

### Multi channel 25kHz NBFM remote control TX/RX

*The CXT transmitter and CXR receiver modules offer a multi channel, low power, and reliable remote control data link. This makes the CXT/CXR 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: CXT2 transmitter and CXR2 receiver

#### Features

- Conforms to EN 300 220-3 and EN 301 489-3
- High performance double superhet. PLL synthesizer with TCXO
- SAW front-end filter
- Usable range over 1km
- 16 bit unit address (65535 unique addresses)
- Momentary and Latched outputs
- Fully screened. Low profile
- Re-programmable via RS232 interface
- Low power requirements

#### Applications

- Industrial telemetry and telecommand
- HVAC controls
- Wireless door entry systems
- Simple On/Off switching
- In-building environmental monitoring and control
- High-end security and fire alarms
- Heavy vehicle/machinery controls
- Status reporting and monitoring secure systems

#### Technical Summary

- Operating frequency: 173.200 - 173.325MHz (UK band)  
150.825 - 152.450MHz (Australian Band)  
433.875 - 434.650MHz (EU band)  
458.525 - 459.1MHz (UK band)
- Other custom VHF and UHF bands
- 32 channels @ 25kHz channel spacing
- Transmit power: +10dBm (10mW) / +20dBm (100mW)
- Supply range: 3.1 – 15V (TX @ 10mW and RX), 4.1 – 15V (TX @ 100mW)
- Current consumption: 34mA @ 10mW, 90mA @ 100mW (transmit) and 20mA (receive)
- Receiver sensitivity: -118dBm (for 12 dB SINAD)
- Serial configuration by inverted RS232 at 3V CMOS level

## Easy control functions with CXT and CXR:

There are certain user applications where a very simple 'on/off' control function is needed (for example: control of floodlights, alarm sounders, machine override shutdown). Normally such applications require a simple microprocessor or dedicated remote control chip to be added to the radio module, incurring extra size, cost and sometimes software overhead.

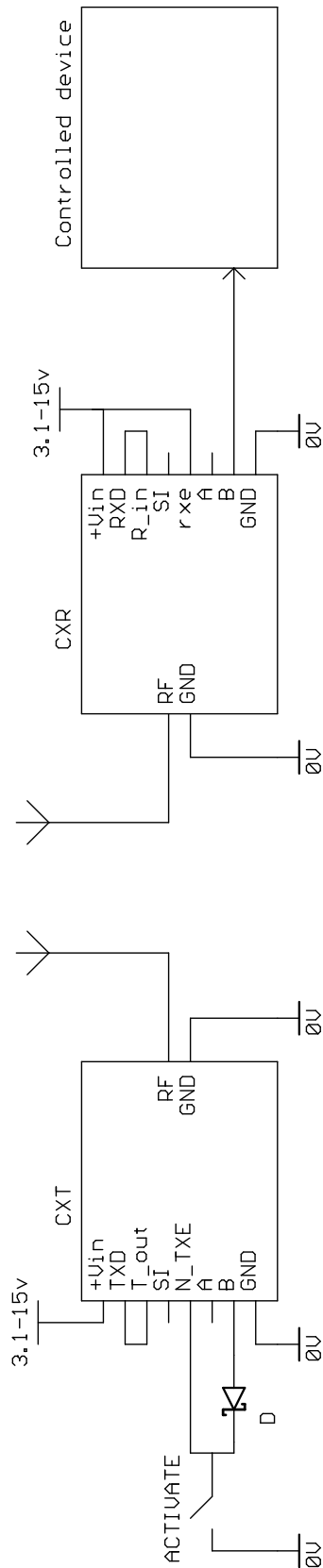
Not anymore. The CXT and CXR module pair (based on either LMT2/LMR2 (UHF version) or LMT1/LMR1 (VHF version)) includes a simple-to-use single function controller/actuator, implemented in the firmware of the radio's internal processor. This code allows the unit to be used as a very simple remote control product, with either a latched or a momentary output. No external control device is required.

