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

QPX1

03rd September 2010

2 Watt Multi-channel VHF Transceiver

The QPX1 transceiver module offers a 2 watt RF output VHF radio link, in a robust aluminium extruded casing. This unit is ideally suited to applications where existing lower powered transceivers provide insufficient range. The QPX1 is a multi-channel, narrowband design, suitable for licensed and unlicensed VHF allocations, FCC part 90 operation, and the 2M amateur band.

Figure 1: QPX1-173-5-12k5-FCC-EAS

Features

- Compliant with FCC part 90
- High performance double superhet PLL synthesizer
- Data rates up to 5 kbps for standard module
- Usable range over 10km
- Feature-rich interface (RSSI, CD, analogue and digital baseband)
- Incorporate a 1200baud dumb modem
- Re-programmable via RS232 interface

Applications

- Amateur radio
- MURS units
- Industrial telemetry and telecommand
- High-end security systems
- APRS systems
- Vehicle data up/download
- ROV/machinery controls

Technical Summary

- Standard operating frequency: 154MHz / 173MHz band FCC allocation (12.5kHz channel)
- Any +/-2MHz band in 135-175MHz
- 8 channels controlled by parallel port or via RS232 interface)
- Transmit power: : 2 W (+33dBm) nominal (500mW and 1 watt versions available)
- Supply range: 12V (11 – 15V)
- Current consumption: 600mA transmit, 30mA receive
- Data bit rate: 5kbps max. (standard module)
- Receiver sensitivity: -118dBm (for 12 dB SINAD)
- Size: 123 x 59 x 30mm (in EAS120 case - excluding connectors)

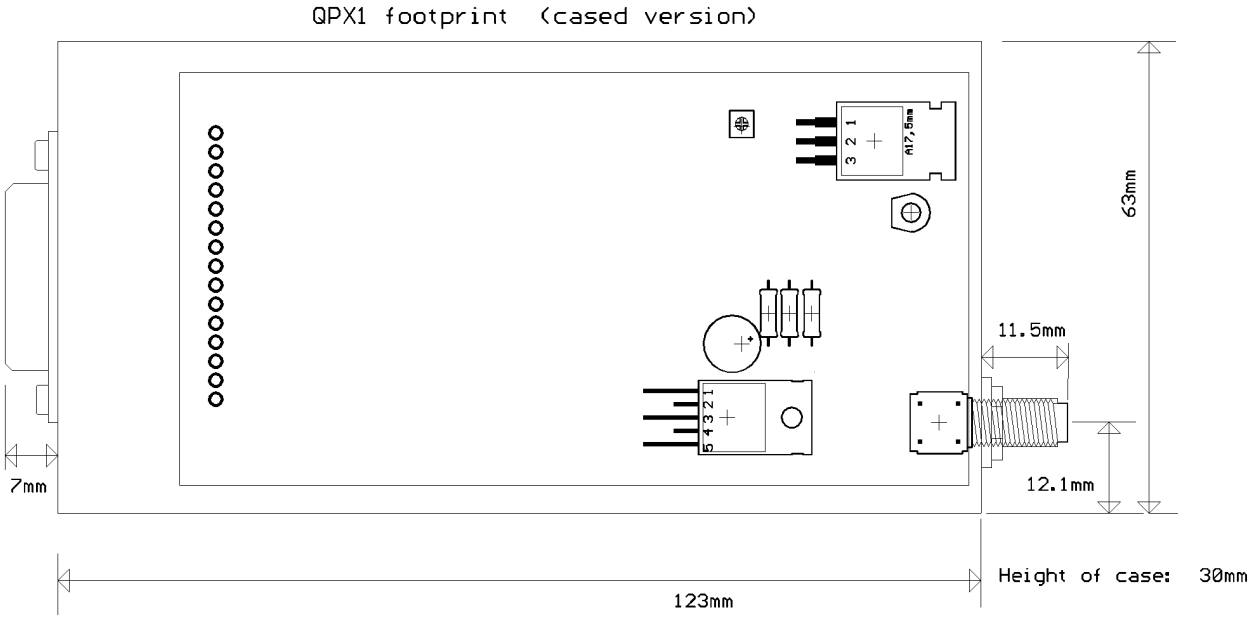

Figure 2: QPX1 footprint (top view through casing)

