

High Power Narrow Band Category 1 Radio Modem

The LNM2H radio modem module offers a 500mW RF output 19200 data link with 3.3V TTL UART 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.



Figure 1: LNM2H-458-19

Features

- Standard 458MHz (UK), 866MHz (India), 869MHz (EU)
- Available from 160MHz to 915MHz
- 12.5kHz / 25kHz channel spacing Narrow Band FM 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
- Whitening of the data by XORing with a 9-bit pseudo-random (PN9) sequence
- 2-byte CRC checksum
- Digital Received Signal Strength Indicator (RSSI)
- Range Test Mode

Applications

- Safety-critical wireless applications such as social alarms and healthcare monitoring
- High-end security and fire alarms
- Lone Worker Alarms
- Industrial/Commercial Telemetry and Telecommand or Non-specific SRD usage
- In-building environmental monitoring and control

Technical Summary

- Size: 47 x 34.5 x 7mm
- Operating frequencies: CH0:458.525, CH1:458.550,...CH15:458.900MHz
- Supply range: 5V DC
- Current consumption: 280mA TX
- Current consumption: 40mA RX
- RF baud rate: 300, 600, 1200, 2400, 4800, 9600, 19200bps (default).
- User baud rate: 300, 600, 1200, 2400, 4800, 9600 (default), 19200, 38400bps.
- Flow control: RTS/CTS, None (default)
- Modulation: 2-level GFSK [Binary], 4-level GFSK [Quaternary] (default)
- Transmit power: +27dBm (500mW) on 458MHz or +26dBm (400mW) on 869MHz
- 32MHz TCXO Reference with ± 2.0 ppm frequency stability over -30°C +85°C
- SAW front end filter

PCB Layout and connections

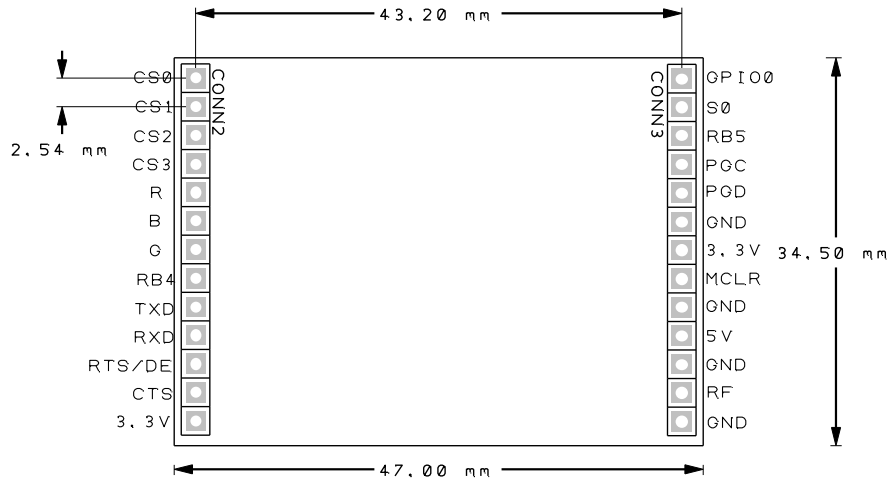


Figure 2: LNM2H/LNM3H Pinout and Dimensions

PIN	DESCRIPTION	NOTE
CS0	Channel Select Bit 0	1,6
CS1	Channel Select Bit 1	1,6
CS2	Channel Select Bit 2	1,6
CS3	Channel Select Bit 3	1,6
R	RED LED output.	4
B	BLUE LED output	4
G	GREEN LED output	4
RB4	Not used	5
TXD	3.3V TTL level UART Transmit Data Input	6
RXD	3.3V TTL level UART Received Data Output	6
RTS/DE	Serial Flow control or RS485 control	3,6
CTS	UART	6
3V3	Low current 3.3V LDO regulator output for reference	7

PIN	DESCRIPTION	NOTE
GPIO0	Not used	5
S0	Not used	5
RB5	Not used	5
PGC	Programming Clock for Firmware update	2
PGD	Programming Data for Firmware update	2
GND	Supply Ground	
3V3	Low current 3.3V LDO regulator output for reference	7
MCLR	Programming only	2
0V	Supply ground	
5V	Externally regulated 5V DC Power Supply	8
GND	RF ground	9
RF	RF output	9
GND	RF ground	9

