

SHX2

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500mW Multichannel UHF transceiver

SHX2 is small multi-channel narrow band UHF transceiver with 500mW RF power output.

It intended for use in the 458MHz UK industrial band, but also has potential use in the 70cm amateur band, in the US part 90/95 licensed allocations, and other UHF bands world wide.



Figure 1: SHX2-458-5

Features

- Conforms to ETSI EN 300 220-3 and EN 301 489-3
- High performance double superhet with PLL synthesizer
- +27dBm (500mW) RF power output
- Data rates up to 5 kbps for standard module
- Usable range over 5km
- Fully screened. Low profile
- Feature-rich interface (RSSI, analogue and digital baseband)
- Incorporate a 1200baud modem
- Re-programmable via RS232 interface
- Low power requirements

Applications

- Telemetry and tele-command
- Remote monitoring
- Asset tracking and tracing
- Amateur radio

Technical Summary

- Operating frequency: Any 4MHz segment in 400-480MHz
(for in 300-330MHz : contact sales)
- 8 parallel and/or 255 serial channels
- Channel spacing: 12.5kHz / 20kHz / 25kHz
- Transmit power: 500mW (+27dBm) nominal
- Supply range: +5V regulated
- Current consumption: 350mA (at 500mW output) transmit, 25mA receive
- Data bit rate: 5kbps max. (standard module)
- Receiver sensitivity: -118dBm (for 12 dB SINAD)
- Size: 67 x 30 x 9mm