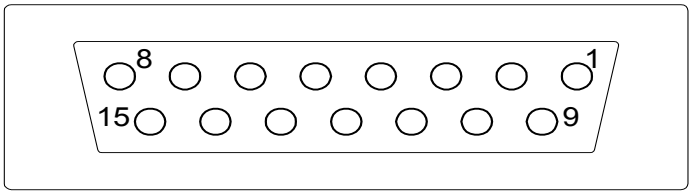

Figure 3: DB15 connector pin arrangement

User interface: Standard mode

Pin	Name	Function
1	TXD	DC coupled input for 3V CMOS logic. R_{in}=47kΩ
2	$\overline{\text{TXE}}$	Transmitter enable. Low = ON, open = off. 100K pullup to (raw Vin -5v)
3	AF in	250mVp-p to 2.5V p-p AC coupled input. Variable gain
4	ENABLE	Overall unit 'on' (high active, high voltage tolerant)
5	RSSI	DC level between 0.5v and 2.5v. 60dB dynamic range
6	AF out	200mV p-p audio. DC coupled, approx 1v bias. Muted by squelch
7	RXD	Open collector output of data slicer suitable for Biphase codes
8	SQF	Carrier level squelch. Open collector. ON/low = no signal
9	0V	Ground
10	P3	Parallel frequency select inputs. Inverted logic, 10K pullups to 5v
11	P2	
12	P1	
13	P0/$\overline{\text{PGM}}$	Serial programming/control input (inverted logic level RS232)[9]
14	PGM	True RS232 input (inverter to pin 13)
15	Vcc	12V DC supply (11-15V). 550mA typ. current drain

***NOTE*:**

1. QPX1 does not invert the sense of the data waveform. There is no resulting in no net link inversion between two units.
   A version with an inversion in the RX data path is also available
2. Carrier detect mutes the AF and DATA outputs. It can be disabled by rotating the level set trimmer fully CW.
3. There are no pullups on the open collector outputs.
4. The sofware incorporates a 1200baud dumb modem, compatible with that implemented in TX2M, RX2M, TR2M and SMX2 radios (i1200 tones and format).
5. RS232 input pins (14 and 12) tolerate true +/- levels. No buffering is required.

6. This is a 2 watt output product. Good grounding , good quality aerials, properly mounted, and a low impedence power supply are required if full performance is to be reliably obtained.
   Be aware of the effect that the strong RF fields generated by this device (and it's aerial) can have upon other adjacent circuitry if this is not properly screened, filtered or otherwise protected. Regulators, sensitive analogue circuitry, and microprocessors seem especially interference prone.
   Two watts of RF at VHF can cause an unpleasant and painful burn. Be careful.
7. **Caution:**. The TXD and P1-P3 inputs are not high voltage tolerant. Low voltage logic, or switches to ground, are required.
8. A simple RS232 voltage tolerant transistor inverter connects pin 14 to PGM
9. Depending on the firmware, some versions use P0-P3 as parallel select. Others use P0 as a programming input only, and P1-P3 as parallel inputs. Refer to tech support for details.
10. Enable pin (4) may be tied to +Vin
11. Overall thermal power dissipation in normal use is around 4 watts, rising to 6-7 watts under aerial fault conditions.
12. This design uses the SMX1 mk2 transceiver RF board as an internal component
13. For visual reference, this unit uses an Evatron-type REAS120 extrusion