Notes

- 1) Connections for HEX channel select, either using rotary switch or CPU controlled, inputs need to be pulled high to operate using reference 3v3 pin.
- 2) Internal cpu programming pins, should be left floating.
- 3) When flow control enabled becomes RTS pin, when flow control disable becomes RS485 txrx control line DE.
- 4) RGB LED 3.3V level outputs current limited with 220Ω series internal resistor.
- 5) Connections for future use, leave floating.
- 6) 3.3V logic input/output
- 7) Maximum output current 40mA for both pins total.
- 8) Module supply pin, 5V nominal 5.1V max, can be reduced down to 3.4V but with reduced RF output power.
- 9) 50Ω impedance RF output, should be connected using 50Ω stripline to antenna.

Absolute maximum ratings

Exceeding the values given below may cause permanent damage to the module.

Operating temperature	-20°C to +60°C
Storage temperature	-30°C to +70°C
RF	±50V @ <10MHz, +13dBm @ >10MHz
All other pins	-0.3V to +5.5V

Performance specifications Transmitter:

(Vcc = 6V / temperature = 20 °C unless stated)

General	pin	min.	typ.	max.	units	notes
DC supply						
Supply voltage		3.4	5	16	V	6
TX Supply current @ 500mW			280mA		mA	
Antenna pin impedance			50		Ω	
Channel spacing			25		kHz	
Number of manual channels			16			5
RF						
RF power output		+25	+27		dBm	1
Spurious emissions					dBm	4
Adjacent channel TX power				-37	dBm	
Frequency accuracy		-1.5	0	+1.5	kHz	2
FM deviation (peak)				5	kHz	3
Dynamic timing						
TX select to full RF	2		2		ms	

Notes:

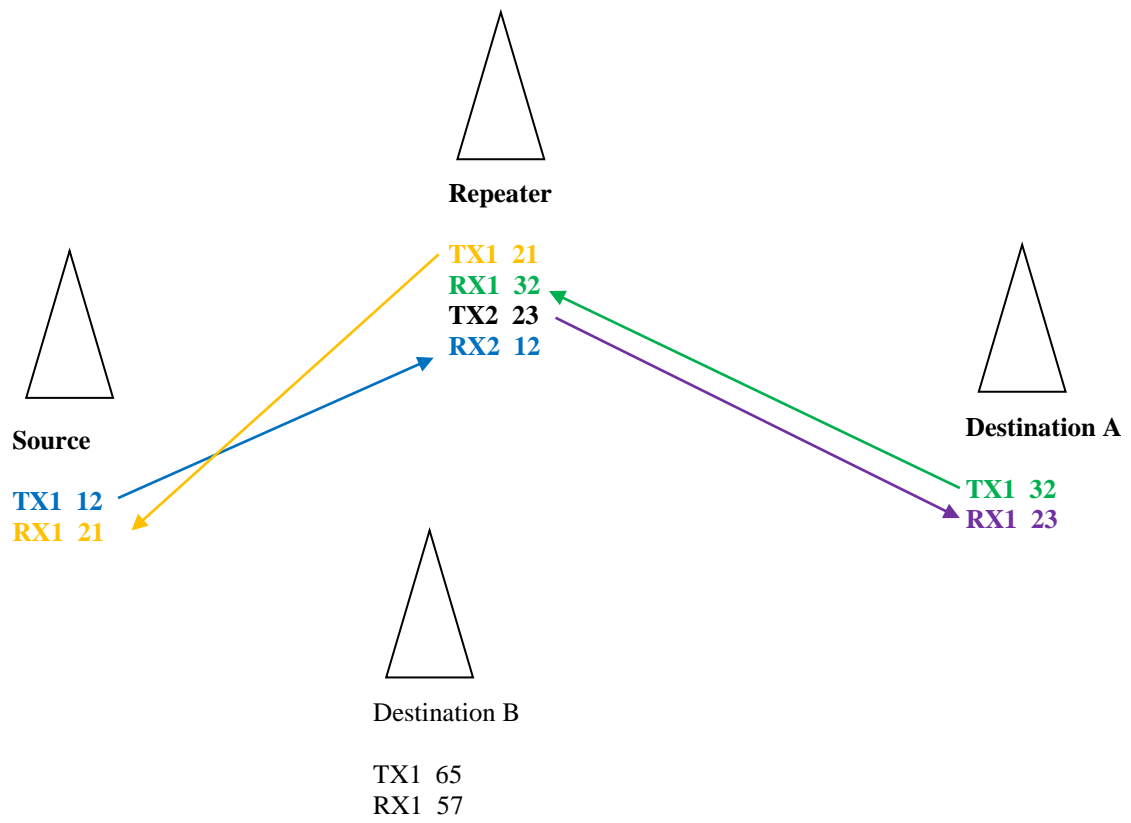
1. Measured into 50Ω resistive load, USB powered reduces output power.
2. Total over full supply and temperature range.
3. Dependant on data rate selected
4. Meets EN300-220
5. Programmable frequency through AT command and selected using on board switch.
6. Below 5V the Transmit RF power output will be decreased.

