RADIOMETRIX

Hartcran House, 231 Kenton Lane, Harrow, Middlesex, HA3 8RP, England
Tel: +44 (0) 20 8909 9595, Fax: +44 (0) 20 8909 2233, www.radiometrix.com

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.

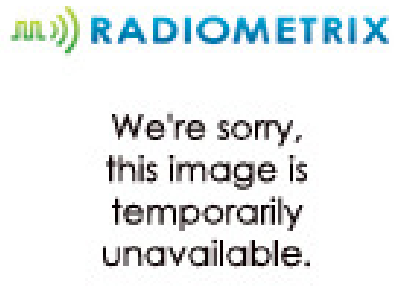

Figure 1: LMT0 transmitter and LMR0 receiver

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

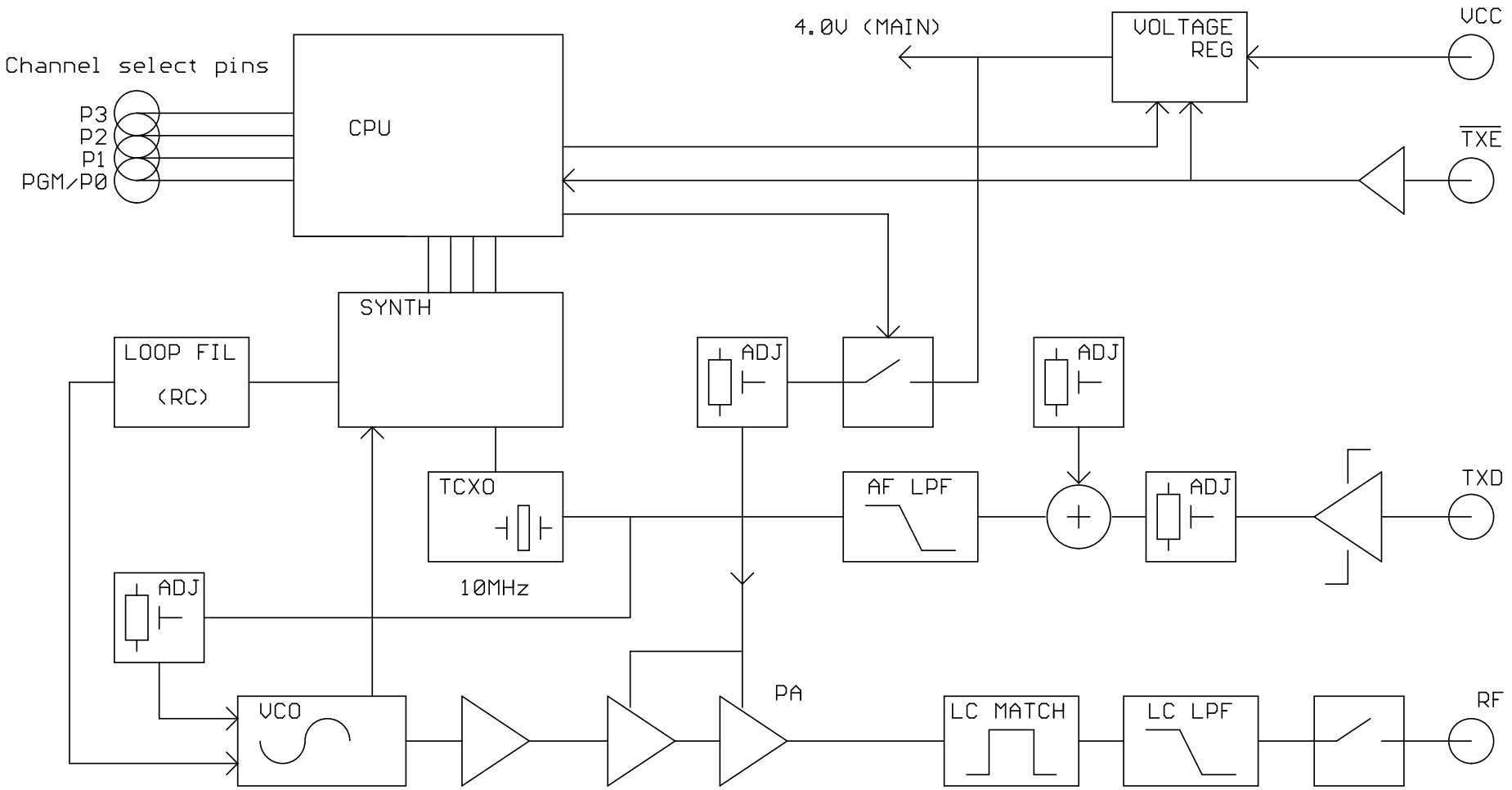

Figure 2: LMT0 block diagram

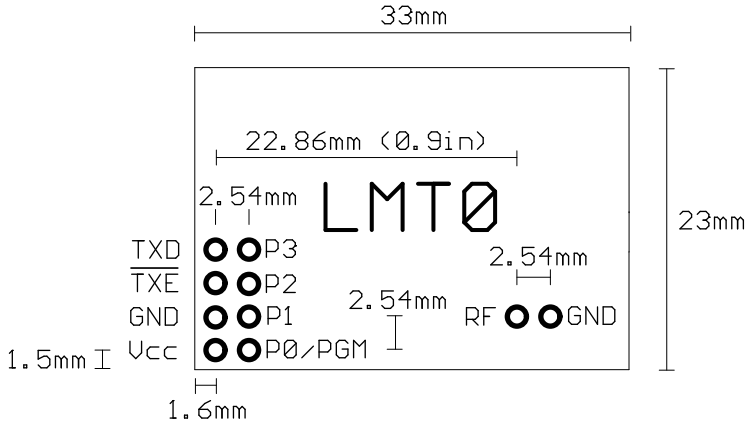

Figure 3: LMT0 footprint (top view)

Pin description – LMT0

Pin	Name	Function
1a	Vcc	4.1V – 15V power supply
2a	0V	Ground
3a	$\overline{\text{TXE}}$	Transmit Enable (active low)
4a	TXD	DC coupled input for CMOS logic. R_{in}=47kΩ
5a	No pin	Not present in LMT0
1b	P0/PGM	Parallel Channel select LSB Serial frequency programming / configuration[1]
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 (50kΩ) to 4V internal rail. Do not exceed 4V logic levels on this port.
3. Channel select inputs are active low
4. $\overline{\text{TXE}}$ has a 100kΩ 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