Two inputs are provided on the CXT transmitter. Grounding input A sends a coded datastream to the CXR receiver which commands it to latch it's A output high (+3v). Grounding the transmitter B input sends a datastream which resets the receiver A pin to zero. Also, for the duration of the B transmission, the receiver B output is high. The minimum duration of a B output pulse is 300mS.

The CXT transmits whenever either A or B are low, but to function the TXE  $\overline{\text{must}}$  also be low (this can be tied low for simplicity, or diode 'or'ed with the A, B inputs to minimise current consumption)

The data format uses is a modified biphasic format with an average data rate of 600 bits per second. A 42 bit data burst is used (preceded by ample preamble). This incorporates a 16 bit unit address. This is easily modified via the 2400 baud serial communication port (SI pin), which allows both the unit address and the channel number (1 of 32 operating frequencies) to be easily modified. Commands are in an easy to understand 'ascii text and decimal numbers' form, simply entered by hand from any terminal program. Once programmed, values are stored in non-volatile memory.

## MOMENTARY PUSH BUTTON OPERATION



## LATCHED <ON/OFF> OPERATION

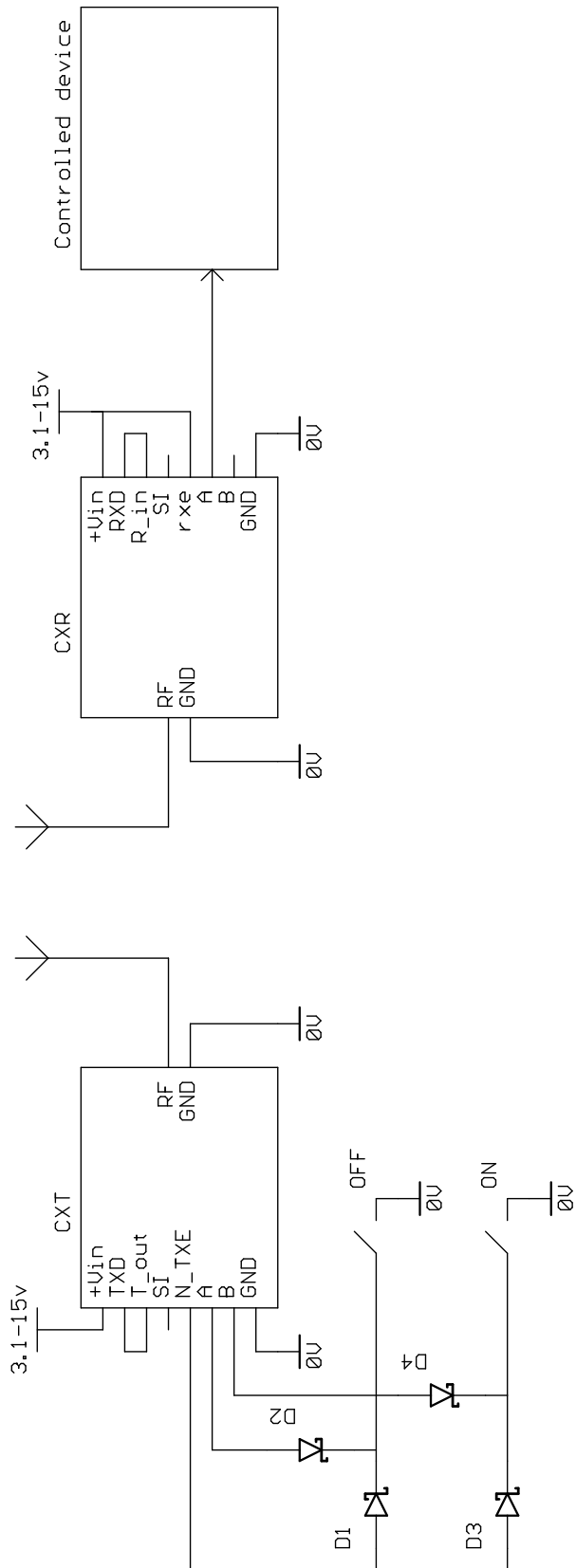


Figure 2: Application circuits

