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CPX2

PRELIMINARY

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2700 baud wireless packet modem

The CPX2s a 2,700 baud half-duplex serial radio packet modem module operating on licence-exempt European 433.05-434.79MHz SRD band. CPX2 is an intermediate level OEM radio modem which is in between a raw FSK radio module like BiM2G and a sophisticated OEM radio modem like RPM2A. It takes care of preamble, frame synchronisation and error checking.

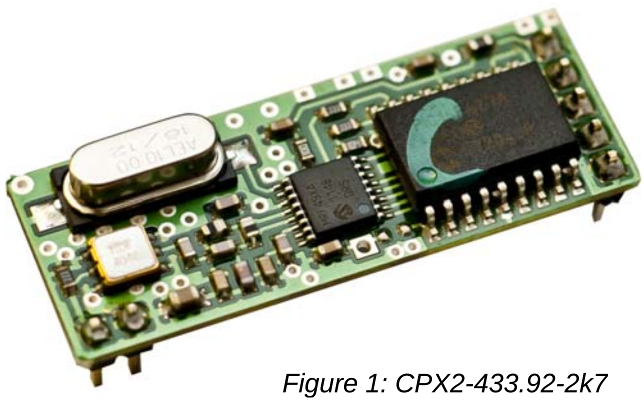

Figure 1: CPX2-433.92-2k7

Features

- Conforms to EN 300 220-2 and EN 301 489-3
- SAW front-end filter
- Small size
- Low cost
- Direct interface to microcontroller UART
- Serial modem baud rate at 2,700bps (half-duplex)
- 200m line of sight operating range

Applications

- Home/Industrial Automation
- Vehicle Sensor Monitoring
- Telemetry
- Data Logging Systems
- Security Systems for Home/Industrial
- In-building environmental monitoring and control
- Sports and Performance Monitoring

Technical Summary

- Operating frequency: 433.92MHz (default)
- Modulation: 2.7kbps NRZ FSK
- UART interface: 57,600bps, 8 data bits, Parity None, Flow Control None
- Supply: 3.3V at 23mA transmit, 13mA receive and <2mA standby
- Transmit power: +3dBm (2mW)
- Receiver sensitivity: -105dBm (for 0.1% data error)
- 32 byte data buffer
- 40 x 14 x 5mm

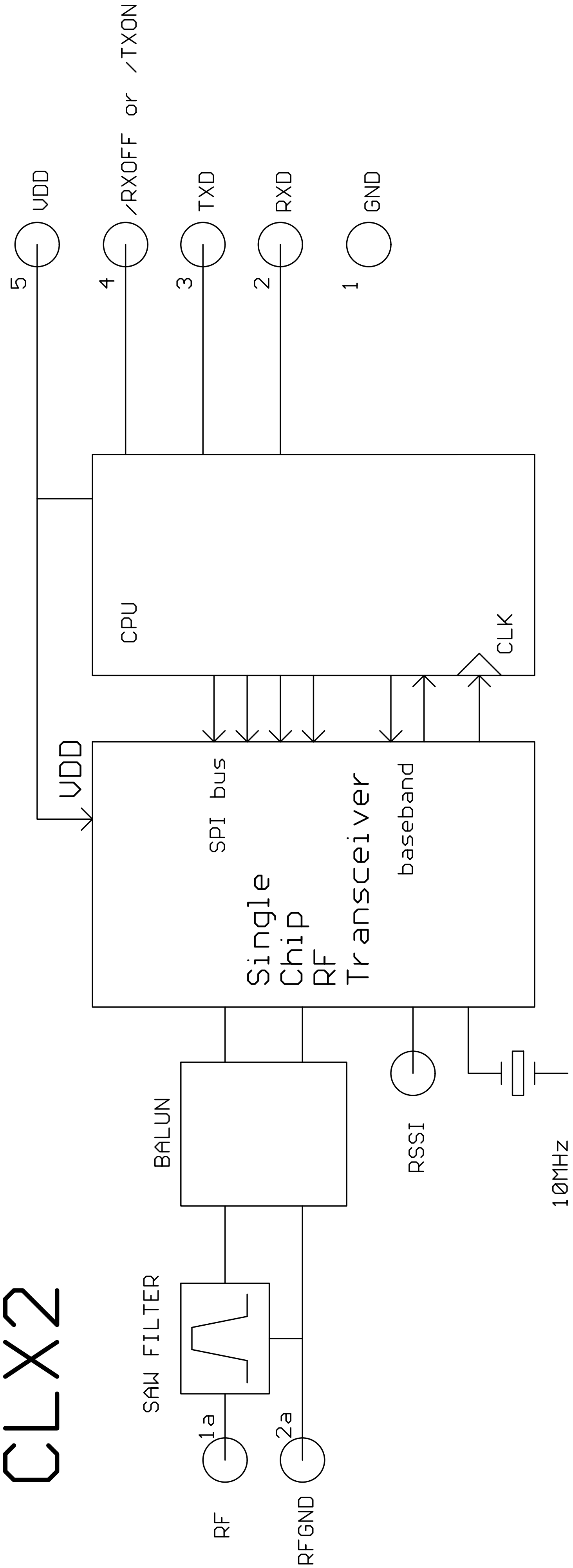

Figure 2: CPX2 block diagram

Operation of the CPX2 packet data transceiver

The CPX2 is a variant of the basic CLX2 data link device, using the same hardware but achieving considerably greater range (albeit at the cost of a lower aggregate data rate). On the other hand, Its user interface data rate is considerably faster (57,600 baud) to minimise data transfer time overhead to and from the module, so in some applications the CPX2 will actually exhibit better efficiency.