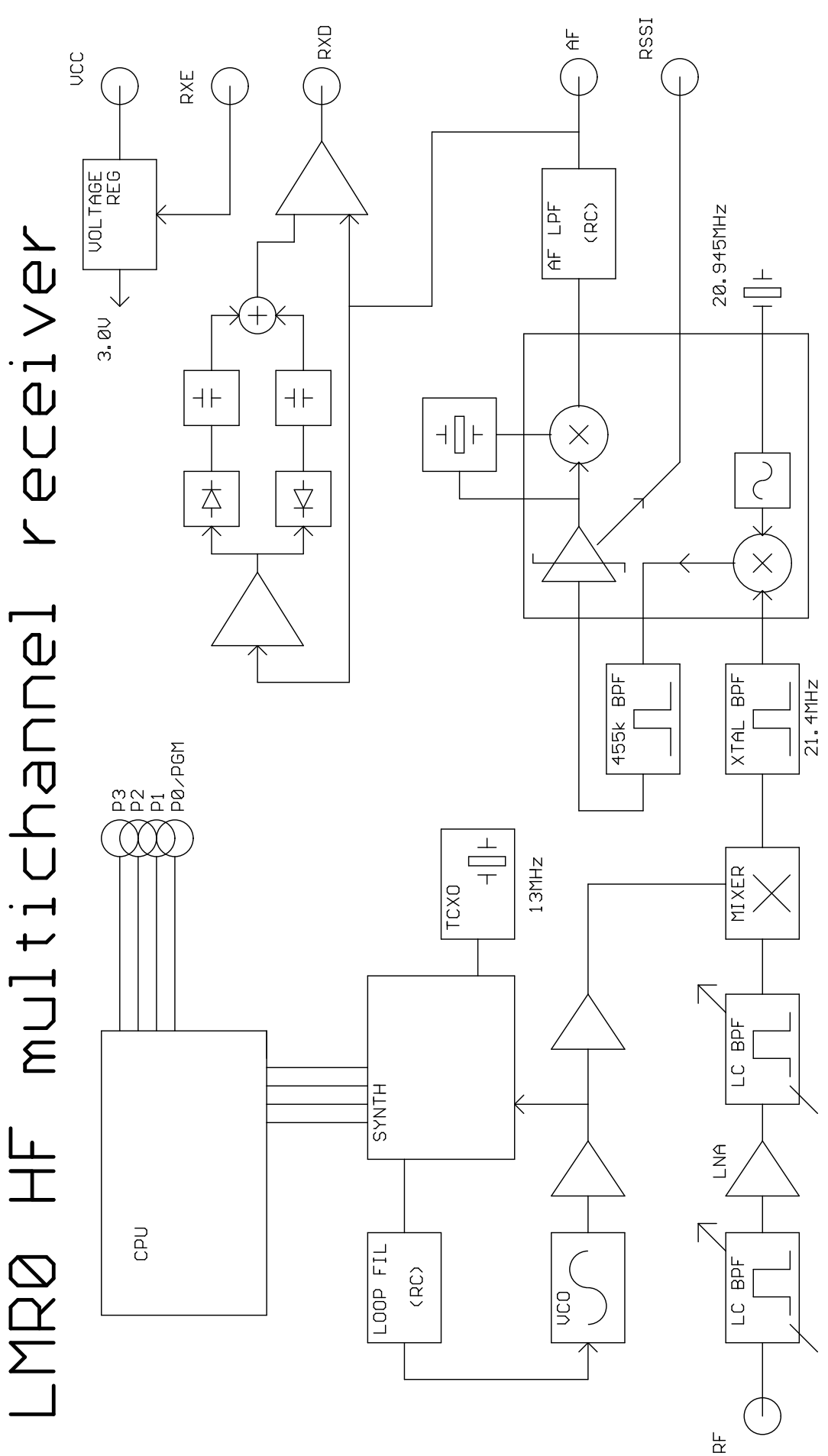

Figure 4: LMR0 block diagram

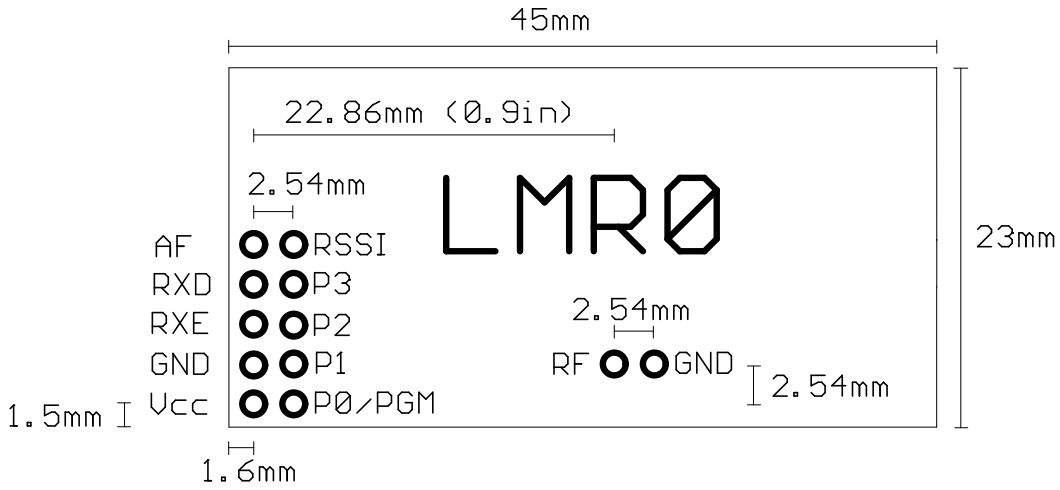

Figure 5: LMR0 footprint (top view)

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[1]
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 $\overline{TXE}$ 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

Frequency	26.995, 27.045, 27.095, 27.145, 27.195, 27.255MHz (Standard) Any 0.5MHz wide sub-band in 26-28MHz (General)
Frequency stability LMT0 *LMR0*	±1.0kHz ±0.5kHz
Channel spacing	10kHz
Number of channels	6 channels (standard) 16 channels controlled by parallel port or 32 via serial 4V level UART interface
Operating temperature	-20 ºC to +70 ºC (Storage -30 ºC to +70 ºC)
Spurious radiations	Compliant with ETSI EN 300 220-2 and EN 301 489-3 Meets FCC Part 95
Transmitter	
Output power	+10dBm (10mW) ±1dB nominal (25mW available to order)
Peak deviation	±1.2kHz
TX on switching time	30ms from $\overline{\text{TXE}}$ 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
Supply	
Voltage	4.1V – 15V
Current	40mA transmit (65mA at 25mW RF power output) <5µA standby ($\overline{\text{TXE}}$ high or floating)
Inputs	Data (CMOS/TTL compatible)
Size	33 x 23 x 9mm
Interface *User*	10 (8) pin 0.1" pitch dual row (5+5) header
RF	2pin 0.1” pitch
Recommended PCB hole size	1.2mm
Receiver	
Sensitivity	-115dBm for 12dB SINAD
Image, Spurii	<-60db
Blocking	Better than 90dB
LO re-radiation	-70dBm
Supply	
Voltage	3.1V – 15V
Current	20mA receive
	<1µA standby (RXE low)
Outputs	RSSI, audio, data (quasi DC data recovery circuit)
Size	46 x 23 x 9 mm
Interface *User*	10 pin 0.1" pitch dual row (5+5) header
RF	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). ΔVmin-max is typically 2V and is largely independent of standing bias variations. Output impedance is 40kΩ. Pin 5b can drive a 100µA meter directly, for simple monitoring.