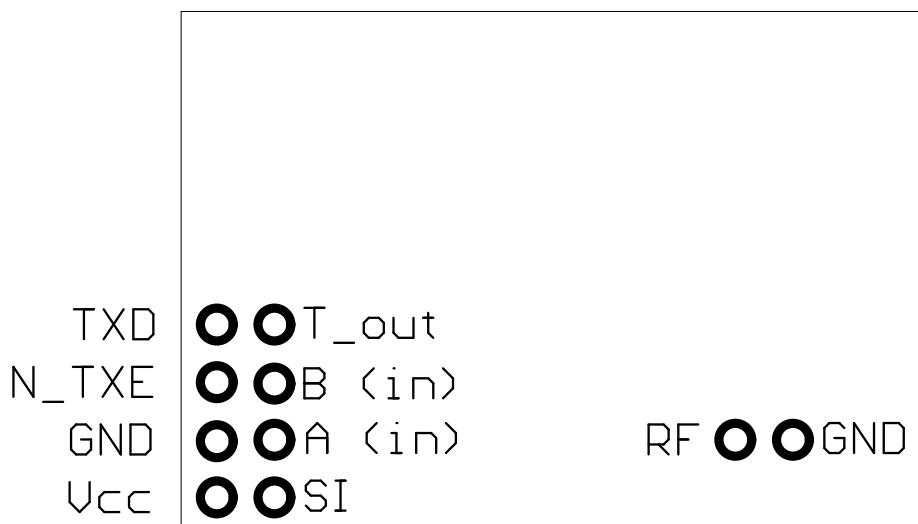


Figure 3: CXT footprint (top view)

### Pin description –CXT

| Pin | Name   | Function                                                  |
|-----|--------|-----------------------------------------------------------|
| 1a  | Vcc    | 3.1 – 15V power supply                                    |
| 2a  | 0V     | Ground                                                    |
| 3a  | N_TXE  | Transmit Enable (active low)                              |
| 4a  | TXD    | Link to 4b                                                |
| 1b  | SI     | Serial frequency programming / configuration <sup>1</sup> |
| 2b  | A (in) | Main (latching) input                                     |
| 3b  | B (in) | Second (cancel) input                                     |
| 4b  | T_out  | Link to 4a                                                |

#### Notes:

1. Serial programming is by an inverted, CMOS logic level, 2400 baud RS232 datastream applied to the SI pin.
2. TXE has a 100kΩ pullup to Vcc
3. Do not exceed 3v logic levels on SI, A or B.
4. SI input has pullup (50K) to 3v internal rail.
5. A and B inputs have pullups (50K) to 3v internal rail. (A, B inputs: active low)
6. CX versions can be identified by the presence of C7, on the underside of the LMT series TX board

