

## LMT0/LMR0

Issue 1, 02 November 2012

### 27MHz HF Narrow Band FM multi channel radio modules

**The LMT0 transmitter and LMR0 receiver modules offer a 10kHz channel spacing multi channel, low power, and reliable HF data link. This makes the LMT0/LMR0 pair ideally suited to those low power applications where existing wideband modules have insufficient range, or where low cost multi-channel operation is needed without compromising on RF specification or regulatory requirement.**



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Figure 1: LMT0 transmitter and LMR0 receiver

#### Features

- Conforms to EN 300 220-2 and EN 301 489-3
- High performance double superhet. PLL synthesizer with TCXO
- 6 channels (standard). Up to 16 parallel select or 32 serial select channels
- quasi-dc (peak sampling) data recovery circuit (for enhanced performance on unbalanced datastreams)
- Data rates up to 4 kbps for standard module
- Usable range over 1km
- Fully screened. Low profile
- Feature-rich interface (RSSI, analogue and digital baseband)
- Re-programmable via UART interface
- Low power requirements

#### Applications

- Radio Control (R/C) Radio Service under FCC Part 95 subpart C
- Radio model control
- Telemetry and telecommand
- Wireless door entry systems
- Simple On/Off switching
- In-building environmental monitoring and control
- Security and fire alarms
- Vehicle/machinery controls

#### Technical Summary

- Operating frequencies: 10mW 26.957-27.283MHz Non-specific Short Range Devices (SRD)  
 100mW 26.995, 27.045, 27.095, 27.145, 27.195 MHz Model Control  
 Any 0.5MHz wide sub-band in 26-28MHz
- Transmit power: +10dBm (10mW) nominal @ 4.1V (factory adjustable 1 - 25mW)
- Receiver sensitivity: -115dBm (for 12 dB SINAD)
- Supply range: 4.1V – 15V Transmitter  
 3.1V – 15V Receiver
- Current consumption: 40mA @ 10mW Transmit  
 20mA Receive
- Data bit rate: 4kbps max.