Performance specifications Receiver:

(Vcc = 5V / temperature = 20 °C unless stated)

	min.	typ.	max	units	notes
DC supply					
Supply voltage	4.8	6.0	5.1	V	
Supply current		40		mA	
RF/ IF					
RF sensitivity for 1ppm BER	-	-117	-	dBm	1
RSSI range	-	TBD	-	dB	
LO leakage, conducted	-54	-95		dBm	
Adjacent channel rejection		TBD		dB	
Blocking		TBD		dB	
DYNAMIC TIMING					
Power up to stable data	-	2		ms	

Notes: 1. Dependant on data rate and modulation used.



Configuration Mode

LN2H/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.
 Responses shown below in *Italics* will also be terminated with Carriage Return.
 Following commands with '?' as suffix can be used to check current setting.

Command	Function	Format, Response	Details
+++	Configuration Mode	+++	Enter Configuration Mode to use AT Commands
ATFACT	Restore Factory DefaultSettings	ATFACT<CR> Response	Restore factory default settings OK<CR>
ATDEF?		ATDEF? <i>Channel = 0</i> <i>RF Frequency = 458.52500</i> <i>Packet length = Variable</i> <i>Packet Length mode</i> <i>Rssi Append Status = 0</i> <i>Uart Baud Rate = 9600</i> <i>RF Power = 15</i> <i>RF Modulation = 4-GFSK</i> <i>RF BandWidth = 25000</i> <i>RF BaudRate = 19200</i> <i>RF Channel Spacing = 25000</i> <i>Manchester State = 0</i> <i>Uart Flow Control = 0</i> <i>Packet CCA Threshold = 0</i> <i>Deviation = 5000</i> <i>Data whitening Enable = 1</i> <i>Rssi_Offset = -107 dBm</i> OK	Lists out current configuration and parameter settings
ATE	Exit Configuration	ATE OK	Save parameters and Exit Configuration Mode
ATRD	RF Data Rate	ATRD=19200 OK	19200 4 level GFSK 25kHz bandwidth 5kHz Deviation Default 9600 4 level GFSK 25kHz bandwidth 5kHz Deviation

			4800 2 level GFSK 20kHz bandwidth 4kHz Deviation 2400 2 level GFSK 12.5kHz bandwidth 4kHz Deviation 1200 2 level GFSK 12.5kHz bandwidth 4kHz Deviation 600 2 level GFSK 12.5kHz bandwidth 4kHz Deviation 300 2 level GFSK 12.5kHz bandwidth 4kHz Deviation Reducing RF Baud Rate increases Receive Sensitivity, hence operating range.
ATU	User Baud Rate	ATU=9600 OK ATU? 9600 OK	Set User Data/Configuration Baud Rate to 9600bps 300, 600, 1200, 2400, 4800, 9600 (default), 19200, 38400bps Check current User Baud Rate setting
ATFCD	Hardware Flow Control	ATFCD=1	Enable RTS/CTS hardware flow control
ATR	Read RSSI	ATR? -96	Digital value which should be calibrated to get proper value
ATRA	Append RSSI	ATRA=1 HELLO9C	Appends RSSI value to end of Received Data packet when outputting 0=Disable (default), 1=Enable Received Packet 'HELLO' and its RSSI value 0x9C (156)
ATF	Frequency Band	ATF=869.4125MHz OK	Enter Frequency Band: e.g. 458MHz, 869MHz.
ATC	Channel Frequency	ATC=09,869.6375 ATC? ATC=00,869.4125 ATC=01,869.4375 ATC=02,869.4625 ATC=03,869.4875 ATC=04,869.5125 ATC=05,869.5375 ATC=06,869.5625 ATC=07,869.5875 ATC=08,869.6125 ATC=09,869.6375 ATC=10,869.4125	Set Channel 09 to 869.6375MHz. Channels 00 to 15 can be reprogrammed to any frequency within the band. Lists current channel 00-15 frequencies

