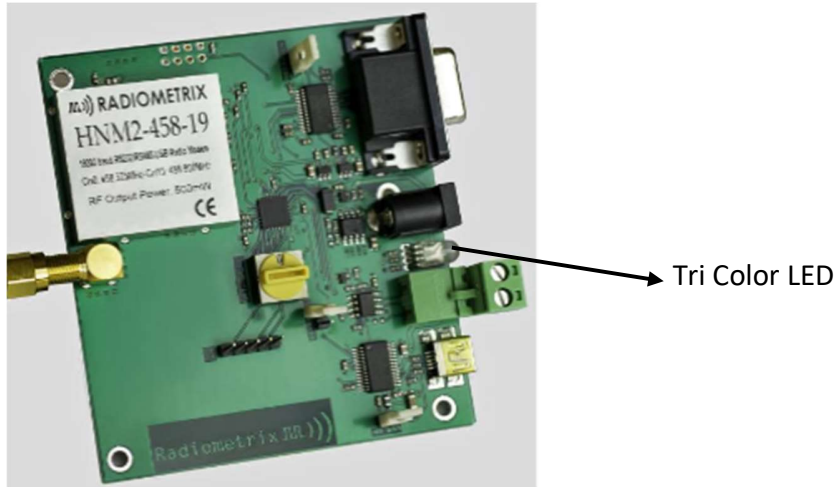
### 2.4 RS485 - 2 Pole Phoenix Connector

This connector is used for R485.To enable the RS485 mode RS485 EN pins should be linked by a jumper connection.



## 2.5 LED indications

Tri color LED is used to indicate Internal Functionalities of the Modem



<b>White LED</b>	To indicate Module Power up	In normal mode, While Power-Up the modem the White LED will be ON for 2 seconds and then will go OFF In P2P mode ,White LED will be blinking 3 times and will go OFF
<b>Red LED</b>	To indicate Data transmission	Red LED will be blinking for Each RF Data Packet Transmission
<b>Green LED</b>	To indicate Data reception	While RF data Reception ,the Green LED will be blinking
<b>Blue LED</b>	To indicate Command mode	The Blue LED will be ON till exit from Command mode
<b>Yellow LED</b>	To indicate RXFIFO overflow error	Yellow LED will be ON if RF receive FIFO error occurs.
<b>Cyan LED</b>	To indicate Repeater Function	If the Module configured as repeater, The Cyan LED will be blinking While forward the data to the Destination
<b>Violet LED</b>	To indicate Queue Full status	It will be blinking If the Internal data buffer becomes full

### 3.0 Programming the Module

This product has the feature to change the RF modem parameters. RF Parameters can be changed according to the Communication requirements. Parameters can be changed through command mode. In order to do this you need a terminal program like “Hyperterminal” or “TeraTerm”.

#### AT Commands:

The command mode is used to read and update the modem configuration registers using AT command

In command mode, the radio is inhibited (transmission and reception), excepted when using test commands.

#### 3.1 Procedure to enter command Mode

Send “+++” sequence from HyperTerminal to enter the command mode, when entering command mode ‘**command mode active**’ message will be displayed on hyper terminal.

To exit from Command Mode, issue “**ATE<CR>**” sequence from HyperTerminal.

#### 3.2 Procedure to Access AT Commands

1. Enter command mode
2. Enter the AT command of corresponding Parameter, the Parameters are listed below
3. Carriage return (<CR>) should be given after writing each AT commands.

#### Example:

To change the Frequency of RF modem

Send this **ATF=458.525 <CR>**

Modem will return

**Freq =458.52500**

**OK**

All AT commands and parameters Explained in **Appendix A4.0. Data Communications**