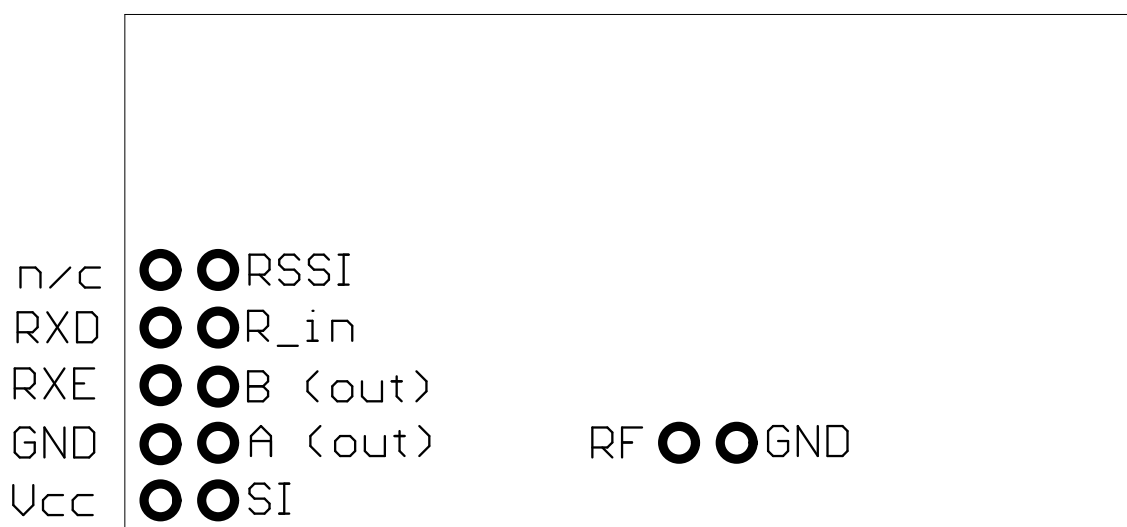


Figure 4: CXR footprint (top view)

### Pin description –CXR

| Pin | Name         | Function                                                      |
|-----|--------------|---------------------------------------------------------------|
| 1a  | Vcc          | 3.1 – 15V power supply                                        |
| 2a  | 0V           | Ground                                                        |
| 3a  | RXE          | Receiver Enable (active high)                                 |
| 4a  | RXD          | Link to 4b                                                    |
| 5a  | N/C (AF out) | No connection, 700mV p-p audio. DC coupled, approx 0.8v bias. |
| 1b  | SI           | Serial frequency programming / configuration <sup>1</sup>     |
| 2b  | A (out)      | Main (latching) output                                        |
| 3b  | B (out)      | Secondary output                                              |
| 4b  | R_in         | Link to 4a                                                    |
| 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 RS232 datastream applied to the SI pin.
2. Do not exceed 3v logic levels on SI, A or B.
3. SI input has pullup (50K) to 3v internal rail.
4. A and B outputs are 3v cmos, active high. Up to 5mA may be drawn from each
5. CX versions can be identified by the presence of C7, on the underside of the LMR series RX board

