NEW

Radiometrix

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TLC2/RLC2

UHF Narrow Band FM Low Cost multi channel radio modules

The TLC2 transmitter RLC2 receiver modules offer a low power, reliable data link in an industry-standard pin out and footprint. This makes the TLC2/RLC2 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: RLC2 receiver, TLC2 transmitter

Features

- 433MHz version conforms to EN 300 220-3 and EN 301 489-3
- High performance double superhet. PLL synthesizer with TCXO
- SAW front-end filter
- Data rates up to 5 kbps for standard module
- Usable range over 500m
- Fully screened. Low profile
- Feature-rich interface (RSSI, analogue and digital baseband)
- Re-programmable via RS232 interface
- Low power requirements

Applications

- Handheld terminals
- EPOS equipment, barcode scanners
- Data loggers
- Industrial telemetry and telecommand
- In-building environmental monitoring and control
- High-end security and fire alarms
- DGPS systems
- Vehicle data up/download
- Heavy vehicle/machinery (e.g. crane) controls

Technical Summary

- Operating frequency: 433.875-434.650MHz
- Any custom frequency on 433MHz – 435MHz
- 32 channels in 433MHz band
- Transmit power: +10dBm (10mW)
- Supply range: 4 - 15V (Transmit), 3.7 – 15V(Receive)
- Current consumption: 32mA (transmit), 18mA (receive)
- Data bit rate: 5kbps max. (standard module)
- Receiver sensitivity: -120dBm (for 12 dB SINAD)
- Serial configuration by inverted RS232 at 3V CMOS level