### Modes of Operation:

This modem supports two modes of operations

1. Normal Mode
2. Repeater Mode

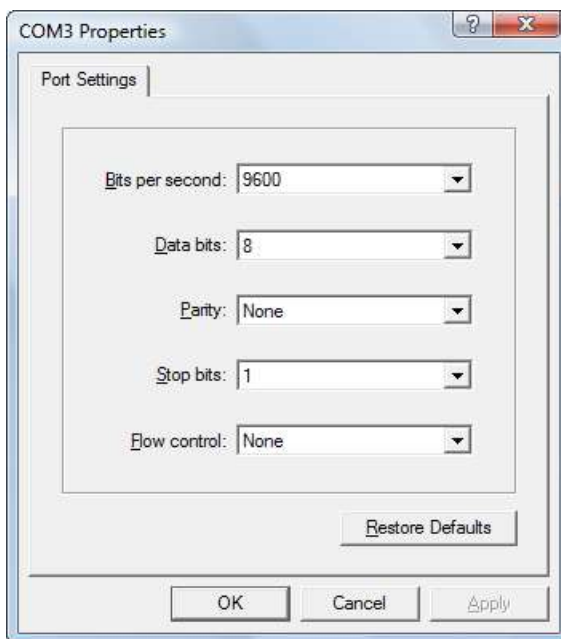
## 4.1 Normal mode

In normal mode of operation, this modem acts as transceiver. In this mode, there is no need to initiate addressing of the modem. The communication is always half-duplex. When the transceiver is sending a radio packet, it is not able to decode any incoming radio packet. User can transmit and receive the data through hyper terminal. By default the modem is in Normal mode

In Idle state the transceiver is waiting for Serial data on Serial port and RF data on Radio link. Once the data is detected on Serial port, the data is transferred to the RF module for RF communication. If the data is detected on RF link, it is transferred to Serial port

### 4.1.1 Setup HyperTerminal for Data communication

1. Open hyper terminal on PC
2. Open baud rate settings menu, Select com port and set the baud rate as 9600(Default)



3.

