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LNM2H-458-19 PRELIMINARY Issue A, 5 October 2018

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 meet 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 ±2.0ppm frequency stability over -30˚C +85˚C
- SAW front end filter

PCB Layout and connections

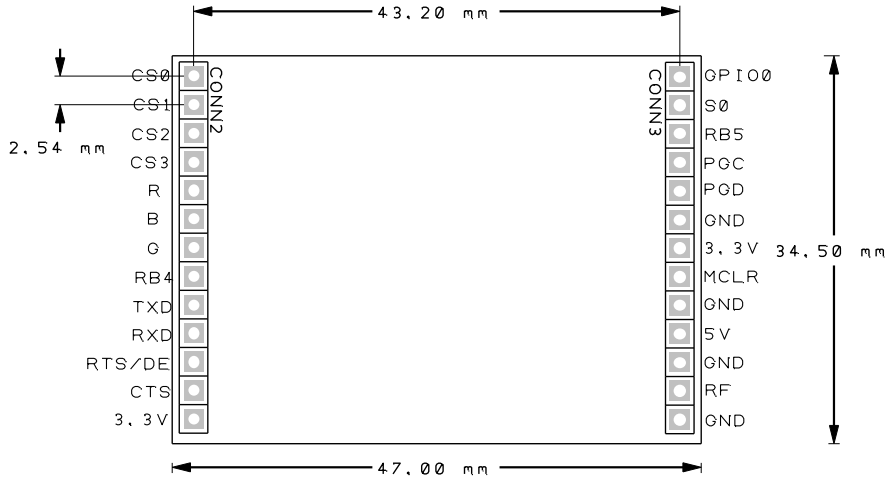


Figure 2: LNM2H/LNM3H Pinout and Dimensions

PIN	DESCIPTION	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	DESCIPTION	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℃ 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	

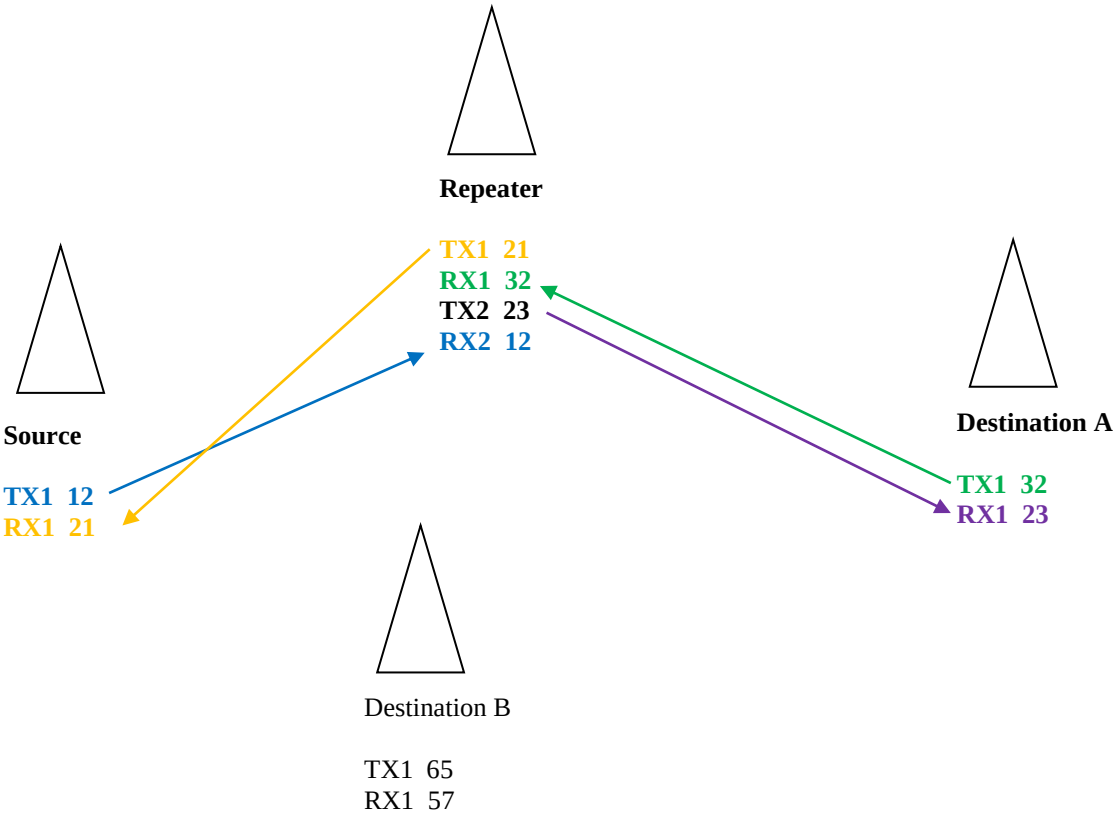
Notes:

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℃ 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.


