NEW

Radiometrix

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Issue A, 20 November 2007 **UHX1-xxx-5**
PRELIMINARY DATA SHEET

NBFM Multichannel 500mW VHF Transceiver

UHX1 is small dual frequency multi-channel VHF transceiver with up to 500mW RF power output.
The dual frequency capability allows UHX1's transmitter section to be operated on one frequency while receiver frequency on another.

Figure 1: UHX1-144-5

Features

- Conforms to ETSI EN 300 220-3 and EN 301 489-3
- High performance double superhet, 128 channel PLL synthesizer
- 500mW RF power output: adjustable via serial command
- Data rates up to 5 kbps for standard module
- Usable range over 1km
- Fully screened. Low profile
- Feature-rich interface (RSSI, analogue and digital baseband)
- Digital RSSI output
- Incorporate a 1200baud modem
- Re-programmable via RS232 interface
- Low power requirements

Applications

- Handheld terminals
- Heavy vehicle/machine remote controls
- EPOS equipment, barcode scanners
- Data loggers
- Industrial telemetry and telecommand
- In-building environmental monitoring and control
- High-end security and fire alarms
- Vehicle data up/download

Technical Summary

- Operating frequency: Any 2MHz segment in 140- 175MHz
- 128 channels selected by serial interface
- 16 channels selected by parallel interface
- Transmit power: 500mW (+27dBm) nominal. Adjustable 1 – 500mW
- Supply range: 5V regulated transmit, 3.1 - 15V receive,
- Current consumption: 330mA (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 12mm