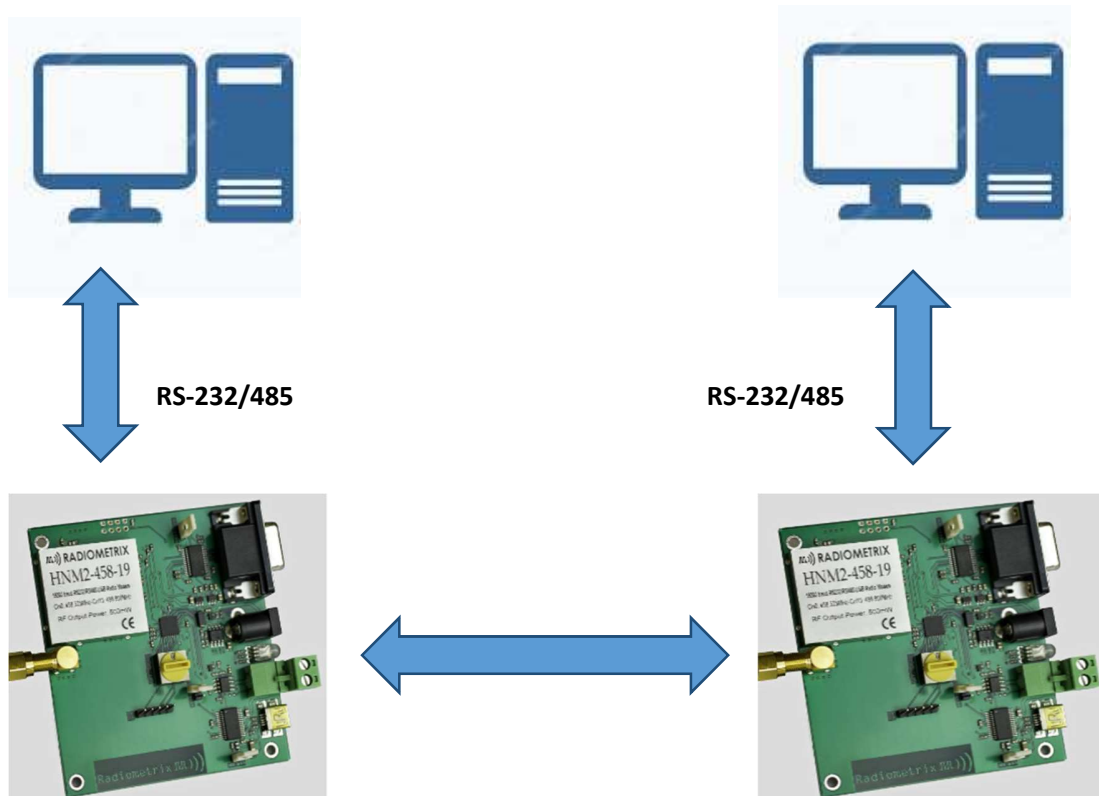
#### **UART data format**

Data bits - 8 bits

Stop Bit - 1 bits

Parity - None





## 4.2 Repeater Mode:

For Long range data transmission, we can configure the modem as repeater. In repeater Mode, We have to address the each modem with source and destination addresses.

For data communication, Modems has to be configured with three configuration settings

1. Transmitter Configuration
2. Receiver configuration
3. Repeater configuration

To enable this repeater mode, the mode is changed to Normal to P2P (Point to point Network) mode

### Procedure to change P2P mode

Enter command mode

Send “+++” from HyperTerminal to enter the command mode, when entering command mode ‘**command mode active**’ message will be displayed on hyper terminal.

Send **ATP2P = 1**<CR> command

Modem will return “**OK**<CR>”

## 4.2.1 Instruction to configure Repeater mode

### 4.2.1.1 Configure transmitter module:

1. Enter command mode

2. Enter transmit address TX1.

Command format:

**"ATTX1=12"** and press enter key (<CR>), **'OK'** message will be displayed as response.

3. Enter receive address RX1.

Command format:

**"ATRX1=21"** and press enter key (<CR>), **'OK'** message will be displayed as response.

4. Exit from command mode

Command format:

**"ATE"** and press enter key (<CR>), **'OK'** message will be displayed as response

### 4.2.1.2 Configure receiver module:

1. Enter command mode

Send **"+++"** from HyperTerminal to enter the command mode, when entering command mode **'command mode active'** message will be displayed on hyper terminal.

2. Enter transmit address TX1.

Command format:

**"ATTX1=21"** and press enter key, **'OK'** message will be displayed as response.

3. Enter receive address RX1.

Command format:

**"ATRX1=12"** and press enter key, **'OK'** message will be displayed as response.

4. Exit from command mode

Command format:

**"ATE"** and press enter key, **'OK'** message will be displayed as response

5. Now both modules can send and receive data through hyper terminal

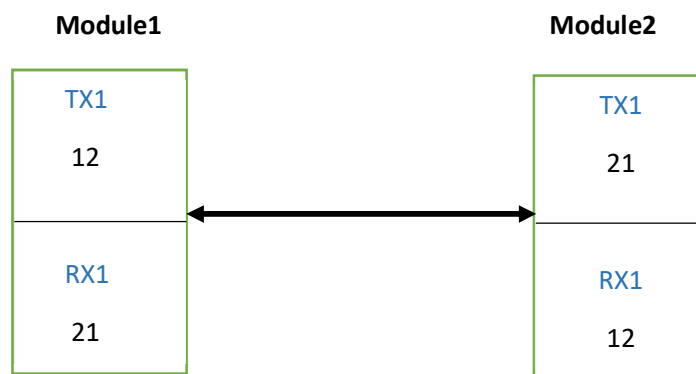
### Point To Point without Repeater

#### Transmitter function:

When user send the data from hyper Terminal, transmitter will transmit the data with transmit address of TX1.

#### Receiver function:

Receiver receives the data only from the address entered in the RX1 address



**Note:** All the Addresses Range is 0 – 9999;

### Point to Point With Repeater

#### 4.2.1.3 configure Repeater module

1. Enter command mode
2. Enable the repeater mode

Command format:

**“ATRPE=1”** and press enter key to enable repeater mode, **‘OK’** message will be displayed as response and it will ask for TX1 TX2, RX1 and RX2 addresses.