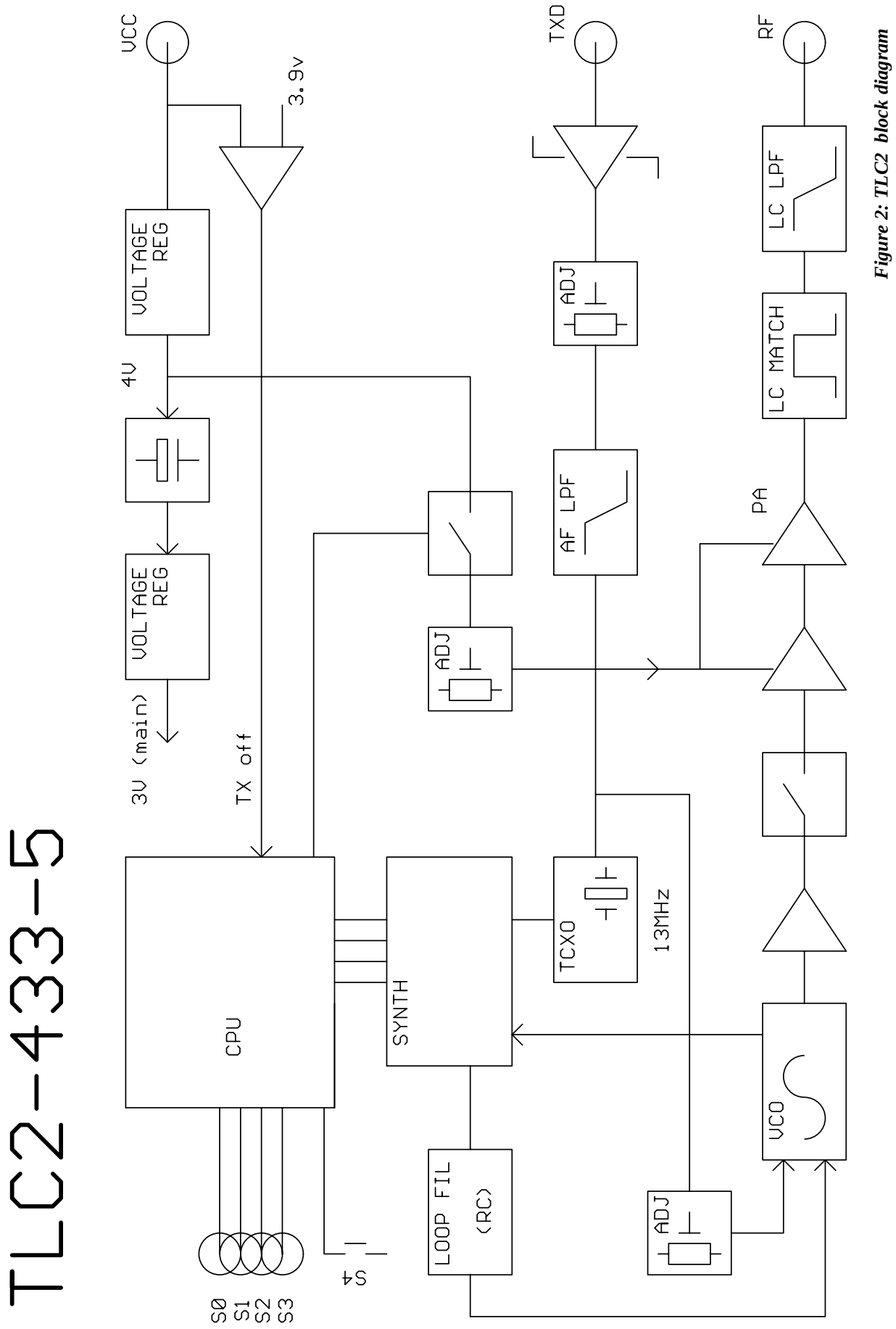

Figure 2: TLC2 block diagram

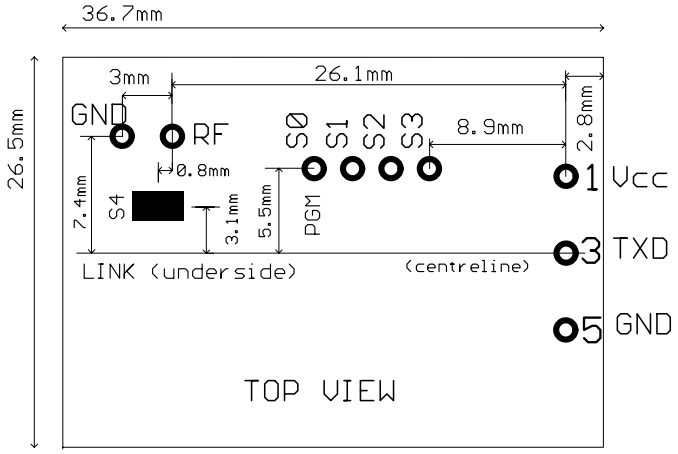

Figure 3: TLC2 footpint (top view)

***Pin description* – TLC2**

Pin	Name	Function
1	Vcc	4 – 15 power supply
2	No pin	Not present in TLC2
3	TXD	DC coupled input for 3V CMOS logic. R_{in}=100kΩ
4	No pin	Not present in TLC2
5	0V	Ground
	S0/PGM	Channel select bit 0 Serial frequency programming / configuration
	S1	Channel select bit 1
	S2	Channel select bit 2
	S3	Channel select bit 3
Jumper	S4	Jumper clear, S4=0 (Channel 0 – Channel 15 at 50kHz step) Jumper soldered, S4=1 (Channel 16 – Channel 31 at 50kHz step)

1. Serial programming is by an inverted 2400 baud RS232 at 3V CMOS level command into the PGM. If connection to a true RS232 port is desired, then a suitable inverting level shifter / buffer (MAX232 or NPN switch transistor) is needed.
2. Parallel channel selection is by a true logic (0V=0, 3V=1), 4-pin parallel input.
3. Channel select inputs have 10kΩ weak internal pull-up to 3V internal rail. Do not exceed 3V logic levels on this port.