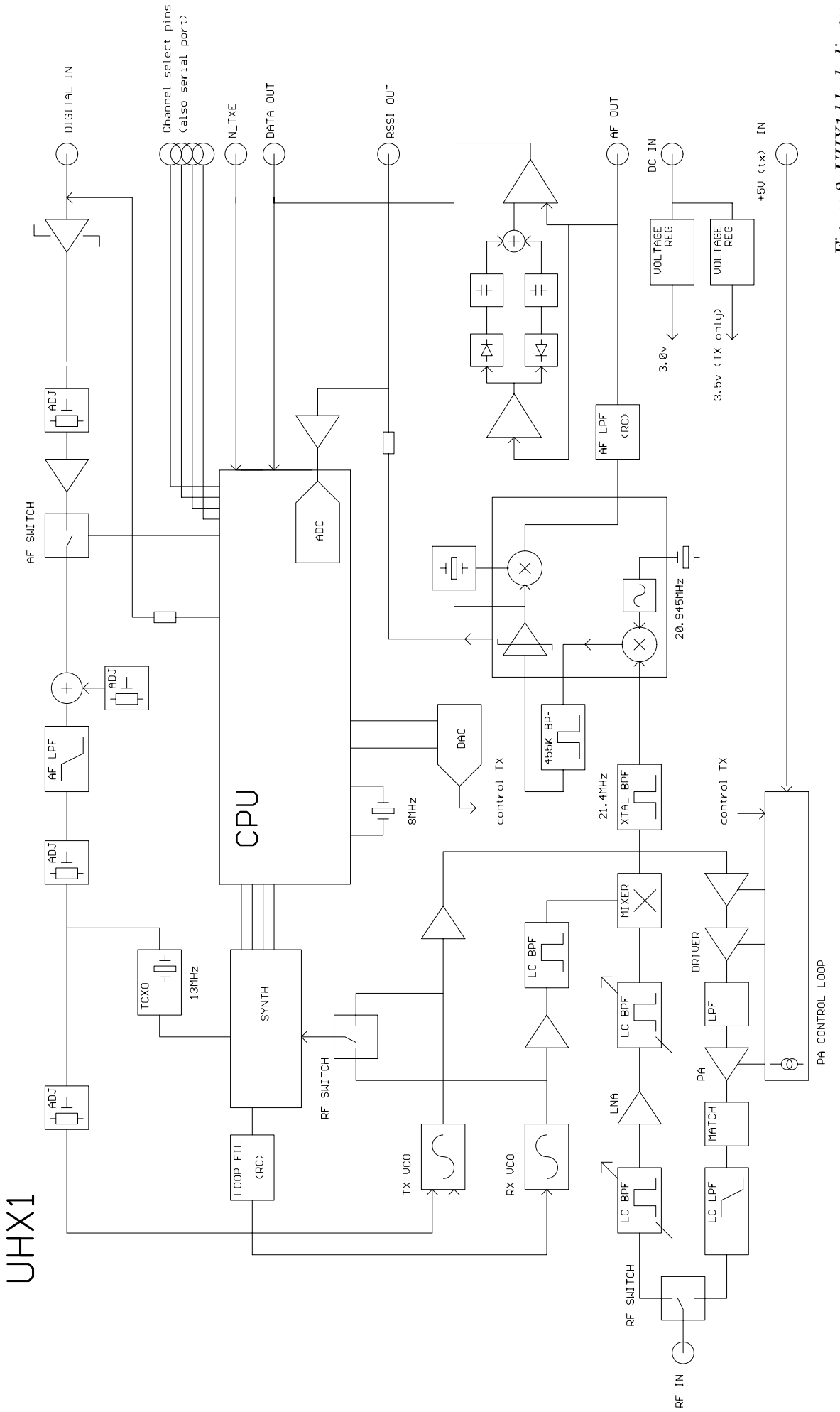

Figure 2: UHX1 block diagram

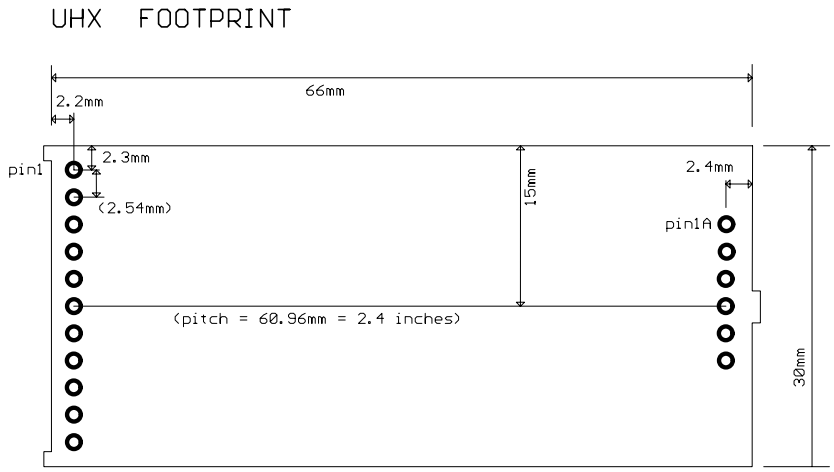

Figure 3: Provisional UHX1 footprint

Pin Description

Pins	Normal mode		Serial mode	Modem mode
RF				
1A	RF Gnd	RF ground		
2A	RF in/out	To the antenna		
3A	RF Gnd	RF ground		
4A	GND	0V		
5A	GND	0V		
6A	Vcc (TX)	5V regulated supply for TX		
User				
1	TXD	DC coupled input for TTL/ CMOS logic		NC
2	$\overline{\text{TXE}}$	Transmit enable. Low = TX mode		NC
3	GND	0V		
4	Vcc	DC supply input (3.1 –15V) for receiver		
5	P3	Parallel channel select MSB	Serial read back	BUSY
6	P2	Parallel channel select	TBA	MOD TXD
7	P1	Parallel channel select	TBA	MOD RXD
8	P0	Parallel channel select LSB	PGM in	PGM in
9	RSSI	DC level between 0.5V and 2.5V. 60dB dynamic range		
10	RXD	Open collector output of data slicer		NC
11	AF out	500mV p-p audio. DC coupled, approx 0.8V bias		NC

NOTES:

1. No inversion occurs between TXD and RXD. However, AF out is inverted relative to mod in.
2. P0 - P3 (parallel channel selects) and $\overline{\text{TXE}}$ are active LOW and have internal 47K pullups to 3v.
3. Open collector output RXD has a 47K pullup to 3v.
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 (P0-P3) operates at 9600 baud. (Command set is not the same as TR2M, SMX families). The unit is capable of operating in 'basic' parallel channel select only mode, or in serial controlled 'expanded' mode.
6. Transmit power can be set by serial command.
7. RSSI, and other status information, can be read back as a digital value. (on P3).