3. Enter reverse transmit address TX1

Command format:

**“ATTX1=21”** and press enter key, **‘OK’** message will be displayed as response

4. Enter reverse receive address RX1

Command format:

**“ATRX1=32”** and press enter key, **‘OK’** message will be displayed as response

5. Enter Forward transmit address TX2

Command format:

**“ATTX2=23”** and press enter key, **‘OK’** message will be displayed as response

6. Enter forward receive address RX2

Command format:

**"ATRX2=12"** and press enter key, **'OK'** message will be displayed as response

7. Exit from command mode

Command format:

**"ATE"** and press enter key to exit from command mode

8. Now the repeater is ready to repeat the data

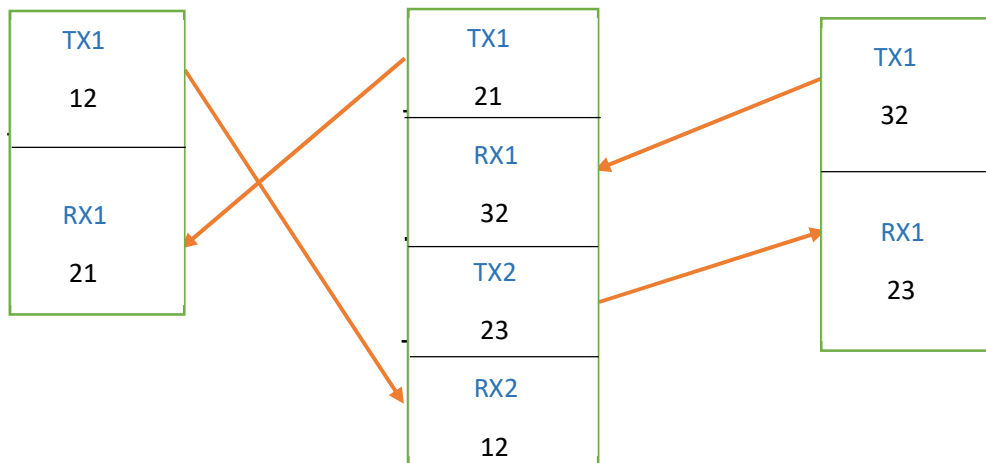
Repeater function:

**Modem1**

**Repeater**

**Modem2**

**0**



9. Change modem2 TX and RX1 address by this procedure

Enter command mode

Set TX1 **"ATTX1=32"**

Set RX1 **"ATRX1=23"**

Exit from command Mode

Now the receiver is ready to receive data

10. If the repeater receives message from modem1 TX1 (12) address, it will forward the message to the modem 2 with the transmit address of 23.

11. Modem 2 will receive the data, and the data will be displayed on hyper terminal
12. If the repeater receives message from Modem2 TX1 (32) address, it will forward the message to the modem 1 with transmit address of 21.
13. Modem1 will receive the data, and the data will be displayed on hyper terminal
14. User can view the received data on hyper terminal.
15. User can read the address of TX1,RX1,TX2,RX2 using AT command  
Send "**ATAR?**" to read the address
16. User can disable the repeater function by sending repeater disable command  
Enter command mode  
Send "**ATRPE=0**" and press enter key to disable repeater mode.  
Exit from command mode
17. User can view the received data on repeater's hype terminal

## Appendix A

All AT commands Listed below. **Note that HNM2/LNM2H are frequencies in the 400MHz range and HNM3/LNM3 are in the 800-900 MHz Range.**

LNM2H/LNM3H can be configured using serial AT Commands in Inverted RS232 (UART) format at 9600bps, 8 data bites, No Parity, 1 stop bit, No Flow control at 5V TTL level.

Each command should be terminated with Enter Key / Carriage Returned (0x0D) to execute.

Parameter	AT commands	Description
<b>Command Mode</b>	Enter “+++” “Command mode active”	To enter command mode
	ATE<CR> OK	Save parameters and Exit Configuration Mode
	ATF? 458.525 OK	Read Center frequency of RF modem
<b>UART baud Rate</b>	ATU = XX Allowed baud rate Range 300,600,1200,2400,4800,9600, 19200,38400 <b>Ex:</b> ATU=9600<CR> Change Terminal Baud Rate to Continue... After, Use Exit 'ATE<CR>' to store baud rate permanently  OK	Write UART baud rate for serial Data TX and RX
	ATU?<CR> 9600 OK	Read Serial Baud Rate
<b>RF received signal strength</b>	ATR? RSSI value continuously displays on hyper terminal To exit from the command Send ESC(0x1B) from terminal	Read Received signal strength