		<p>ATC=11,869.4375 ATC=12,869.4625 ATC=13,869.4875 ATC=14,869.5125 ATC=15,869.5375 OK</p>	
ATCHM	Channel selection mode	<p>ATCHM=0<CR> Channel Selection By Hardware OK</p> <p>ATCHM=1<CR> Channel Selection By AT Command</p> <p>OKATCHM?<CR> Response</p>	<p>Set Channel selection Method Parallel Channel Selection via Hex Switch (default)</p> <p>Channel Selection by ATCH command OK</p> <p>Read channel selection Mode Channel Selection By Switch / Command OK</p>
ATCH	Channel No	<p>ATCH=2 Channel 2 is Selected OK</p>	<p>Serially select channel 2 out of 00-15 as operating channel. OK</p>
ATPER	Packet Error Rate	<p>ATPER <i>Packet error Rate Mode</i> <i>Good=1,Bad=0</i></p>	<p>Enables Packet Error Rate (PER) mode. Displays the no of good and bad packet received Press "ESC" to exit from ATPER mode</p>
ATRG	Range Test	<p>ATRG=0 <i>Range test Tx started</i></p> <p>ATRG=1 <i>Range test Rx started</i></p> <p>ATRG=2 Range test Master started</p>	<p>Following commands can be used for site survey and range testing. Press "ESC" to exit from Range test mode Transmitter sends packet every 500ms and prints "Tx succeed"</p> <p>Acts as receiver, if good packet received prints "Rx succeed"</p> <p>Bi directional communication acts as master Transmits to Slave and displays if valid packet is received from Slave</p>

		ATRG=3 Range test slave started	Bi directional communication acts as Slave Displays if valid packet is received from Master, transmits back to Master
ATV?	Firmware version	ATV? VER_3.0.31.0 OK	Read Firmware version
ATP2P=x	Addressing mode Enable/disable	ATP2P=1<CR> OK	1 - Enable Point to Point Addressing mode 0 - Disable addressing mode (Default) OK<CR>
ATDEU=x	Unicast/Broadcast Transmission	ATDEU=xx<CR> Response ATDEU=FF<CR> Response	In this unicast transmission ,User can change the unicast address dynamically without storing in eeprom OK<CR> Broadcast transmission OK<CR>
ATTX1	Transmit Address 1	ATTX1=21	In Dual Addressing Mode, This address will be accept by next repeater(RX1 or RX2/receiver (Receiver must have this address in RX1) ATX1=21<CR> ARX1=XX<CR> ATX2=XX<CR> ARX2=XX<CR> No of repeater =xx<CR> Repeater disabled/Enabled<CR> P2P mode enabled/disabled<CR> OK<CR>
ATRX1	Receive Address 1	ATRX1=32	In Dual addressing mode ,This address will be the trasmit address of next repeater(TX1)(transmitter must have this address in tranamit address (TX1) ATX1=21<CR> ARX1=32<CR> ATX2=XX<CR> ARX2=XX<CR> No of repeater =xx<CR> Repeater disabled/Enabled<CR> P2P mode enabled/disabled<CR>

			OK<CR>
ATTX2=x	Transmit Address 2	ATTX2=23	In dual addressing , this address will be the receive address of next repeater(RX2) ATX1=21<CR> ARX1=32<CR> ATX2=23<CR> ARX2=XX<CR> No of repeater =xx<CR> Repeater disabled/Enabled<CR> P2P mode enabled/disabled<CR> OK<CR>
ATRX2=x	Receive Address 2	ATRX2=12<CR> Response	In dual addressing ,this address will be the transmit address of transmitter(TX1)/repeater(TX2) ATX1=21<CR> ARX1=32<CR> ATX2=23<CR> ARX2=12<CR> No of repeater =xx<CR> Repeater disabled/Enabled<CR> P2P mode enabled/disabled<CR> OK<CR>
ATAR?	Read addressing mode status	ATAR?<CR> Response	Read module status ATX1=XX<CR> ARX1=XX<CR> ATX2=XX<CR> ARX2=XX<CR> No of repeater =xx<CR> Repeater disabled/Enabled<CR> P2P mode enabled/disabled<CR> OK<CR>
ATRPE=x	Repeater mode	ATRPE=1<CR> Response ATRPE=0<CR> Response	Enable Repeter mode Enter TX1 RX1 TX2 RX2 ADDRESSES TO USE THIS FEATURE<CR> Repeater Enabled<CR> OK<CR> Disable Repeater mode,In this mode it will act as receiver Repeater Disabled<CR>