7a. The RSSI is a high impedence output. If a low impedence voltage source (an op-amp output) is connected to the RSSI out pin then this voltage (0-2.5v) will override the RSSI value during RSSI 'digital read' operations.

8. If analogue transmit modulation is needed, then connect a series 1uF cap + 500K trimmer (a multiturn is advised) in the 'baseband TXD' circuit. Adjust trimmer for 90% of peak deviation (+/- 2.7KHz) at mean input level.
9. The high current (250mA max.) transmitter supply (5v regulated) is fed to a separate connector
10. A version without a RX/TX switch is available. This unit has a 4 pin RF connector (RX, GND, TX, GND) and is intended for use with external power amplifiers

Serial interface commands

The UHX1 user interface is accessed through the four parallel pins (P0/serial through P3).

It has four operating modes:

1. Parallel.

Frequency of operation is selected as one of 16 (chans 0-15), by means of a 4 bit inverted value applied to P0-P3. The P0 pin will also respond to a LOCKSERIALMODE datastream (inverted rs232, 9600 baud), which will cause the radio to enter **serial** mode. In parallel mode, the IDENT command string is still decoded, but the unit remains in parallel mode.

2. Serial

Frequency of operation, radio set up, power output and various other parameters are controlled by command strings sent to P0. Pin P3 functions as a 'readback' port while P1,2 are not used in this mode.

In this mode, decimal values are used (to simplify direct manual programming via a terminal)
Commands include:

Commands	Function	Notes
:	empty command buffer	
? or /	read back buffer contents	
<backspace>	delete last character	
<cr>	process buffer	
PARALLEL	return to the basic, **parallel** mode (and turn modem off)	
DUMP	read back contents of EEPROM (output on P3)	
MODEM	activate 1200 baud modem	#
NOMODEM	de-activate 1200 baud modem	#
DEFCH ccc	set default channel (non-volatile)	#
DEFPOW pp	set default tx power (non-voltatile)	#
CHAN ccc	jump to channel (volatile)	
POWER pp	select tx power (volatile)	
RSSI	single read of RSSI (output on P3)	
SHORT	enter **short** command mode	#

(The following commands are used to set up the radio operating characteristics, and should be viewed with caution. Especially the CALPOWER command, which initiates a multiple write operation to the power calibration table)

Commands	Function	Notes
NDIV nnnnn	force N divider value (volatile)	
RDIV rrrrr	force R divider value (volatile)	
RLOAD rrrrr	Set R divider value	#
OFFSET ooooo	Set RX offset	#
LOAD aa nnnnn	Set N values for first 16 channels	#
START nnnnn	Set N value for ch 16	#
STEP i	Set increment for table	#
LIMIT ccc	Set highest permitted channel number	#
SETPOW eee	Set maximum power output (500mW)	
CALPOWER (etc)	(see factory procedures for more details)	
TEST	Generate a 250Hz test modulation (only fuctions in TX mode, cancelled by sending a <cr> byte)	
IDENT	Readback a single byte, depending on current mode:	

Commands	Function		Notes
	Parallel:	**P**	
	Serial:	**S**	
	Short:	**I**	
	Modem:	**M**	

(Channels 0-15 are individually programmed by the **LOAD** operation. Channels 16-127 are a consecutive table, using the **START** value as a start point (=channel 16) and increasing the N value by **STEP** with each increase in channel number)

ccc = a channel number from 00 to 127
aa = a **two** digit channel number from 00 to 15
nnnnn = synthesizer N register value, (up to 65535)
rrrrr = synthesizer R register value, (up to 16383)
pp = power setting value (3-30: a value of 30 corresponds to a power output of +27dBm)
i = table step (increments of N) (0-7)
ooooo = receive mode frequency offset
eee = power calibration figure

N = channel frequency / (10MHz / R)

10MHz / R = 25KHz , so R = 400 (usually)

receive offset = 21.4MHz / (10MHz / R) , so = 856 (usually)

A pause of at least 50mS must be allowed after operations which result in eeprom programming operations (all except NDIV, RDIV, GOTO, PSET and RSSI). This allows the programming cycle to complete.