<b>Append RSSI status</b>	ATRA =xx 1 –Enable      0 – Disable <b>EX:</b> ATRA=1<CR> OK	Enable /Disable Append RSSI with Data After this command each packet received with Rssi value  HELLO9C Received Packet 'HELLO' and its RSSI value 0x9C (156)
	ATRA?<CR> 1 OK	Read the Status of append RSSI
<b>Channel Selection Mode</b>	ATCHM =x x = 0 - Hardware Switch x= 1 - AT command mode  <b>EX:</b> ATCHM =0<CR> Channel Selection By Hardware OK  ATCHM=1<CR> Channel Selection By AT Command OK	Channel selection by AT Commands or Hardware switch(Hex switch)
	ATCHM?<CR> Channel Selection By Hardware/AT commands OK	Read channel selection mode
<b>Channel Selection</b>	ATCH=xx xx- channel no (0 to 15)  <b>EX:</b> ATCH = 2<CR> Channel 2 is selected OK	Write channel no from (0 to15)
	ATCH?<CR> channel 2 is selected OK	Read current channel no

	<p>ATC= xx,yyy.yyy  xx – channel no (00 to 15)  yyy.yyy –frequency  433.xxx - Band  868.xxx - Band  164.xxx - Band  <b>Ex:</b>  ATC=01,458.12345&lt;CR&gt;  OK</p>	<p>Write frequency for the corresponding Channel</p>
<p><b>Channel and Frequency</b></p>	<p>ATC?&lt;CR&gt;  0 – 458.52500  1 - 458.12345  2 - 458.57500  ..  .  .  .  15-458.90000  OK</p>	<p>Read each channel frequency</p>
<p><b>RF baud Rate</b></p>	<p>ATRD =xx  xx –RF baud rate  RF baud Rate-  1200,2400,4800,9600,19200  <b>EX:</b>  ATRD=1200&lt;CR&gt;  OK</p>	<p>Write RF baud rate</p> <p><b>19200</b> -4 level GFSK 25kHz bandwidth 5kHz Deviation (Default )  <b>9600</b> - 4 level GFSK 25kHz bandwidth 5kHz Deviation  <b>4800</b>- 2 level GFSK 20kHz bandwidth 4kHz Deviation  <b>2400</b>- 2 level GFSK 12.5kHz bandwidth 4kHz Deviation  <b>1200</b> -2 level GFSK 12.5kHz bandwidth 4kHz Deviation  <b>600</b> - 2 level GFSK 12.5kHz bandwidth 4kHz Deviation  <b>300</b> - 2 level GFSK 12.5kHz bandwidth 4kHz Deviation</p> <p>Reducing RF Baud Rate increases Receive sensitivity, hence operating range.</p>



	ATRD?<CR> 1200 OK	Read RF baud rate
<b>Packer Error Rate</b>	ATPER<CR>  Good=1,Bad=0  It returns No of good and bad packet  <b>Press "ESC" to exit from this mode</b>	Read Packet error status
<b>UART Hardware Flow Control</b>	ATFCD =x X - 0 - Disable X - 1 - Enable <b>EX:</b> ATFCD =1<CR> OK	Enable/Disable UART hardware flow control (CTS/RTS)
	ATFCD? <CR> 1 OK	Read current status of flow control
<b>Range Test</b>	ATRG = xx xx - mode 0 - Range Tx 1 - Range Rx 2- Range Master 3- Range Slave  <b>Press "ESC" to exit from Range test mode</b>	check the RF modem communication Range  It can be used for site survey and range testing.
	ATRG=0 <CR> Range test Tx started	Transmitter sends packet every 500ms and prints "Tx succeed"
	ATRG=1 <CR> Range test Rx started	Acts as receiver, if good packet received prints "Rx succeed"
	ATRG=2 <CR> Range test Master started	Bi directional communication acts as master Transmits to Slave and displays if valid packet is received from Slave