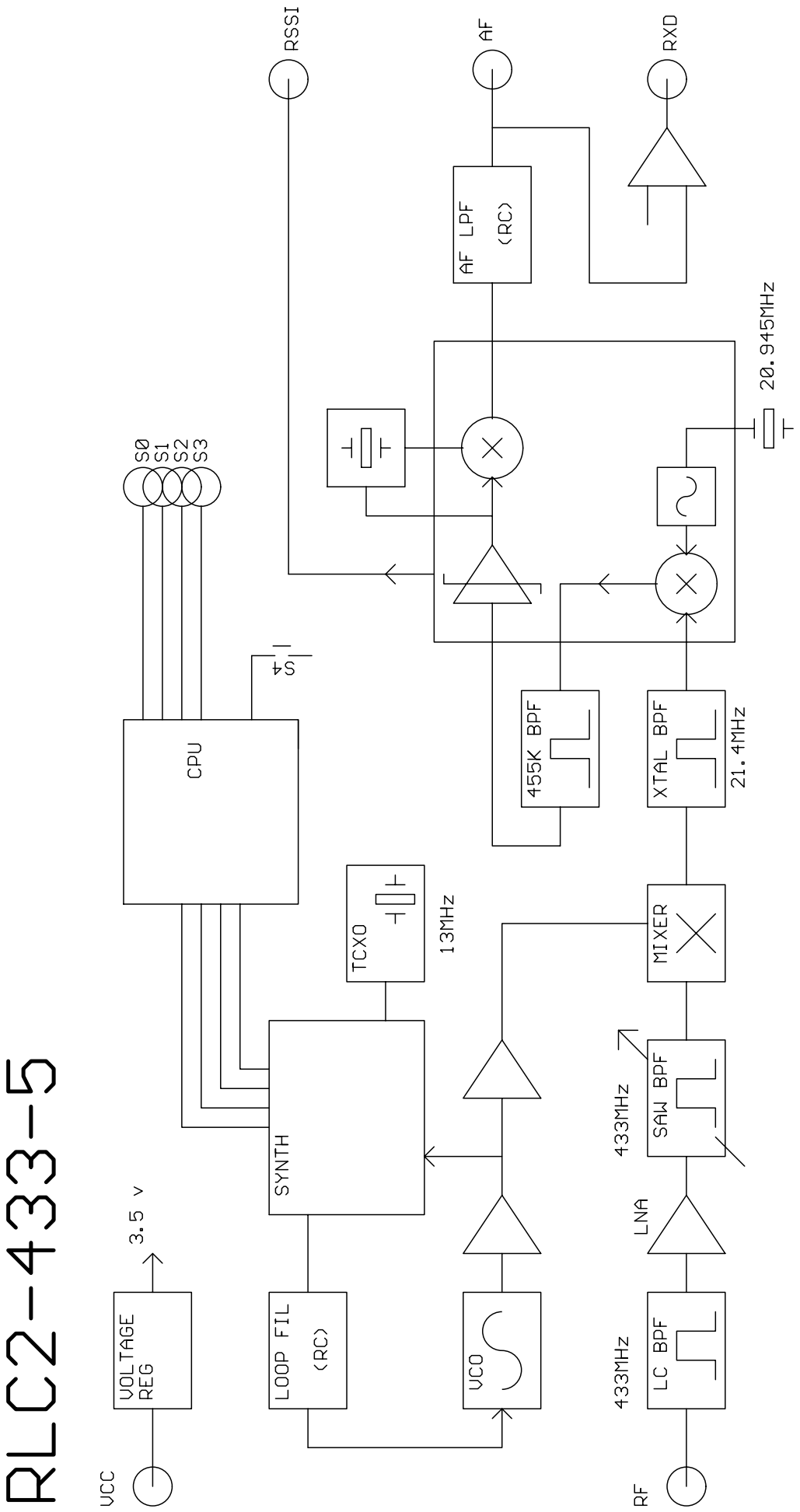

Figure 4: RLC2 block diagram

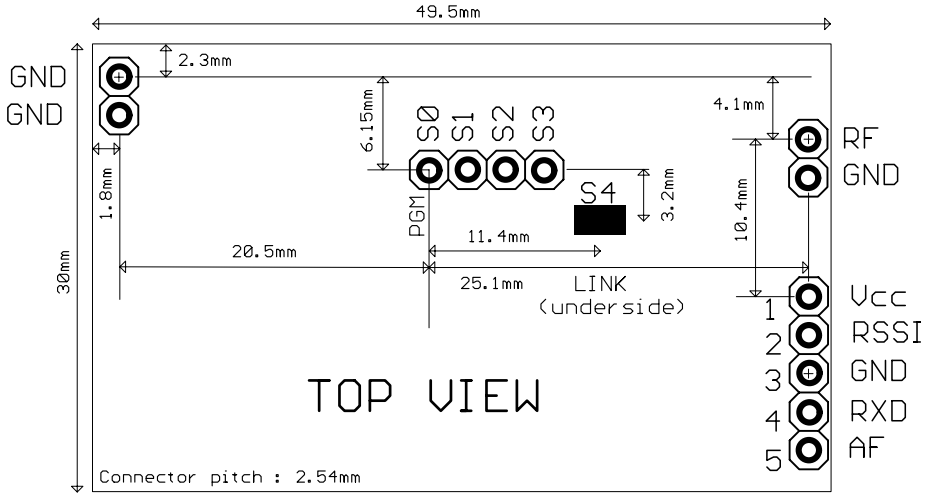

Figure 5: RLC2 footpint (top view)

***Pin description* – RLC2**

Pin	Name	Function
1	Vcc	DC supply (3.7V to 15V, at 18mA).
2	RSSI	0.5V-2.5V DC level. 60dB dynamic range. 40kΩ output impedance
3	0V	Ground
4	RXD	Open collector digital data output with internal 47kΩ pull-up to Vcc
5	AF	600mV $_{pk-pk}$ audio. DC coupled, approx 0.8V bias.
	S0/PGM	Parallel channel select bit 0. Serial frequency programming / configuration[1]
	S1	Channel select bit 1. Weak pull-up to 3.5V
	S2	Channel select bit 2. Weak pull-up to 3.5V
	S3	Channel select bit 3. Weak pull-up to 3.5V
Jumper	S4	Jumper clear, S4=0 (Channel 0 – Channel 15 at 50kHz step) Jumper soldered, S4=1 (Channel 16 – Channel 31 at 50kHs step)

NOTES:

1. Serial programming is by an inverted 2400 baud RS232 at 3V CMOS level command into the PGM. If connection to a true RS232 port is desired, then a suitable inverting level shifter / buffer (MAX232 or NPN switch transistor) is needed.
2. Parallel channel selection is by a true logic (0V=0, 3V=1), 4-pin parallel input
3. Channel select inputs have 10kΩ weak internal pull-up to 3.5V internal rail. Do not exceed 3V logic levels on this port.

Serial interface commands