Evaluation platforms: NBEK + UHX carrier

SHX2 500mW UHF multichannel transceiver

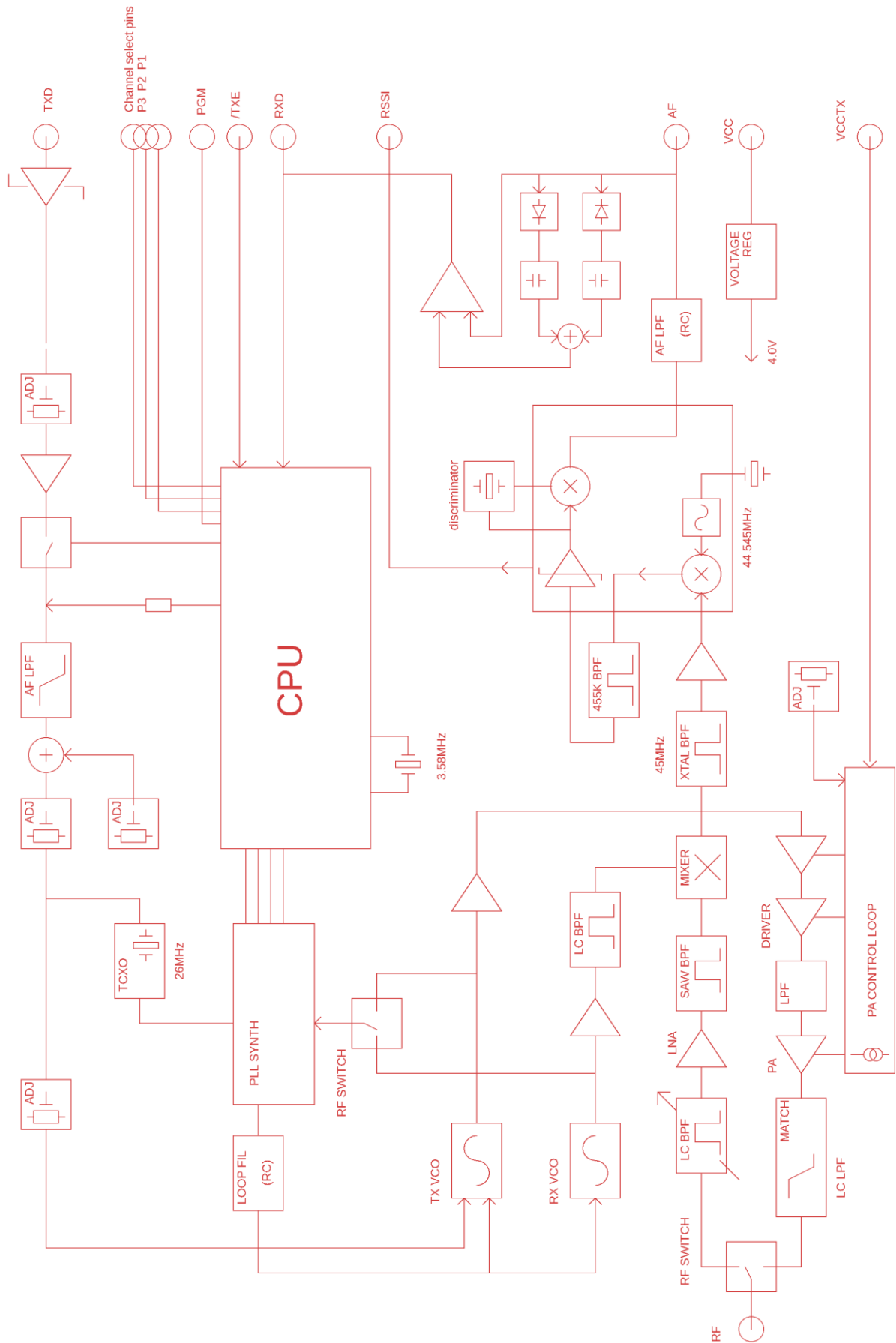


Figure 2: SHX2 block diagram

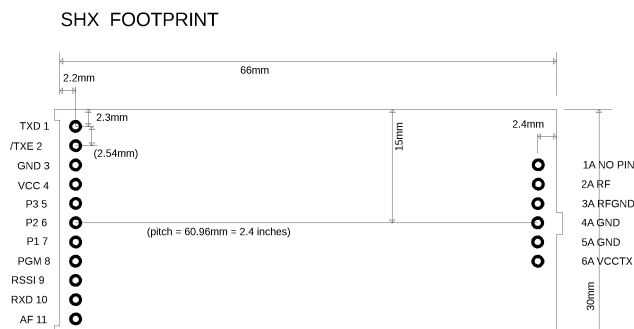


Figure 3: SHX2 footprint (Top) view

Pin Description

Pins		Normal mode	Modem mode
RF			
1A	NO PIN		
2A	RF in/out	To the antenna	
3A	RF Gnd	RF ground	
4A	GND	0V	
5A	GND	0V	
6A	VCCTX	+5V regulated supply for TX ⁷	
User			
1	TXD	DC coupled input for TTL / CMOS logic	NC
2	TXE	Transmit enable. Low = TX mode	NC
3	GND	0V	
4	Vcc	DC supply input (+5V regulated) ⁸	
5	P3	Parallel channel select	BUSY
6	P2	Parallel channel select	MOD TXD
7	P1	Parallel channel select	MOD RXD
8	PGM in	Serial programming/control input (inverted logic level RS232)	PGM in
9	RSSI	DC level between 0.5V and 2.5V. 60dB dynamic range	
10	RXD	Open collector output of data slicer. 47K pullup to 4V	NC

Notes:

1. No inversion occurs between TXD RXD However, AF out is inverted relative to TXD.
2. PGM, P0 - P3 (parallel channel selects) and TXE are active LOW with internal 47K pullups to 4v.
3. Open collector output RXD has a 47K pullup to 4V.
4. The software incorporates a 1200baud dumb modem, compatible with that implemented in other Radiometrix narrowband units (i1200 tones and format). Modem operation is selected by a serial command.
5. Main serial port (PGM) operates at 2400 baud. The unit is capable of operating in 'basic' parallel channel select only mode, or in serial controlled 'expanded' mode.
6. If analogue transmit modulation is needed, then connect a series 1uF cap + 500K trimmer (a multi-turn is advised) in the 'baseband TXD' circuit. Adjust trimmer for 90% of peak deviation (+/- 2.7kHz) at mean input level.
7. The high current (350mA max.) transmitter supply (5v regulated) is fed to a separate pin, on the RF out connector (pin 6A).
The Vcc (pin 4 on the user connector) can tolerate 4.1 - 15v, and draws up to 25mA. Both pins must be supplied at all times (most users connect them to a common +5v supply)

Serial interface commands

Serial data is sent to the unit on the programming input (PGM).
To successfully program the unit, it must be powered

Once 'modem' mode has been selected, the unit locks into serial command mode (and the parallel port pins have other functions) until a SETPAR command returns the unit to ordinary parallel operation.

Unlike earlier Radiometrix multichannel units, the SHX2 (like the QPX1 and USA versions of SMX1) has separate N and R registers for each channel, on transmit and on receive. In other words, the frequency of each channel is individually programmed in every mode.
Channels 8-255 then constitute a sequential table, starting from channel 7

Functionally, the N value for any 'table' channel is derived by multiplying the STEP value by the (channel number -7) and adding it to the N value programmed for channel 7 (the chan 7 "R value" is used throughout the table).

