MicroFox2 Manual

Version 0.5 – August 28, 2017

Overview

The Byonics MicroFox2 (MF2) is a small, 500mW, frequency agile 2-meter transceiver designed for hidden transmitter hunts, also called T-hunts, foxhunts, and ARDF. It is based on the Byonics MicroFox-PicCon, but is small enough to fit with a LiPo battery inside a 60x30x18mm tube. It can be remote controlled via DTMF and configured via DTMF or a computer. It is programmable to any frequency between 144 MHz and 148 MHz in 5KHz steps, will work with any SMA VHF antenna, and can be adjusted with many tones, durations, and duty cycles.

The transmissions consist of a looping sequence as follows:

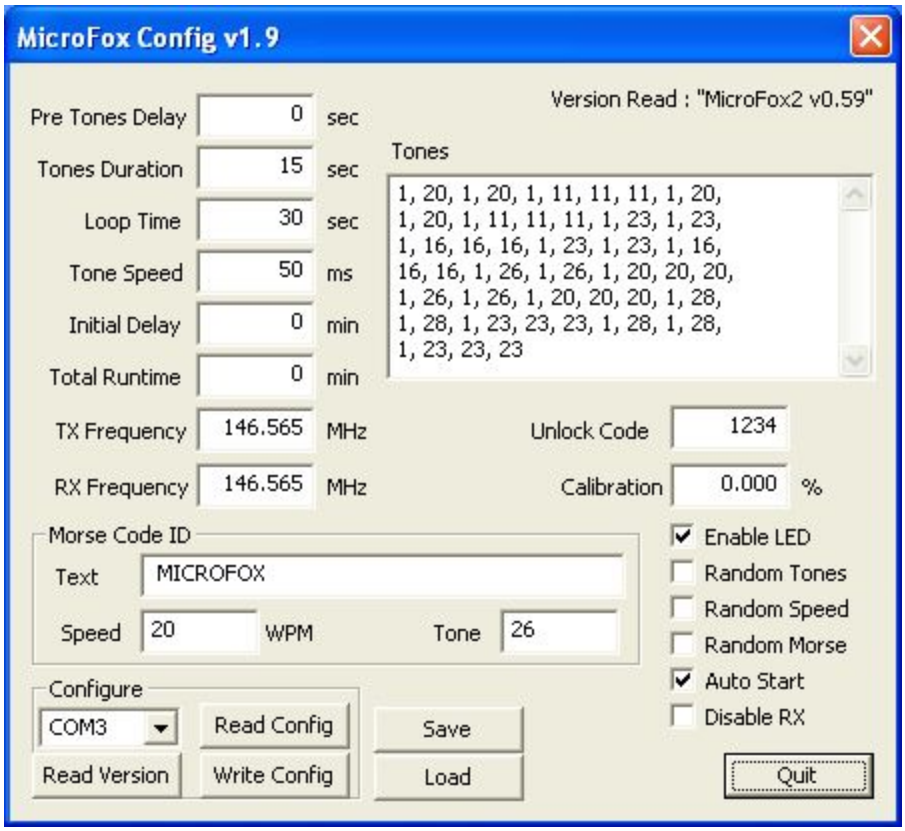
- **an off the air pre-tones delay** to support multiple sequenced transmitters
- **a looping tones transmission** is user configurable and played during the majority of the hunt
- **a Morse code message** or ID to legally identify the transmitter
- **an off the air delay** to allow DTMF control, lower duty cycle, or other transmitters to be heard

In addition to the sequence above, it also supports:

- **an initial delay** to start the transmitter when the hider is not present
- **a total runtime** to limit the length of the hunt

Computer Configuration

The MF2 settings can be configured via DTMF tones or with the a 2.5mm serial or USB cable and the Windows MicroFoxConfig program version 1.9 or later. The cables and software are available from www.byonics.com/mf. PL2303 USB drivers can be found at www.prolific.com.tw. The configuration program can only be used within 3 seconds powering the MF2.