## Condensed specifications

|                            |                                                                                                                                                                                                                    |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Frequency</b>           | 433MHz EU, 458MHz / 173MHz UK and 151MHz Australian bands<br>EU 433.875 - 434.65MHz<br>UK: 458.525 - 459.1MHz<br>173.200 - 173.325MHz<br>Australian: 150.825 - 152.450MHz<br><i>Other custom VHF and UHF bands</i> |
| <i>Frequency stability</i> | ±1.5kHz                                                                                                                                                                                                            |
| <i>Channel spacing</i>     | 25kHz                                                                                                                                                                                                              |
| <i>Number of channels</i>  | 32 (controlled via RS232 interface)                                                                                                                                                                                |
| Operating temperature      | -20 °C to +55 °C (Storage -30 °C to +70 °C)                                                                                                                                                                        |
| Spurious radiations        | Compliant with ETSI EN 300 220-3 and EN 301 489-3                                                                                                                                                                  |
| <b>Transmitter</b>         |                                                                                                                                                                                                                    |
| Output power               | +10dBm (10mW) ±1dB (factory adjustable 1 - 25mW)<br>+20dBm (100mW) ±1dB (factory adjustable 25 - 100mW)                                                                                                            |
| Peak deviation             | ±3kHz                                                                                                                                                                                                              |
| Modulation type            | 2.5kbps FSK (biphase) data stream                                                                                                                                                                                  |
| TX modulation bandwidth    | DC – 5kHz (3V CMOS compatible)                                                                                                                                                                                     |
| Adjacent channel TX power  | <-37dBm                                                                                                                                                                                                            |
| TX spurious                | <-45dBm (no output in Standby)                                                                                                                                                                                     |
| Supply                     |                                                                                                                                                                                                                    |
| <i>Voltage</i>             | 3.1V – 15V (1-25mW)<br>4.1 – 15V (25 – 100mW)                                                                                                                                                                      |
| <i>Current</i>             | 35mA @ 10mW (nominal)<br>65mA @ 50mW (nominal)<br>100mA @ 100mW (nominal)<br><9µA standby (TXE high or floating)                                                                                                   |
| Inputs                     | data (CMOS/TTL compatible)                                                                                                                                                                                         |
| Size                       | 33 x 23 x 9mm (BiM sized footprint, new pinout)                                                                                                                                                                    |
| Interface <i>User</i>      | 10 (8) pin 0.1" pitch dual row (5+5 or 4+4) header                                                                                                                                                                 |
| RF                         | 2pin 0.1" pitch                                                                                                                                                                                                    |
| Recommended PCB hole size  | 1.2mm                                                                                                                                                                                                              |
| <b>Receiver</b>            |                                                                                                                                                                                                                    |
| Sensitivity                | -115dBm for <0.1% data errors)                                                                                                                                                                                     |
| AF bandwidth (-3dB)        | 4kHz                                                                                                                                                                                                               |
| image                      | <-60db                                                                                                                                                                                                             |
| spuri / adjacent channel   | <-65db                                                                                                                                                                                                             |
| blocking                   | - 84dB                                                                                                                                                                                                             |
| LO re-radiation            | -60dBm                                                                                                                                                                                                             |
| Auxiliary outputs          | RSSI, audio                                                                                                                                                                                                        |
| Supply                     |                                                                                                                                                                                                                    |
| <i>Voltage</i>             | 3.1V – 15V                                                                                                                                                                                                         |
| <i>Current</i>             | 20mA receive<br><1µA standby (RXE low)                                                                                                                                                                             |
| Size                       | 46 x 23 x 9mm                                                                                                                                                                                                      |
| Interface <i>User</i>      | 10 pin 0.1" pitch dual row (5+5) header                                                                                                                                                                            |
| RF                         | 2pin 0.1" pitch                                                                                                                                                                                                    |
| Recommended PCB hole size  | 1.2mm                                                                                                                                                                                                              |

## Programming the CXT and CXR

A 2400 baud cmos level 'inverted RS232 format' (1 start bit, 8 data, 1 or 2 stop bits, no parity) is used.

These units employs a sub-set of the programming commands used by standard LMT/LMR modules. In addition, the command AVALUE is used to set the address number.

As the SI pin is dedicated to serial communication only, the 'ENABLESERIALMODE' command string is NOT required.

To successfully program the unit it must be in active state (RXE high, or TXE low), so provision should be made to force the unit into this state while programming (either a jumper, or a third pin on the programming connector, could be used).

|               |                                                                      |
|---------------|----------------------------------------------------------------------|
| GOCHAN aa     | Serially select channel aa, where aa is ch0 to ch31                  |
| AVALUE bbbbb  | Set value for unit address                                           |
| LOAD aa nnnnn | Set value of N register for channel aa, where aa is Channels 0 to 31 |
| 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)

bbbbb = unit address (up to 65535)

$$CXT = N_{TX} = \frac{f_{RF}}{f_{Channelspacing}} = \frac{433.900MHz}{25kHz} = 17356 \qquad R = \frac{f_{TCXO}}{f_{channelspacing}} = \frac{13MHz}{25kHz}, \text{ So } R=520$$

**VHF CXT units have 10MHz, not 13MHz reference oscillators:**

$$R = \frac{f_{TCXO}}{f_{channelspacing}} = \frac{10MHz}{25kHz}, \text{ So } R=400 \text{ (for VHF CXT)}$$

$$CXR = N_{RX} = \frac{f_{RF} - 21.4MHz}{f_{Channelspacing}} = \frac{433.900MHz - 21.4}{25kHz} = 16500$$