**Evaluation platforms:** NBEK + LM Series carrier

# LMT0 HF multi-channel transmitter

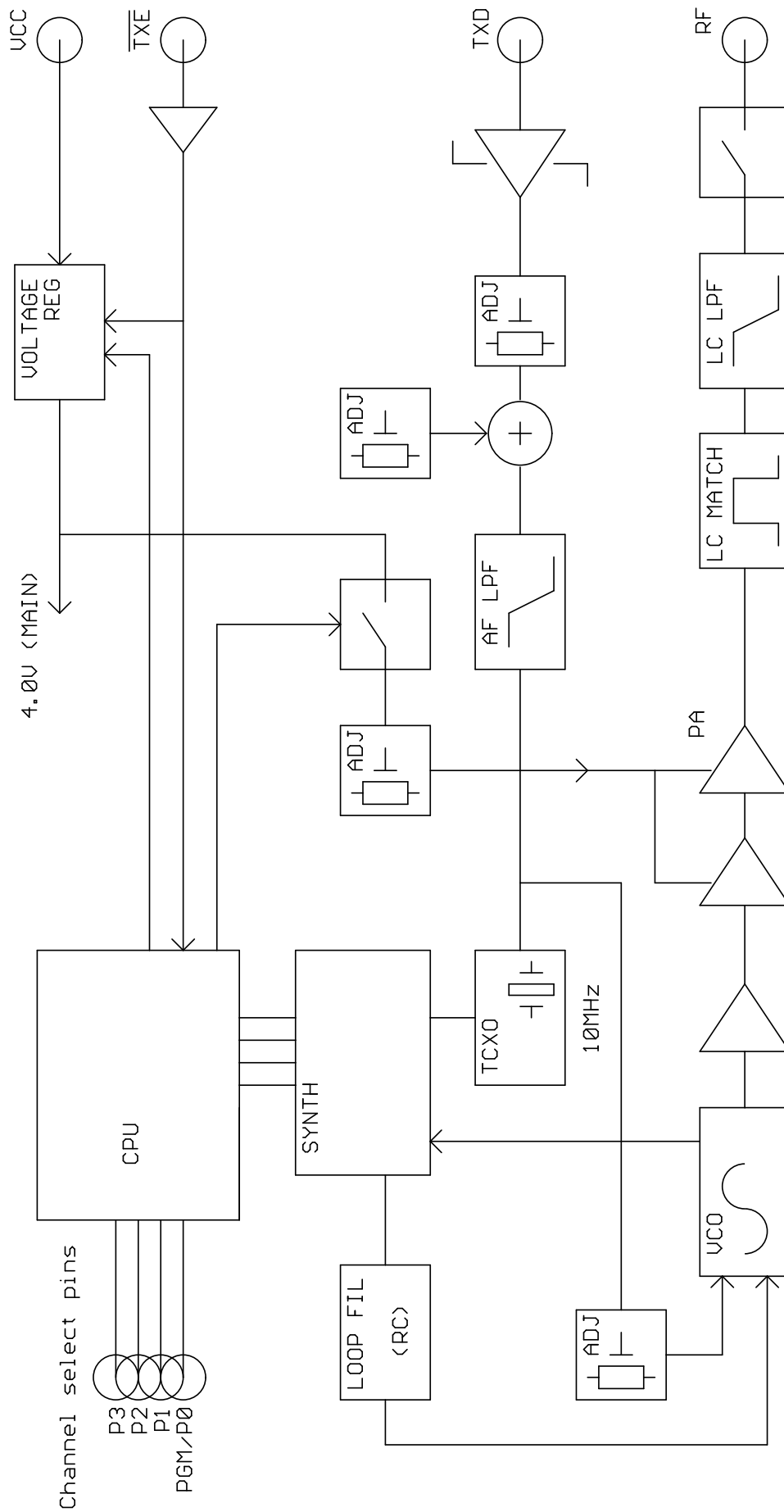


Figure 2: LMT0 block diagram

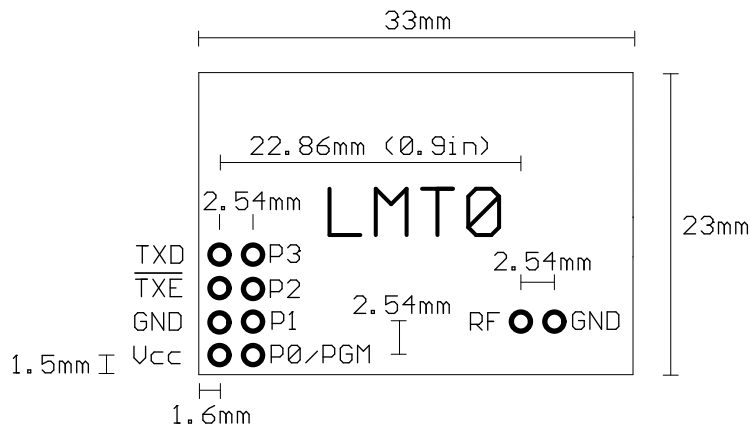


Figure 3: LMT0 footprint (top view)

### Pin description – LMT0

Pin	Name	Function
1a	Vcc	4.1V – 15V power supply
2a	0V	Ground
3a	TXE	Transmit Enable (active low)
4a	TXD	DC coupled input for CMOS logic. $R_{in}=47k\Omega$
5a	No pin	Not present in LMT0
1b	P0/PGM	Parallel Channel select LSB Serial frequency programming / configuration <sup>1</sup>
2b	P1	Parallel Channel select
3b	P2	Parallel Channel select
4b	P3	Parallel Channel select MSB
5b	No pin	Not present in LMT0