The default settings that appear when the configuration program is started are recommended for a basic hunt with the MF2 transmitting tones for 15 seconds, and then a

Morse code ID. It then will stop transmitting, and repeats every 30 seconds. The only setting users must change is the Morse Code ID text to be their assigned amateur radio callsign. After setting the desired options, select the configuration cable COM port, connect the cable to the 2.5mm jack on the MF2, being sure to push the plug all the way in, switch on the power and press Read Version, then Write Config to apply the settings.

.There are two options that are available in the Config program but not via DTMF commands:

- Calibration can be use to tweak the long term timing of a MF2. Positive calibration numbers make the unit run faster. If you determine that the MF2 is running 0.03% slow, set the calibrate to +0.03% to correct.
- Disable RX can be used to turn off the internal radio when the MF2 is not transmitting. This will save battery life, but will not allow DTMF remote control of configuration.

DTMF Configuration and Control

The MF2 can be remote controlled and configured by sending DTMF tones from a separate radio on the frequency the MF2 is using for receive, by default, 146.565 MHz. The transmitting radio need to be able to send all 16 DTMF tones : 0-9, *, #, and A-D. On some radios, the A-D keys may not be labeled. The MF2 cannot receive DTMF while it is transmitting. The LED will flash quickly while DTMF tones are being decoded and at a medium speed during configuration. The MF2 can be DTMF locked to prevent other DTMF controls or configuration until it received the unlock code, default 1234. If the MF2 receiver has been disabled, no DTMF features can be used.

DTMF Control Codes

DTMF tone	Function
1	Start transmission
2	Toggle transmission
3	Stop transmission
D	Lock DTMF control

DTMF Configuration Codes

DTMF configuration is divided into 3 command sets. The A commands take 6 DTMF digits, the B commands take 4 DTMF digits, and the C commands are a variable length, and terminate with the # tone.

A1mmss	**Set the pre-tones off the air delay to mm minutes and ss seconds.** The default is off, and can be set with A10000.
A2mmss	**Set the tones duration to mm minutes and ss seconds.** The default is 15 seconds, and can be set with A20015.
A3mmss	**Set the loop time to mm minutes and ss seconds.** This should be set to at least the duration of the tones, plus the time to send the morse ID. The default is 30 seconds, and can be set with A30030.

A4hhmm	**Set the initial delay to hh hours and mm minutes.** The default is off, and can be set with A40000.
A5hhmm	**Set the total runtime to hh hours and mm minutes.** The default is off, and can be set with A50000.
A6xxxx	**Set the transmit frequency to 14x.xxx MHz.** Power must be cycled for the new value to take effect. The default is 146.565 MHz and can be set with A66565.
A7xxxx	**Set the receive frequency to 14x.xxx MHz.** It doesn't need to be the same as the transmit frequency. Power must be cycled for the new value to take effect. The default is 146.565 MHz and can be set with A76565.
A8xxxx	**Set the 4 digit unlock code.** The default is 1234 and can be set with A8 1234.
B1xx	**Set tone duration in 5 ms units.** This controls the tone sequence speed. The default is 50 ms and can be set with B110.
B2xx	**Set morse code speed in words per minute.** Valid settings are between 03 and 31 wpm. The default is 20 wpm and can be set with B220.
B3xx	**Set morse tone to tone code xx.** This sets the audio frequency of the morse code ID. Refer to the DTMF Tone Codes table below. The default code is 24 (784 Hz) and can be set with B324.
B4xx	**Set flags bits to xx.** This sets various on/off options. The possible flags codes are: ● 1 for Random tones, instead of the C2 sequence. ● 2 for Random tone speed, instead of the B1 setting. ● 4 for Random morse tone, instead of the B3 setting. ● 8 for Auto-Start right after powerup, rather than waiting for a DTMF 1 or 2. ● 16 for Disable LED, to make the transmitter more difficult to visually see. To set more than 1 flag, just add the codes together, for example, to enable random tone speed and auto-start (2+8=10), send B410. The default flags are just auto-start and can be set with B408.
C1 xx xx xx .. #	**Set the morse code message/callsign.** Use the DTMF Morse Codes table below. To keep the transmissions legal, a valid amateur radio callsign should be included in this message. Each character is entered as a 2 digit code and the message is terminated with a #. Maximum message length is 60 characters. For example, to set to N6BG enter C1 14 36 02 07 #.
C2 xx xx xx .. #	**C2 xx xx xx .. # - Set the tone sequence.** This sets tones that are repeated during the tone sequence. Each note is entered as a 2 digit code from the chart below and the sequence is terminated with a #. Maximum tone sequence length is 160 notes. The default tone sequence can be set with C2 01 20 01 20 01 11 11 11 01 20 01 20 01 11 11 11 01 23 01 23 01 16 16 16 01 23 01 23 01 16 16 16 01 26 01 26 01 20 20 20 01 26 01 26 01 20 20 20 01 28 01 28 01 23 23 23 01 28 01 28 01 23 23 23 #.