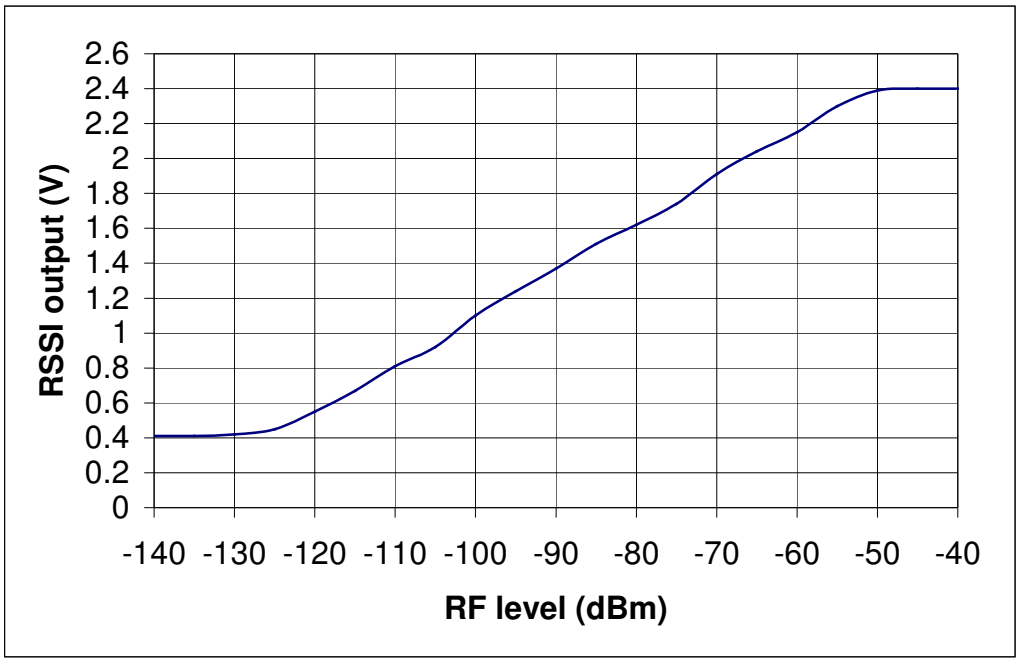

Figure 6: typical RSSI level with respect to received RF level at LMR0 antenna pin

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

Radiometrix Ltd
Hartcran House
231 Kenton Lane
Harrow, Middlesex
HA3 8RP
ENGLAND
Tel: +44 (0) 20 8909 9595
Fax: +44 (0) 20 8909 2233
sales@radiometrix.com
www.radiometrix.com

Limitation of liability

The information furnished by Radiometrix Ltd is believed to be accurate and reliable. Radiometrix Ltd reserves the right to make changes or improvements in the design, specification or manufacture of its subassembly products without notice. Radiometrix Ltd does not assume any liability arising from the application or use of any product or circuit described herein, nor for any infringements of patents or other rights of third parties which may result from the use of its products. This data sheet neither states nor implies warranty of any kind, including fitness for any particular application. These radio devices may be subject to radio interference and may not function as intended if interference is present. We do NOT recommend their use for life critical applications.
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/

Information Requests
Ofcom
Riverside House
2a Southwark Bridge Road
London SE1 9HA
Tel: +44 (0)845 456 3000 or 020 7981 3040
Fax: +44 (0)20 7783 4033
information.requests@ofcom.org.uk

European Radiocommunications Office (ERO)
Peblingehus
Nansensgade 19
DK 1366 Copenhagen
Tel. +45 33896300
Fax +45 33896330
ero@ero.dk
www.ero.dk