2400 baud RS232. 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 EEPROM will result. For this reason the user must send the 16 character string ENABLESERIALMODE to fully enable 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.

SINGLE nnnnn	Set value of N for single channel operation. N value NOT stored in EEPROM
GOCHAN aa	Serially select channel XX, where XX is 0 to 31
LOAD aa nnnnn	Set value of N register for channel aa, where aa is Channels 0 to 31
SETPAR	Channel selected by 5 bit parallel inputs (4pins + jumper)
SETSER	Channel selected by most recent GOCHAN operation
RVALUE rrrr	Set value for R register
<cr>	Process entry
/	Clear all buffers

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)

$$N_{TX} = \frac{f_{RF}}{f_{Channelspacing}} = \frac{433.875MHz}{25kHz} = 17355 \qquad R = \frac{f_{TCXO}}{f_{channelspacing}} = \frac{13MHz}{25kHz}, \text{ So R=520}$$

$$N_{RX} = \frac{f_{RF} - 21.4MHz}{f_{Channelspacing}} = \frac{433.875MHz - 21.4}{25kHz} = 16499$$

Note: *A pause of at least 25ms must be allowed between command strings (EEPROM programming time).*
SINGLE mode does not store the N value in EEPROM. Therefore 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.

TLC2, RLC2 channels are spaced at 50kHz interval into two frequency groups. 50kHz spacing between sequential channels minimises adjacent channel interference. S4 jumper link determines which frequency group is selected.