#### Notes:

1. Serial programming is by an inverted, CMOS logic level, 2400 baud UART data stream applied to the PGM pin.
2. Channel select inputs have pull-ups (50k $\Omega$ ) to 4V internal rail. Do not exceed 4V logic levels on this port.
3. Channel select inputs are active low
4. TXE has a 100k $\Omega$  pull-up to Vcc
5. All pins are on an 0.1" grid
6. The pins 5a/b are not present, but are included in footprint for compatibility with other units in this family



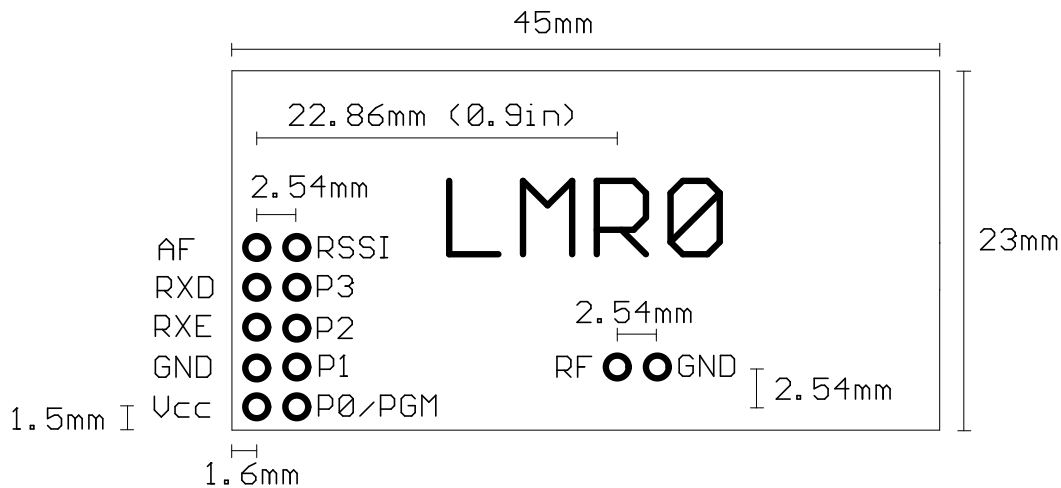


Figure 5: LMR0 footprint (top view)

### Pin description – LMR0

Pin	Name	Function
1a	Vcc	3.1 – 15V power supply
2a	0V	Ground
3a	RXE	Receiver Enable (active high)
4a	RXD	Data out (open collector, no pull-up)
5a	AF out	600mV p-p audio. DC coupled, approx 0.8v bias.
1b	P0/PGM	Parallel Channel select LSB Serial frequency programming / configuration <sup>1</sup>
2b	P1	Parallel Channel select
3b	P2	Parallel Channel select
4b	P3	Parallel Channel select MSB
5b	RSSI	DC level between 0.5v and 2.2v. 60dB dynamic range

#### NOTES:

1. Serial programming is by an inverted, cmos logic level, 2400 baud UART data stream applied to the P0 pin.
2. Channel select inputs have pull-ups (50kΩ) to 3V internal rail. Do not exceed 3V logic levels on this port.
3. Channel select inputs are active low
4. All pins are on an 0.1" grid
5. Unit will operate (with marginally reduced specifications) from a 3.0v rail. This must be well regulated and without noise or ripple, as in this state the unit's internal regulator no longer operates, and provides no supply rejection.
6. A quasi-DC data extractor is provided, to better deal with mark - space errors in simple coder schemes
7. Compared to a standard LMR, the AF output has the opposite 'sense'. Data output polarity is, however, the same.

## Serial interface commands

2400 baud UART. 8 bit data, no parity, 1 start bit, 1 or 2 stop bits.