**Note:** A pause of at least 50ms must be allowed between command strings (EEPROM programming time).

## SERIAL PROGRAMMING CONNECTIONS

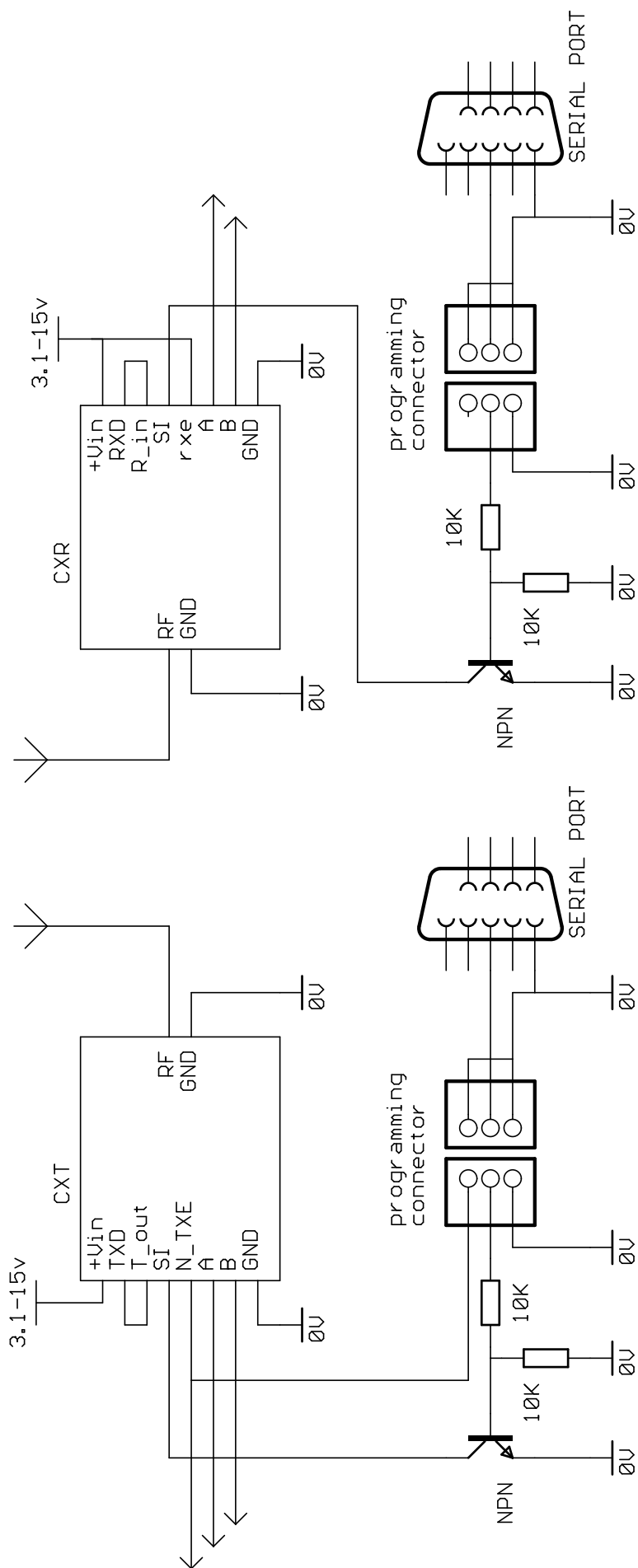


Figure 5: Serial programming interface

## 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           |
|--------------------------------------|-------------|----------------|-------------|
|                                      | <i>whip</i> | <i>helical</i> | <i>loop</i> |
| 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.