Instructions marked ' # ' output a three byte ' OK<cr> ' sequence after sucessfully completing their eeprom programming cycles

When first powered up, the unit will operate on channel and output level specified by the last CHAN and POWER instructions, irrespective of previous NDIV, RDIV, CHAN or PSET operations)

3. Short

A limited range of radio functions are controlled by sending a single byte to PO

0 - 127	select channel	(volatile)
128 - 159	select power	(= byte -128) (volatile)
200	single read of RSSI	(output on P3)
201	single byte read, as for IDENT command	
222	reception of 16 consecutive 222 bytes returns radio to **serial** mode.	

This mode of operation is intended to provide a simple, fast, serial command mode.

4. Modem

Commands are interpreted as in SERIAL mode (and 'short' mode may be selected.) In this mode the unit operates as a simple 1200 baud packet modem, with TXD (in) on P2 and RXD (out) on P1.
The TXE pin does not control tx switching in this mode, but rather the presence of valid data in the tx buffer initiates a transmit burst. No handshaking is provided, and the unit has a sufficient over-link data rate to transparently 'stream' continuous data. Error correction, re-transmission of corrupt packets and addressing are not provided.
This mode is compatible with other Radiometrix 'i 1200' mode equipment, including the narrow band eval kit.

Notes:

1. Unlike in the RLC and TLC units, the LOCKSERIALMODE (and FAST) commands are non-volatile. Once a serial mode is selected, the unit will power up in this mode until a PARALLEL command is received.

2. The command interpreter IS case sensitive. Use upper case.
3. Spaces are optional (they are not decoded), provided the command line does not exceed 16 characters.
4. When manually programming this unit we recommend setting your terminal to local echo. The 'backspace' key functions normally.
5. All serial communications use 9600baud 'inverted RS232' 8 bit data, no parity, 1 start bit, 1 or 2 stop bits
6. A simple 'driver' program will be made available to simplify programming of these units, if desired.
7. RSSI read operations only function correctly if the unit is in RX mode ($\overline{\text{TXE}}$ pin is high or floating)

Condensed specifications (All details are provisional)

Frequency	Any 2MHz segment in 140 - 175MHz (TX and RX frequencies need not be the same)
Frequency stability	+/-5ppm (better than ±1.5kHz)
Channel spacing	20kHz or 25kHz (12.5kHz by special order)
Number of channels	128 channels by serial RS232 interface or 16 by parallel select
Supply Receive	3.1 -15V at 24mA
Transmit:	5.0V regulated 55mA (at 10mW output) 270mA (at 500mW output) (plus 20mA at 3.6-15v from pin4: Vcc)
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	
User	11 pin 0.1" pitch molex
RF and TX supply	6 pin 0.1" pitch molex
Reprogram	5 pin 0.1" pitch socket in top of case
Recommended PCB hole size	1.2mm (min.)
Size	67 x 30 x 12mm
Transmitter	
Output power	500mW (+27dBm); Adjustable via serial command 1 - 500mW in 1dB steps)
TX on switching time	<50 ms
Modulation type	FM, FSK (F1D, F3D)
TX modulation bandwidth	DC – 3kHz
Deviation	±3kHz (±1.5kHz for 12.5kHz channel variant)
Adjacent channel TX power	-37dBm
TX spurii	<-40dBm
Inputs	Data (CMOS/TTL compatible)
Receiver	
Sensitivity	-118dBm for 12dB SINAD
image / spurious	-65dB
blocking	-86dB
adjacent channel	-65dB (tested per ETSI EN300 086)
Outputs	RSSI, Audio, Data
Dynamic timing	
RX data recovery settling time	20ms
Power on to stable (50:50 mark / space) RXD	50ms (TXE low/active to stable RX data out)
Maximum time between data transitions	250ms

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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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