Serial data is sent to the unit on one of the parallel channel select pins (P0). It is very important that the unit does not 'decode' switch bounce in ordinary operation as a command string, or spurious re-writing of the e2prom will result. For this reason the user must send the 16 character string ENABLESERIALMODE (followed by a carriage return) to activate the serial command mode before sending any of the command strings listed below. Command mode is disabled on power down, or on reception of a # character. To successfully program the unit, it must be enabled ('RXE high (rx) or TXE low (tx)).

GOCHAN aa	Serially select channel aa, where aa is ch0 to ch31
LOAD aa nnnnn	Set value of N register for channel aa, where aa is Channels 0 to 31
SETPAR	Channel selected by 4 bit parallel inputs (ch0 to ch15 only)
SETSER	Channel selected by most recent GOCHAN operation
RVALUE rrrr	Set value for R register
SINGLE nnnnn	Set value of N for single channel operation. N value NOT stored in EEPROM
<cr>	Process entry
/	Clear all buffers
#	Disable command mode

aa = a two digit channel number from 00 to 31  
 nnnnn = synthesizer N register value (up to 65535)  
 rrrr = synthesizer R register value (up to 16383)

### For LMT0 Transmitter:

$$R = \frac{f_{Xtal}}{f_{comp}} = \frac{10MHz}{5kHz} = 2000$$

$$N_{TX} = \frac{f_{RF}}{f_{Comp}} = \frac{27.095MHz}{5kHz} = 5419$$

### For LMR0 Receiver:

$$R = \frac{f_{Xtal}}{f_{Comp}} = \frac{13MHz}{5kHz} = 2600$$

$$N_{RX} = \frac{f_{RF} + IF}{f_{Comp}} = \frac{27.095MHz + 21.4MHz}{5kHz} = 9699$$

- Notes:**
1. A pause of at least 50ms must be allowed between command strings (EEPROM programming time).
  2. : In 'SINGLE' mode the unit is inoperative after a power down until either another valid SINGLE command is received, or mode is changed by a GOCHAN, SETPAR or SETSER command. 'Single' mode is intended for frequency agile applications.
  3. Unlike most other Radiometrix receivers, the LMR0 design places the local oscillator 21.4MHz ABOVE the channel frequency

## Condensed specifications

<b>Frequency</b>	26.995, 27.045, 27.095, 27.145, 27.195, 27.255MHz (Standard) Any 0.5MHz wide sub-band in 26-28MHz (General)
<i>Frequency stability LMT0 LMR0</i>	±1.0kHz ±0.5kHz
<i>Channel spacing</i>	10kHz
<i>Number of channels</i>	6 channels (standard) 16 channels controlled by parallel port or 32 via serial 4V level UART interface
Operating temperature	-20 °C to +70 °C (Storage -30 °C to +70 °C)
Spurious radiations	Compliant with ETSI EN 300 220-2 and EN 301 489-3 Meets FCC Part 95
<b>Transmitter</b>	
Output power	+10dBm (10mW) ±1dB nominal (25mW available to order)
Peak deviation	±1.2kHz
TX on switching time	30ms from TXE transition
Modulation type	FSK (F3D)
TX modulation bandwidth	DC – 4kHz (CMOS compatible)
Adjacent channel TX power	<-37dBm
TX spurious	<-40dBm (<-54dBm in forbidden bands) No RF output in Standby
<b>Supply</b>	
<i>Voltage</i>	4.1V – 15V
<i>Current</i>	40mA transmit (65mA at 25mW RF power output) <5µA standby (TXE high or floating)
Inputs	Data (CMOS/TTL compatible)
Size	33 x 23 x 9mm
Interface <i>User</i>	10 (8) pin 0.1" pitch dual row (5+5) header
<i>RF</i>	2pin 0.1" pitch
Recommended PCB hole size	1.2mm
<b>Receiver</b>	
Sensitivity	-115dBm for 12dB SINAD
Image, Spurii	<-60db
Blocking	Better than 90dB
LO re-radiation	-70dBm
<b>Supply</b>	
<i>Voltage</i>	3.1V – 15V
<i>Current</i>	20mA receive <1µA standby (RXE low)
Outputs	RSSI, audio, data (quasi DC data recovery circuit)
Size	46 x 23 x 9 mm
Interface <i>User</i>	10 pin 0.1" pitch dual row (5+5) header
<i>RF</i>	2pin 0.1" pitch
Recommended PCB hole size	1.2mm

## RX Received Signal Strength Indicator (RSSI)

The LMR0 has wide range RSSI that measures the strength of an incoming signal over a range of 60dB or more. This allows assessment of link quality and available margin and is useful when performing range tests.