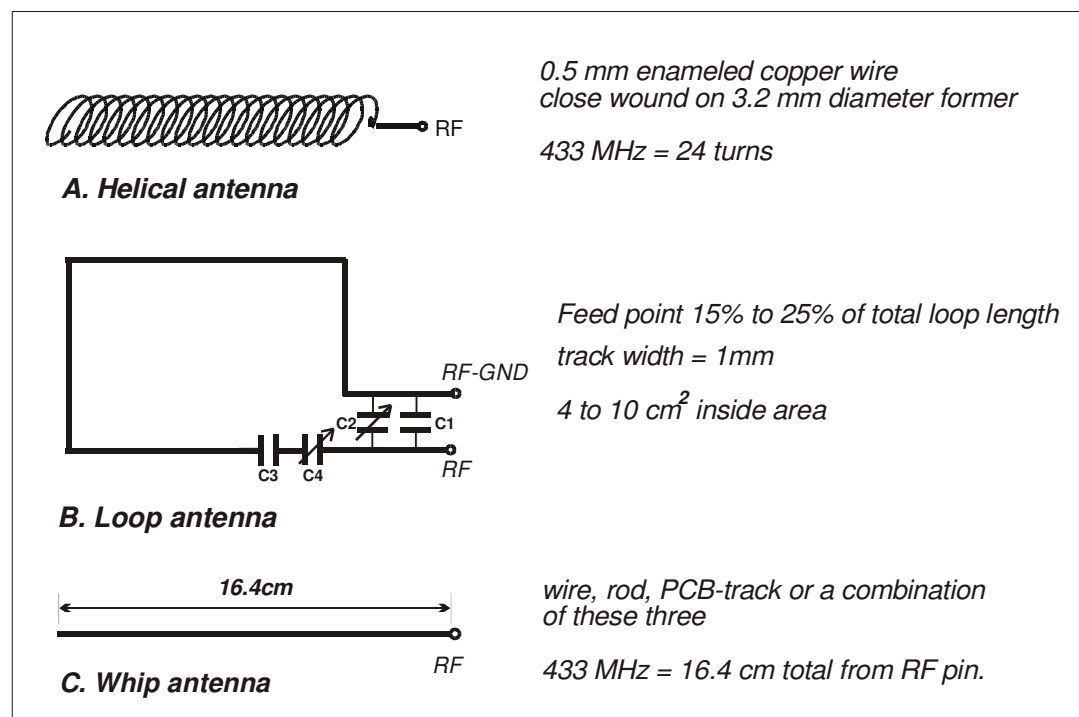


Figure 6: Antenna types (433MHz version)

## Ordering Information:

| Part No.   | Description | Frequency band (MHz) | Supply (V) | RF power (mW) |
|------------|-------------|----------------------|------------|---------------|
| <b>VHF</b> |             |                      |            |               |
| CXT1-173-1 | Transmitter | 173.200 - 173.325    | 3.1 -15    | 10            |
| CXR1-173-1 | Receiver    | 173.200 - 173.325    | 3.1 -15    |               |
| CXT1-151-1 | Transmitter | 150.825 - 152.450    | 4.1 -15    | 100           |
| CXR1-151-1 | Receiver    | 150.825 - 152.450    | 3.1 -15    |               |
| <b>UHF</b> |             |                      |            |               |
| CXT2-433-1 | Transmitter | 433.875-434.650      | 3.1 -15    | 10            |
| CXR2-433-1 | Receiver    | 433.875-434.650      | 3.1 -15    |               |
| CXT2-458-1 | Transmitter | 458.525 - 459.1      | 4.1 -15    | 100           |
| CXR2-458-1 | Receiver    | 458.525 - 459.1      | 3.1 -15    |               |

### Notes:

1. CXT/CXR are available on number of other VHF and UHF frequencies. Other non standard UHF band frequencies are subject to SAW filter availability.

## APPENDIX:

### CXT2-433-1 & CXR2-433-1 Application boards



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

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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:

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