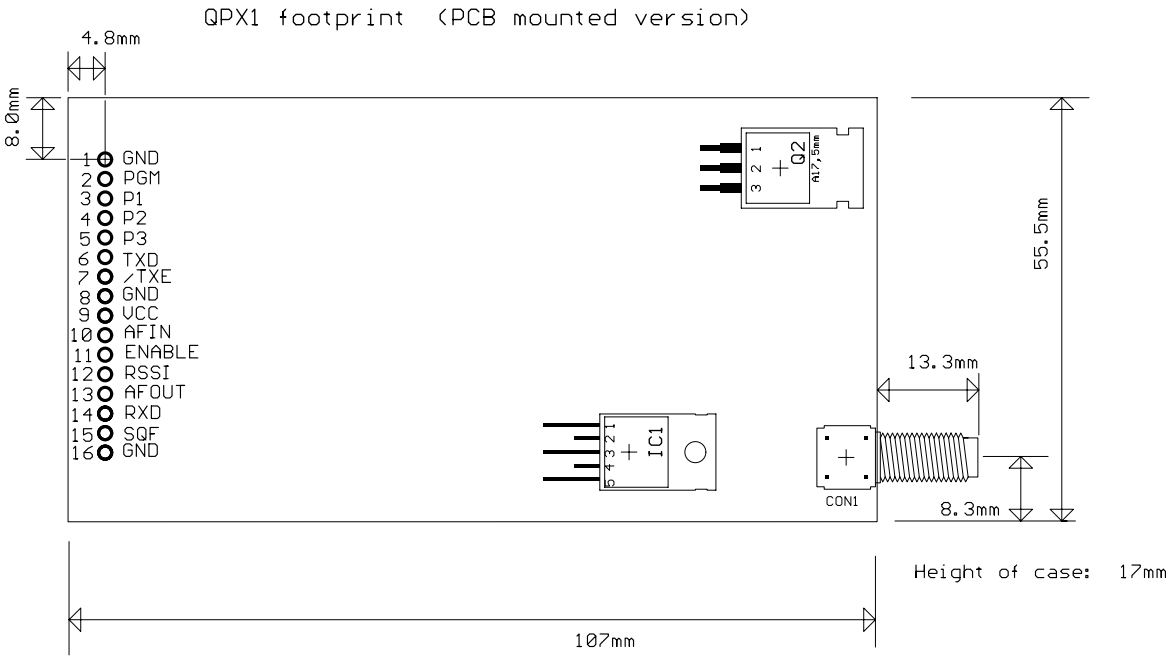

Figure 3: QPX1 footprint (PCB mounted version)

User interface (PCB mounted version)

Pin	Name	Function
1	GND	Ground
2	PGM	True RS232 input (inverter to pin 13)
3	P1	Parallel frequency select inputs. Inverted logic, 10K pullups to 5v
4	P2	
5	P3	
6	TXD	DC coupled input for 3V CMOS logic. R_{in}=47kΩ
7	TXE	Transmitter enable. Low = ON, open = off. 100K pullup to (raw Vin -5v)
8	GND	Ground
9	Vcc	12V DC supply (11-15V). 550mA typ. current drain
10	AF in	250mVp-p to 2.5V p-p AC coupled input. Variable gain
11	ENABLE	Overall unit 'on' (high active, high voltage tolerant)
12	RSSI	DC level between 0.5v and 2.5v. 60dB dynamic range
13	AF out	200mV p-p audio. DC coupled, approx 1v bias. Muted by squelch
14	RXD	Open collector output of data slicer suitable for Biphase codes
15	SQF	Carrier level squelch. Open collector. ON/low = no signal
16	GND	Ground

User interface: Modem mode

The 'modem' mentioned is a 1200 baud RS232 semi-intelligent unit (Transmit keyed when valid serial data is present, so no separate TX control needed. Coding in the datastream 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.

Pin	Name	Function
1	NC	Leave open
2	$\overline{\text{TXE}}$	Open = normal modem operation. Low = constant TX (for test). 10K pullup to 5v
3	NC	Leave open
4	ENABLE	Overall unit 'on' (high active, high voltage tolerant)
5	RSSI	DC level between 0.5v and 2.5v. 60dB dynamic range
6	AF out	200mV p-p audio. DC coupled, approx 1v bias. Muted by squelch
7	NC	Leave open
8	NC	Leave open
9	0V	Ground
10	(tba)	Leave open
11	MOD RXD	inverted "RS232" data out (to inverting buffer like MAX232)
12	MOD TXD	RS232 data input (true). 10K pullups to 5v
13	$\overline{\text{PGM}}$	inverted version of pin 14
14	PGM	Serial programming/control input (true RS232)
15	Vcc	12V DC supply (11-15V). 550mA typ. current drain

Serial Programming

Serial data is sent to the unit on the programming input PGM (pin 14)
2400 baud at RS232 level. 8 bit data, no parity, 1 start bit, 1 or 2 stop bits, No flow control. All commands must be in upper case.

To successfully program the unit, 'ENABLE' (pin 4) must be 'high' (active) to enable the unit.

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 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.