DTMF Morse Codes

code	char	code	char	code	char	code	char	code	char	code	char	code	char	code	char
00	space	07	G	14	N	21	U	28	.	35	5	42	SK	51	,
01	A	08	H	15	O	22	V	29	/	36	6	43	$		
02	B	09	I	16	P	23	W	30	0	37	7	45	AS		
03	C	10	J	17	Q	24	X	31	1	38	8	46	‘		
04	D	11	K	18	R	25	Y	32	2	39	9	47	(		
05	E	12	L	19	S	26	Z	33	3	40	!	48	)		
06	F	13	M	20	T	27	-	34	4	41	“	50	AR		

SK, AS, and AR are procedural signs.

DTMF Tone Codes

code	note	freq	code	note	freq	code	note	freq	code	note	freq	code	note	freq
01	silence		11	$F^{\#}_{4}$	370	21	E_{5}	659	31	D_{6}	1175	41	C_{7}	2093
02	A_{3}	220	12	G_{4}	392	22	F_{5}	698	32	$D^{\#}_{6}$	1244	42	$C^{\#}_{7}$	2218
03	$A^{\#}_{3}$	233	13	$G^{\#}_{4}$	415	23	$F^{\#}_{5}$	740	33	E_{6}	1318	43	D_{7}	2350
04	B_{3}	247	14	A_{4}	440	24	G^{5}	784	34	F_{6}	1397	44	$D^{\#}_{7}$	2489
05	C_{4}	262	15	$A^{\#}_{4}$	466	25	$G^{\#}_{5}$	831	35	$F^{\#}_{6}$	1480	45	E_{7}	2636
06	$C^{\#}_{4}$	277	16	B_{4}	494	26	A_{5}	880	36	G_{6}	1568	46	F_{7}	2793
07	D_{4}	294	17	C_{5}	523	27	$A^{\#}_{5}$	932	37	$G^{\#}_{6}$	1661	47	$F^{\#}_{7}$	2960
08	$D^{\#}_{4}$	311	18	$C^{\#}_{5}$	554	28	B_{5}	987	38	A_{6}	1760	48	G_{7}	3136
09	E_{4}	330	19	D_{5}	587	29	C_{6}	1046	39	$A^{\#}_{6}$	1864	49	$G^{\#}_{7}$	3323
10	F_{4}	349	20	$D^{\#}_{5}$	622	30	$C^{\#}_{6}$	1109	40	B_{6}	1975			

LED

The LED will show the various states of the MF2. It flashes 3 times on powerup. If a TTL serial connection is found, it flashes 3 more times. If it is jumpered for a system restore, it will fash 3 more times. The LED can be disabled to make the fox more difficult to find. The list below shows the LED meaning during operation.

- **LED on Solid** - Transmitting
- **LED Fast Flash (20Hz)** - Receiving DTMF
- **LED Medium Flash (5 Hz)** - Receiving configuration tones
- **LED Slow Flash (1 Hz)** - In a transmit sequence but currently off the air.
- **LED Off** - Not in a sequence

Restore

The MF2 can restored to factory settings by shorting jumper pads J5 on the PCB and applying power. There will be 3 extra LED flashes to show the settings have been restored.