			OK<CR>
ATNOR=x	No of Repeater	ATNOR=x<CR> Response	No of repeater between transmitter and receiver modules to calculate the trasmission time. OK<CR> No of repeater should be entered at transmitter,its not necessary in repeater



Figure 3: LNM2H/LNM3H Evaluation Kit with RS232, RS485 and USB interface

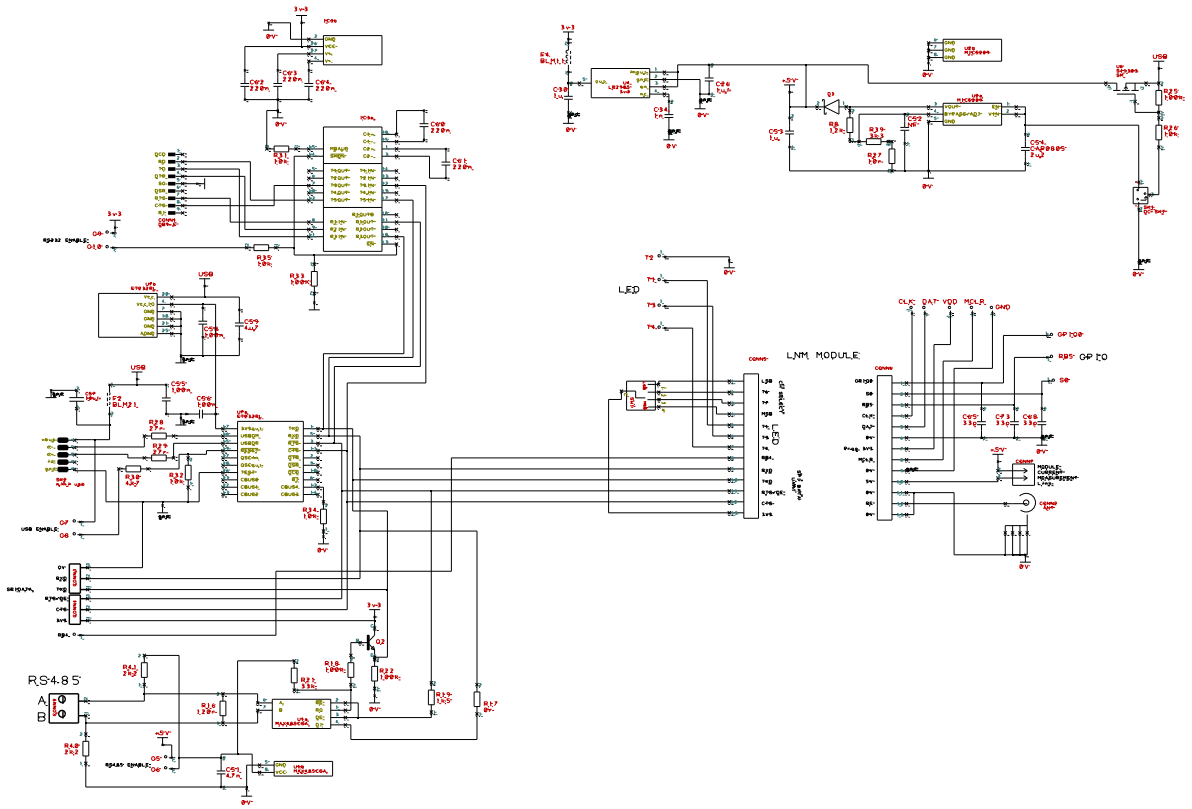


Figure 4: LNM2H/LNM3H Evaluation Kit Schematics

Variants and ordering information

The LNMH MODEM is manufactured in several variants:

LNM2H-458-19	500mW	UK
LNM3H-869-19	400mW	EU

For other variants please contact the factory.

Other variants can be supplied to individual customer requirements at frequencies from 160MHz to 915MHz

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R&TTE Directive

After 7 April 2001 the manufacturer can only place finished product on the market under the provisions of the R&TTE Directive. Equipment within the scope of the R&TTE Directive may demonstrate compliance to the essential requirements specified in Article 3 of the Directive, as appropriate to the particular equipment. Further details are available on The Office of Communications (Ofcom) web site:

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

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