Channel (S4 clear)	Frequency (MHz)	Channel (S4 soldered)	Frequency(MHz)
0	433.875		
		16	433.900
1	433.925		
		17	433.950
2	433.975		
		18	434.000
3	434.025		
		19	434.050
4	434.075		
		20	434.100
5	434.125		
		21	434.150
6	434.175		
		22	434.200
7	434.225		
		23	434.250
8	434.275		
		24	434.300
9	434.325		
		25	434.350
10	434.375		
		26	434.400
11	434.425		
		27	434.450
12	434.475		
		28	434.500
13	434.525		
		29	434.550
14	434.575		
		30	434.600
15	434.625		
		31	434.650

Condensed specifications

Frequency	433.875-434.675MHz (custom variants on 433MHz – 435MHz)
Peak deviation	
Frequency stability	±1.5kHz
Channel spacing	25kHz (12.5kHz by special order)
Number of channels	32 channels selected via RS232 interface or 2 x 16 groups by parallel port
Operating temperature	-10 C to +60 C (Storage -30 C to +70 C)
Spurious radiations	Compliant with ETSI EN 300 220-3 and EN 301 489-3
Interface	
User	5pin 0.1" pitch molex
channel	4pin 0.1" pitch molex
RF	2pin 0.1" pitch molex

Transmitter	
Output power	+10dBm (10mW) ±1dB (1mW or 5mW by special order)
TX on switching time	50ms from power up
Modulation type	FSK (F3D)
TX modulation bandwidth	DC – 5kHz (3V CMOS compatible)
Adjacent channel TX power	<-37dBm
TX spurious	<-50dBm

Transmitter	
Supply	
Voltage	4V – 15V
Current	32mA nominal transmit
Inputs	analogue, data (CMOS/TTL compatible)
Size	37 x 27 x 8mm
Receiver	
Sensitivity	-112dBm for 1 part per 1000 BER
	-120dBm for 12 dB SINAD
AF bandwidth (-3dB)	4kHz
image / spurious / adjacent channel	<-60dB
Blocking	<-85dB
LO re-radiation	<-60dBm
Supply	
Voltage	3.7V – 15V
Current	18mA
Outputs	RSSI, audio, data
Size	50 x 30 x 10mm
Power on to valid audio	28ms
Power on to stable data out (50:50 mark / space)	50ms

Notes:

1. The data slicer cannot be depended upon for data waveform frequencies below 250Hz

2. When RX is on and a transmitter keys up, again a 50ms period is required to stabilise data output mark/space. i.e. allow at least 50ms of preamble

Low Cost TLC2 transmitter differs from standard BMT2 transmitter in the following key features.

	BMT2	TLC2
Footprint	Industry standard (extra 2 pins)	Industry standard
Frequency band	400-480MHz (any 5MHz band)	433.875 - 434.650Hz (only)
Channels	32 parallel or 256 serial	32 parallel/serial
Channel select switches	5 bit optional	Not available
Parallel channel select	4 pins (and 1 jumper link)	4 pins (and 1 jumper link)
Serial Frequency programming	Pin 2	Via S0/PGM pin
Transmit Enable	Pin 4	not present on TLC2
Modem	1200 baud modem	Not available
Supply	2.4V-15, 40mA	4V-15, 32mA

Low Cost RLC2 receiver differs from standard BMR2 receiver in the following key features.

	BMR2	RLC2
Footprint	Industry standard	Industry standard
Frequency band	400-480MHz (any 5MHz band)	433 – 435 MHz
Channels	32 parallel or 256 serial	32 parallel/serial
Channel select switches	5 bit internal	Not available
Parallel channel select	4 pins (and 1 jumper link)	4 pins (and 1 jumper link)
SAW front end filter	-	Yes
Serial Frequency programming	Via RSSI/PGM pin	via S0/PGM pin
Modem	1200 baud modem	Not available
Supply	3.7V-15, 18mA	3.7V-15, 20mA
Spurii	65dB-70dB	<-60dB
Sensitivity	-118dBm	-120dBm

Antenna requirements

Three types of integral antenna are recommended and approved for use with the module:

A) ***Whip*** This is a wire, rod ,PCB track or combination connected directly to RF pin of the module. Optimum total length is 16.4cm (1/4 wave @ 433MHz). Keep the open circuit (hot) end well away from metal components to prevent serious de-tuning. Whips are ground plane sensitive and will benefit from internal 1/4 wave earthed radial(s) if the product is small and plastic cased

B) ***Helical*** Wire coil, connected directly to RF pin, open circuit at other end. This antenna is very efficient given it's small size (20mm x 4mm dia.). The helical is a high Q antenna, trim the wire length or expand the coil for optimum results. The helical de-tunes badly with proximity to other conductive objects.