While a standard CLX2 will reliably receive a -95dBm signal, the CPX2 is reliably seen to recover packets at signal levels of -105dBm and less (corresponding to around twice the range).

The CPX2 is not a transparent modem. It cannot handle constant streaming data.
All timing and data formatting tasks are handled by the software. The user need not worry about keying the transmitter before sending data. For transmission across the radio link data is formatted into packets, each comprising data bytes, preamble sequence, frame synchronisation code and checksum.

It sends its data in discrete 32 byte blocks, and while it is sending a block it cannot do anything else.
A 32 byte block (or "packet") takes about 150ms to send (during which the RF carrier is 'on' for 140ms)

The unit idles in receive. If a valid RF packet is detected, then it is immediately decoded and outputted as a stream of serial data bytes (start bit following preceding stop bit)

If data is presented to a unit's TXD pin, the first byte received initiates the transmit process. The unit will immediately switch its RF circuits from receive to transmit and start loading any available transmit data into its buffer. It will carry on loading the buffer until either:

1. 32 bytes are received, or
2. A gap of 5ms is seen following a byte.

At this point the unit pulls the active low TXON pin low and begins modulating its carrier (by now stabilised and at full power) with the coded data packet. Any "extra" bytes beyond the first 32 are discarded.
Once the burst has been transmitted, the transmitter turns off and TXON is returned to the high state.

In the absence of a valid signal, the CPX2 (in idle/receive) uses framer and checksum data to avoid outputting random garbage. Similarly, at the edge of the range or in the presence of interference the unit will either output complete, correct data blocks or nothing at all (it is very unlikely to ever output a corrupted block)

Pulling the /RXOFF pin low (against its internal pull-up) puts the unit into standby (as on the CLX2)

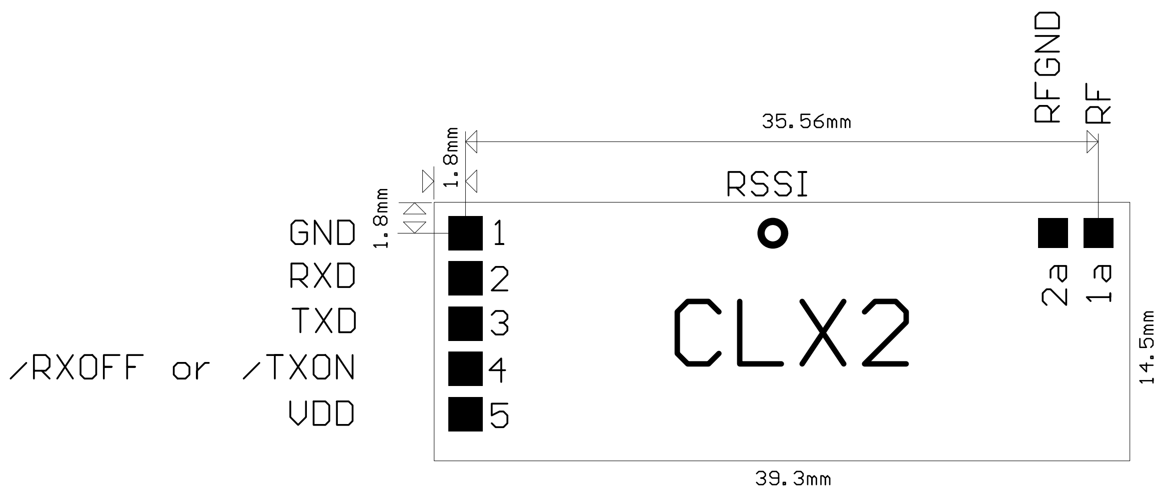

Figure 3: CPX2 footprint (top view)

Pin description

Pin	Name	Function
1	GND	Ground
2	RXD	Received Data output at 3V UART (inverted RS232) level
3	TXD	Transmit Data input at 3V UART (inverted RS232) level [No pull-up]
4	/TXON /RXOFF	/TXON Active low Transmitter ON indicator Output [Transmit Mode] /RXOFF Active low Receiver hot Standby Input [Receive Mode] Open drain, 50kΩ internal pull-up
5	VDD	3.3V DC (externally regulated power supply)
	RSSI	Received Signal Strength Indicator output (An optional pad for wire connection)
1a	RF	RF in/out (50Ω impedance)
2a	RFGND	RF Ground

Notes:

1. TXD has no internal pull-up. If the unit is used in Receive only mode, tie this pin to VCC
2. VDD must be a clean 3.3V DC regulated supply
3. The STATUS pin. In transmit, this pin pulls low if the device is transmitting a data packet. On receive it floats high. If pulled low in receive, the unit goes into hot standby (<2mA) In standby the unit does not receive, but will go into transmit if valid data is presented to TXD.
4. TXD / RXD are inverted RS232 at 3V CMOS levels. To connect to a true RS232 device, inverting level shifters must be used (e.g. MAX232 type are ideal, but simple NPN transistor switches with pull-ups often suffice). With typical microcontrollers and UARTs, direct connection is possible.
5. Because CPX2 provides a lower 2,700 baud half duplex radio link with higher 57,600 user baud rate, no more than 32 bytes should be uploaded at a time. i.e. data cannot be streamed.
6. Provided no two devices attempt to transmit at one time, then no further restrictions on data transmission need be made, as all transmit timing, valid data identification and data byte buffering is conducted by the unit. There is no 'transmit enable' pin. Synchronisation and framing words in the packet prevent the receiver outputting garbage in the absence of signal or presence of interference.
7. A 2.2kΩ resistance is present from RF pin 1a to ground for ESD protection

Condensed specifications

Frequency	433.92MHz
Frequency stability	±10kHz
Channel width	250kHz
Number of channels	1
Supply *Voltage*	3.3V DC
Current	23mA transmit
	13mA receive/ <2mA standby
Operating temperature	-20°C to +55°C (Storage -30°C to +70°C)
Spurious radiations	Compliant with ETSI EN 300 220-2 and EN 301 489-3
Interfaces	
User	5pin 0.1" pitch molex (pin 6 absent)
RF	2pin 0.1" pitch molex
Size	40 x 14 x 5mm
Transmitter	
Output power	2mW ±1dB
TX on switching time	<4ms
Modulation type	2.7kbps NRZ FSK
FM peak deviation	+/-30kHz (nominal)
TX spurious	<-36dBm
Receiver	
Sensitivity	-105dBm (for 0.1% data error)
Blocking	-50dB (±1MHz)
Local Oscillator re-radiation	<-57dBm
Interface	
Data rate	57,600baud, Half duplex
Format	1 Start bit, 8 Data bits, No parity, 1 Stop bit
Levels	3V CMOS (inverted RS232 ‘0’=0V, ‘1’=3V)
Buffers	32 byte FIFO
Flow control	None
Initial start up	10ms from power on

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 16cm (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	*	**	***

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.

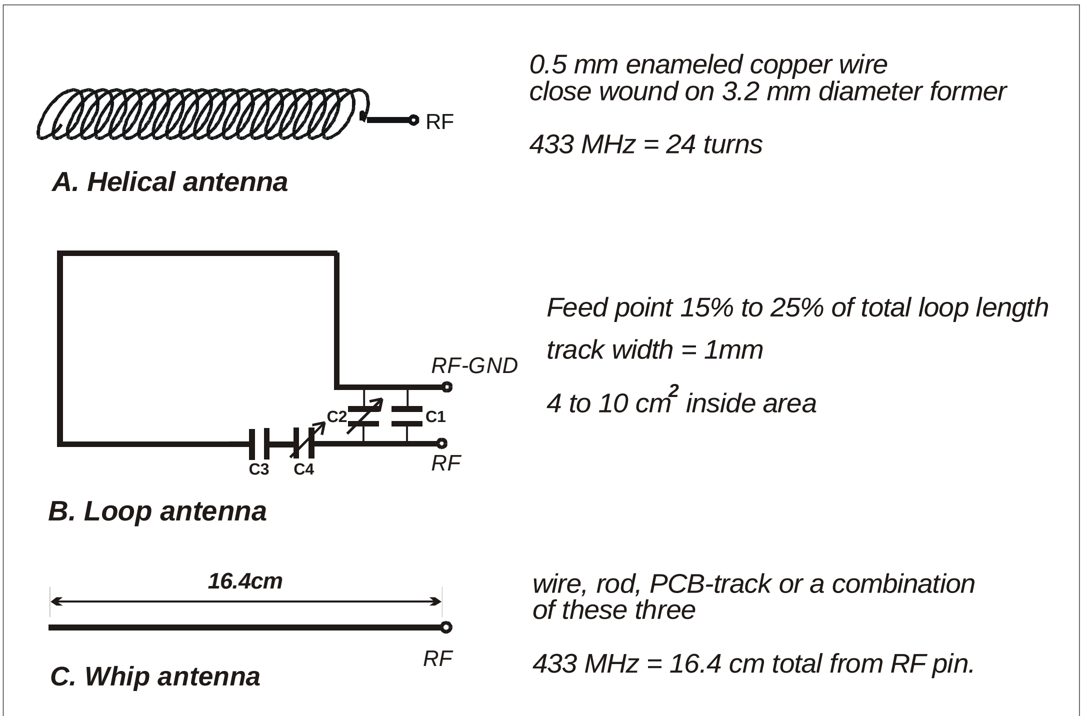

Figure 4: Antenna types

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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 The Office of Communications (Ofcom) web site:
http://stakeholders.ofcom.org.uk/spectrum/technical/rtte/

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