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

Command	Function
GOCHAN a	serial select of channel a (ch0 to 7)
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 rrrrr	set value of R for channel a , for transmit
LDRXR a rrrrr	set value of R for channel a , for receive
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 SINGLE command
SINGLE nnnnn	set value of N for single channel operation. N value NOT stored in e2prom
SETMOD	Enable internal modem. Frequency selected by most recent 'gochan' or 'single'
<cr>	process entry
/	clear all buffers
#	disable command mode

a = a single digit channel number from 0 to 7
nnnnn = a synthesizer N register value, (up to 65535)
rrrrr = the synthesizer R register value, (up to 16383)

For Transmit, $N_{tx} = \frac{ChannelFrequency}{10kHz/R}$

For Receive, $N_{rx} = \frac{ChannelFrequency - 21.4}{10kHz/R}$

$R = \frac{f_{Xtal}}{f_{channelspacing}} = \frac{10Hz}{25kHz}$, So R= 400 (usually)

Note: 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 applies a receive frequency offset of 21.4MHz
'Single' mode is intended for frequency agile applications.
A pause of at least 50mS must be allowed between command strings (eeprom programming time)

Condensed specifications

Frequency	154.45625 - 154.47875MHz (12.5kHz steps) – FCC part 90 173.20375 - 173.39625MHz (12.5kHz steps) - FCC part 90 General: any +/-2MHz band in 135-175MHz
Frequency stability	± 1.5kHz
Channel spacing	25kHz / 12.5kHz
Number of channels	8 channels (controlled by parallel port or via RS232 interface)
Supply *voltage*	11 - 15V
Current	600mA nominal (800mA max.) transmit
	30mA receive
	<5uA standby ('enable' pin low)
Operating temperature	-10 to +55 °C (Storage -30 to +70 °C)
Size	in EAS120 case 123 x 59 x 30mm (excluding connectors) 107 x 55.5 x 17mm (PCB mounted version - excluding RF connector)
Spurious radiations	< 2nW (-57dBm)
Interface	
User	15pin D type (extrusion case version) 16 pin 0.1" pitch header (PCB mounted version)
RF	SMA
Intended approval	US 'part 90' approval EU EN300-220 (dependant on power level)
Transmitter	
Output power	2W (+33dBm) +/- 1dB (500mW and 1 watt versions available)
TX on switching time	<50 ms (from $\overline{TXE}$ transition)
Modulation type	FSK (F3D)
TX modulation bandwidth	DC – 5kHz (CMOS compatible, or analogue AF)
Deviation	+/- 3kHz (25kHz) or 1.5kHz (12.5kHz)
Adjacent channel TX power	-37dBm
TX spurii	-36dBm
Inputs	data (CMOS/TTL compatible)
Receiver	
Sensitivity	-118dBm for 12dB SINAD
image / spurious	-60dB
blocking	-84dB
adjacent channel	-60 dB
Outputs	RSSI, carrier detect, audio, data
Power on to valid audio	28ms
Power on to stable data out	50ms (for 50:50 mark / space)

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

FCC Part 90.238 Telemetry frequency channels (12.5KHz spacing)

CHANNELS	154MHz band	173MHz band
CH0	154.45625	173.20375
CH1	154.46375	173.21000
CH2	154.47125	173.23750
CH3	154.47875	173.28750
CH4	154.45625	173.31250
CH5	154.46375	173.33750
CH6	154.47125	173.36250
CH7	154.47875	173.39625

Ordering Information

Part No.	Description	Frequency band (MHz)
QPX1-154-5-12k5-FCC-EAS	US version in extrusion case	154MHz
QPX1-173-5-12k5-FCC-EAS	US version in extrusion case	173MHz
QPX1-xxx-5-EAS	Standard 25kHz channel in extrusion case	Where xxx is any VHF frequency with in 135-175MHz
QPX1-154-5-12k5-FCC	US version as PCB mounted	154MHz
QPX1-173-5-12k5-FCC	US version as PCB mounted	173MHz
QPX1-xxx-5	Standard 25kHz channel as PCB mounted	Where xxx is any VHF frequency with in 135-175MHz

Data sheet links:

http://www.radiometrix.co.uk/dsheets/qpx1.pdf
http://www.radiometrix.co.uk/dsheets/smx1.pdf

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

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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/

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