The LOADMX command sets an upper limit for usable channel numbers, beyond which the unit reverts to channel 0

Unless a complex frequency map has been selected, all the R value registers are likely to be programmed with the same value

Commands include:

Commands	Function
GOCHAN a	empty command buffer
LDTXN a nnnnn	set value of N for channel a , for transmit
LDRXN a nnnnn	set value of N for channel a , for receive
LDTXR a nnnnn	set value of R for channel a , for transmit
LDRXR a nnnnn	set value of R for channel a , for receive
LOADST ss	set per-channel increment step for table (channels 8 and up)
LOADMX aaa	set highest valid channel (all channels above this point default to ch0)
SETMOD	Enable internal modem. Frequency selected by most recent 'gochan' or 'single'
SETPAR	channel selected by 3 bit parallel input 3
SETSER	channel selected by most recent 'gochan' operation
RVALUE rrrrr	set R register value used by FORCE command
FORCE nnnnn	set value of N for single channel operation. N value NOT stored in EEPROM. It is necessary to send a FORCE command with a different value of nnnnn when changing from tx to rx or vice versa.
GOTEST	lock transmitter on, sending 250Hz squarewave (nothing overrides this command: you must power-off the unit)
<cr>	process entry
/	clear all buffers
#	disable command mode

Volatile channel set up:

A byte with bit 7 set puts the ls nibble into the high 4 bits of a holding register.

A byte with bits 6 and 7 set puts the ls nibble into the low 4 bits of the holding register and the uses this value as a channel number to program the PLL. This function does not work if set to parallel mode.

At power-up the unit reverse back to the last E2prom stored GOCHAN value

a = single digit channel number from 0 to 7

aaa = channel number from 0 to 255

nnnnn = a synthesizer N register value, (up to 65535)

rrrrr = the synthesizer R register value, (up to 16383)

ALL COMMANDS MUST BE IN UPPER CASE.

For transmit: $N = \text{channel frequency} / (26\text{MHz} / R)$

For receive: $N = (\text{channel frequency} - 45\text{MHz}) / (26\text{MHz} / R)$

$26\text{MHz} / R = 25\text{KHz}$, so $R = 1040$ (usually)

NOTE:

- In 'FORCE' mode the unit is inoperative after a power down until either another valid FORCE command is received, or until mode is changed by a GOCHAN, SETPAR or SETSER command.
- FORCE mode does not apply any receive frequency offset.
- Different values need to be sent when changing from transmit to receive and vice versa.
- FORCE is intended mainly for test/diagnostic operation.
- A pause of at least 50ms must be allowed between command strings (EEPROM programming time)

Modem mode

The 'modem' mentioned is a 1200baud RS232 semi-intelligent unit (Transmit keyed when valid serial data is present, so no separate TX control needed. Coding in the data stream also permits the receiver to ignore noise and only output valid serial data) This is a half duplex unit, so collisions between transmitted and received packets must be dealt with by the user.

This modem function is compatible and inter-operable with the "i1200" modems implemented on the NBEK jig, and in the RX2M, TX2M and TR2M family modules, as well as the SMX2

Ordering Information

Part No.	Application	Channel spacing	Frequency band (MHz)
SHX2-434-5	Amateur Radio	25kHz	432-436MHz
SHX2-458-5	Industrial telemetry (UK)	25kHz	CH0:458.525 – CH7:458.700MHz

Condensed specifications (All details are provisional)

Frequency	Any 4MHz segment in 400 - 480MHz (TX and RX frequencies need not be the same)
<i>Frequency stability</i>	+/-2ppm (better than $\pm 1.5\text{kHz}$)
<i>Channel spacing</i>	12.5kHz / 20kHz / 25kHz (factory set)
<i>Number of channels</i>	8 parallel or 255 serial channels
Supply	Receive: 5.0V regulated at 25mA Transmit: 5.0V regulated at 350mA for 500mW output
Operating temperature	-20 to +70 °C (Storage -30 to +70 °C)
Spurious radiations	Compliant with ETSI EN 300 220-3 and EN 301 489-3
Interface	
<i>User</i>	11 pin 0.1" pitch molex
<i>RF and TX supply</i>	5 pin 0.1" pitch molex
Recommended PCB hole size	1.2mm (min.)
Size	67 x 30 x 9mm
Transmitter	
Output power	+27dBm (500mW)
TX on switching time	50 ms nominal
Modulation type	FM, FSK (F1D, F3D)
TX modulation bandwidth	DC – 3kHz
Deviation	$\pm 3\text{kHz}$ ($\pm 1.5\text{kHz}$ for 12.5kHz channel variant) nominal
Adjacent channel TX power	-37dBm
TX spuri	<-40dBm
Inputs	Data (CMOS/TTL compatible)
Receiver	
Sensitivity	-118dBm for 12dB SINAD
image / spurious	-60dB or better
blocking	-84dB
adjacent channel	-60dB (tested per ETSI EN300 086)
Outputs	RSSI, Audio, Data

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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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