Repeater
TX1 21
RX1 32
TX2 23
RX2 12
Source
TX1 12
RX1 21
Destination A
TX1 32
RX1 23
Destination B
TX1 65
RX1 57

Configuration Mode

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.
Responses shown below in *Italics* will also be terminated with Carriage Retun.
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? *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*	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

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

		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 Trasmission	ATDEU=xx<CR> Response ATDEU=FF<CR> Response	In this unicast trasmission ,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

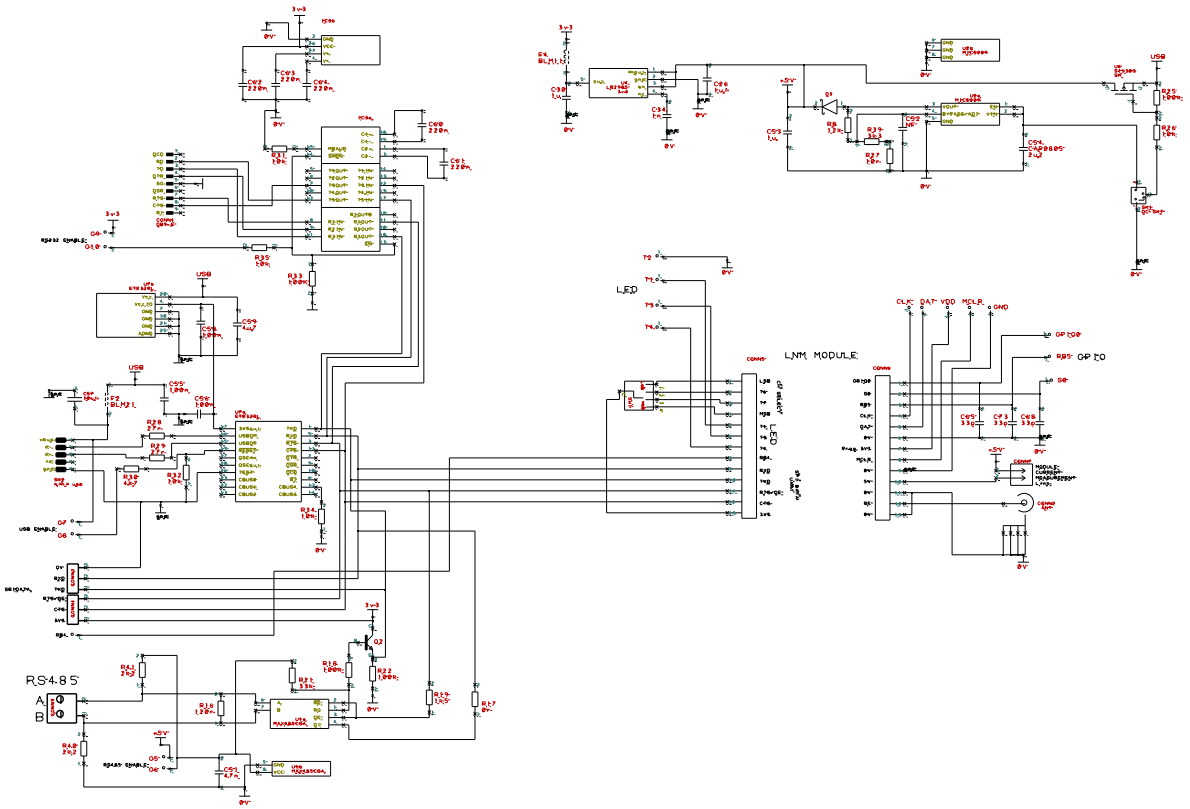


Figure 4: LNM2H/LNM3H Evaluation Kit Schematics

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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The Intrastat commodity code for all our modules is: 8542 6000

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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