The output on pin 5b of the module has a standing DC bias of up to 0.5V with no signal, rising to 2.2V at maximum indication (RF input levels of -40dBm and above).  $\Delta V_{min-max}$  is typically 2V and is largely independent of standing bias variations. Output impedance is 40k $\Omega$ . Pin 5b can drive a 100 $\mu$ A meter directly, for simple monitoring.

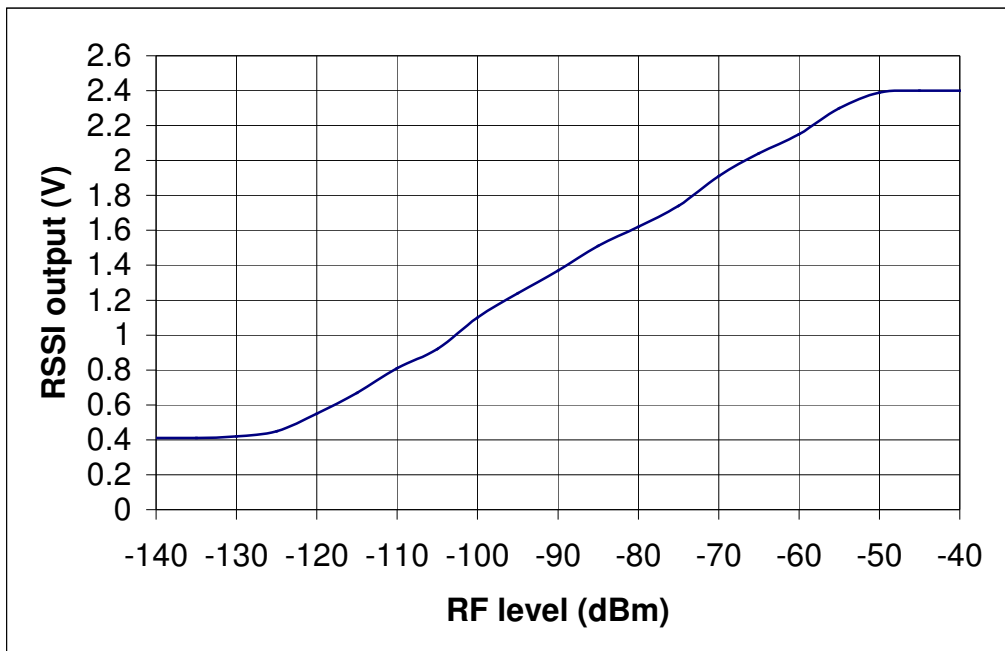


Figure 6: typical RSSI level with respect to received RF level at LMR0 antenna pin

## Ordering Information:

Part No.	Description	Channel Frequencies (MHz)	RF power (mW)	Channel Spacing (kHz)	Data rate kbps
LMT1-27-4	Transmitter	CH0: 26.995, CH1: 27.045MHz, CH2: 27.095, CH3: 27.145MHz, CH4: 27.195, CH5: 27.255MHz	10	10	4
LMR1-27-4	Receiver				
LMT1-27-4-25mW	Transmitter	CH0: 26.995, CH1: 27.045MHz, CH2: 27.095, CH3: 27.145MHz, CH4: 27.195, CH5: 27.255MHz	25	10	4

**Note:** 25mW version is intended for use in USA, Australia, NZ and only for model control in Europe

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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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