C) ***Loop*** A loop of PCB track tuned by a fixed or variable capacitor to ground at the 'hot' end and fed from RF pin at a point 20% from the ground end. Loops have high immunity to proximity de-tuning.

	A	B	C
	whip	***helical***	***loop***
Ultimate performance	***	**	*
Easy of design set-up	***	**	*
Size	*	***	**
Immunity proximity effects	*	**	***
Range open ground to similar antenna	500m	200	100

The antenna choice and position directly controls the system range. Keep it clear of other metal in the system, particularly the 'hot' end. The best position by far, is sticking out the top of the product. This is often not desirable for practical/ergonomic reasons thus a compromise may need to be reached. If an internal antenna must be used, try to keep it away from other metal components, particularly large ones like transformers, batteries and PCB tracks/earth plane. The space around the antenna is as important as the antenna itself.

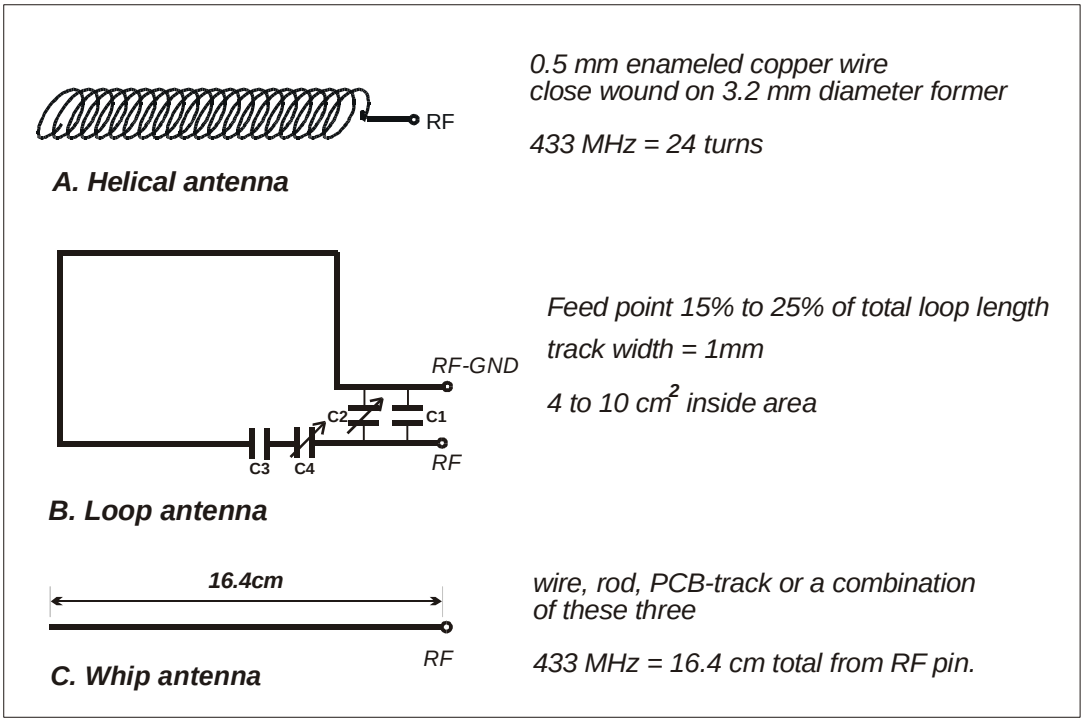

Figure 6: Antenna types

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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 Radiocommunications Agency (RA) web site:

http://www.radio.gov.uk/topics/conformity/conform-index.htm

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