	<p>ATRG=3 &lt;CR&gt; Range test slave started</p>	<p>Bi directional communication acts as Slave Displays if valid packet is received from Master, transmits back to Master</p>
<b>Transmitter 1 address</b>	<p>ATTX1=xx xx - 4 digit address <b>EX:</b> ATTX1=21&lt;CR&gt;</p> <p><b>Response</b></p> <p>ATX1=21 ARX1=XX ATX2=XX ARX2=XX No of repeater =xx Repeater disabled/Enabled P2P mode enabled/disabled OK&lt;CR&gt;</p>	<p>Write Transmitter 1address for Repeater mode</p> <p>In Dual Addressing Mode, This address will be accept by next repeater(RX1 or RX2/receiver (Receiver must have this address in RX1 )</p>
<b>Receiver 1 Address</b>	<p>ATRX1=xx xx - 4 digit address <b>EX:</b> ATRX1=32&lt;CR&gt;</p> <p><b>Response</b></p> <p>ATX1=21 ARX1=32 ATX2=XX ARX2=XX No of repeater =xx Repeater disabled/Enabled P2P mode enabled/disabled OK</p>	<p>Write Receiver 1 address for Repeater mode</p> <p>In Dual addressing mode ,This address will be the transmit address of next repeater(TX1)(transmitter must have this address in transmit address (TX1)</p>
<b>Transmitter 2 address</b>	<p>ATTX2 =xx xx - 4 digit address <b>EX:</b> ATTX2=23&lt;CR&gt;</p> <p><b>Response</b></p> <p>ATX1=21 ARX1=32 ATX2=23 ARX2=XX No of repeater =xx Repeater disabled/Enabled P2P mode enabled/disabled</p>	<p>Write Transmitter 2 address for Repeater mode</p> <p>In dual addressing , this address will be the receive address of next repeater(RX2)</p>

	OK	
<b>Receiver 2 Address</b>	ATRX2=xx xx - 4 digit address <b>EX:</b> ATRX2=12<CR> <b>Response</b> ATX1=21 ARX1=32 ATX2=23 ARX2=12 No of repeater =xx Repeater disabled/Enabled P2P mode enabled/disabled OK	Write Receiver 2 address for Repeater mode  In dual addressing ,this address will be the transmit address of transmitter(TX1)/repeater(TX2)
<b>P2P mode</b>	ATP2P=xx 1 – Enable 0 – disable ATP2P=1 OK	Enable/Disable P2P mode
<b>P2P parameter</b>	ATAR? <CR> It will return Transmitter 1 address Transmitter 2 address Receiver 1 Address Receiver 2 Address No of repeaters Repeater status P2P mode status ATX1 = xx ARX1 =xx ATX2 = xx ARX2 =xx No of repeater =xx Repeater Enabled P2P mode Enabled	Read all P2P parameters
<b>Repeater Mode</b>	ATRPE=xx 1 –Enable 0 – Disable ATRPE =1<CR> OK	Enable/Disable repeater mode in P2P communication
<b>No of repeaters</b>	ATNOR =xx No of Repeaters should be entered in transmitter only ATNOR=2<CR> OK	Write no of repeaters between source and destination

<b>Unicast/Broadcast Transmission</b>	ATDEU=xx xx -4 digit address	Write Address Of Destination for Unicast transmission.  In this unicast transmission User can change the unicast address dynamically without storing in eeprom
	ATDEU=FF	Initiate the Broadcast Transmission
<b>Factory Default settings</b>	ATFACT<CR> OK	Restore RF factory default settings
	ATDEF?<CR>  Channel = 0 RF Frequency = 458.52500 Packet length = Variable Packet Length mode Rssi Append Status = 0 Uart Baud Rate = 9600 RF Power = 15 RF Modulation = 4-GFSK RF BandWidth = 25000 RF BaudRate = 19200 RF Channel Spacing = 25000 Manchester State = 0 Uart Flow Control = 0 Packet CCA Threshold = 0 Deviation = 5000 Data whitening Enable = 1 Rssi_Offset = -107 dBm OK	Display RF Default settings on HyperTerminal
<b>Firmware version</b>	ATV?<CR> VER_3.0.31.0 OK	Read firmware version

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*<http://www.ofcom.org.uk/radiocomms/ifi/>*

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