Battery

When run from the included 3.7V 650mAh LiPo battery, the MF2 will typically draw about 230mA when transmitting, so it should provide about 5 hours of half duty cycle runtime. The time may be a bit

less if the receiver is enabled. The included LiPo battery charger can charge multiple batteries at a time, and is powered from any USB port. A red LED indicates the battery is charging and will turn off when fully charged.

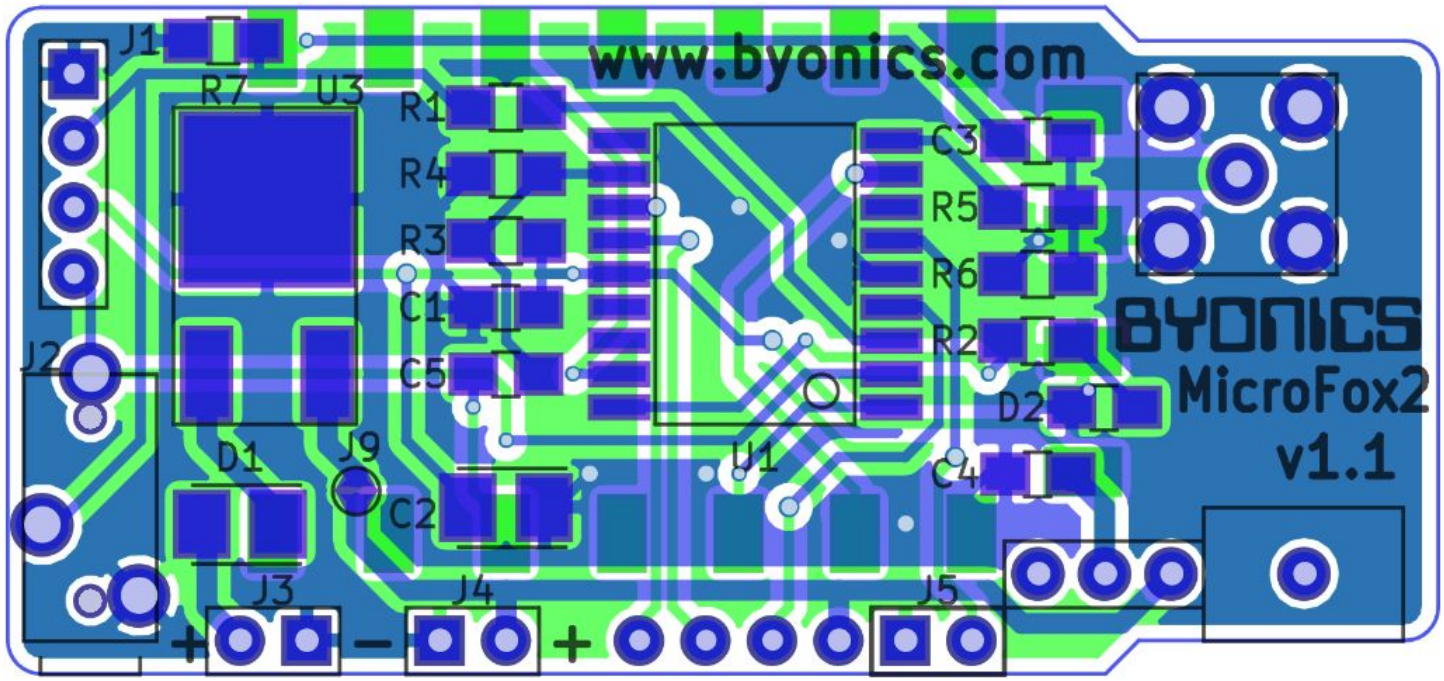
Notes

- The 2.5mm programming jack is initially very tight. Although the programming plug may feel like it is fully seated, you may need to use a bit more force the first few times the jack is used. The difference between working and failing is only a matter of a few thousandths of an inch.
- If the assigned COM port is not showing in the config software, it can be manually entered, or the COM port can be changed with Windows Device Manager.
- Disabling the FIFO buffer in the Com Port settings may allow more reliable reading and writing of configurations.
- We recommend leaving a note with the transmitter identifying it as an Amateur Radio, and listing a contact telephone number. These days, your transmitter may cause undue alarm if found by a member of the public and outside agencies are contacted.

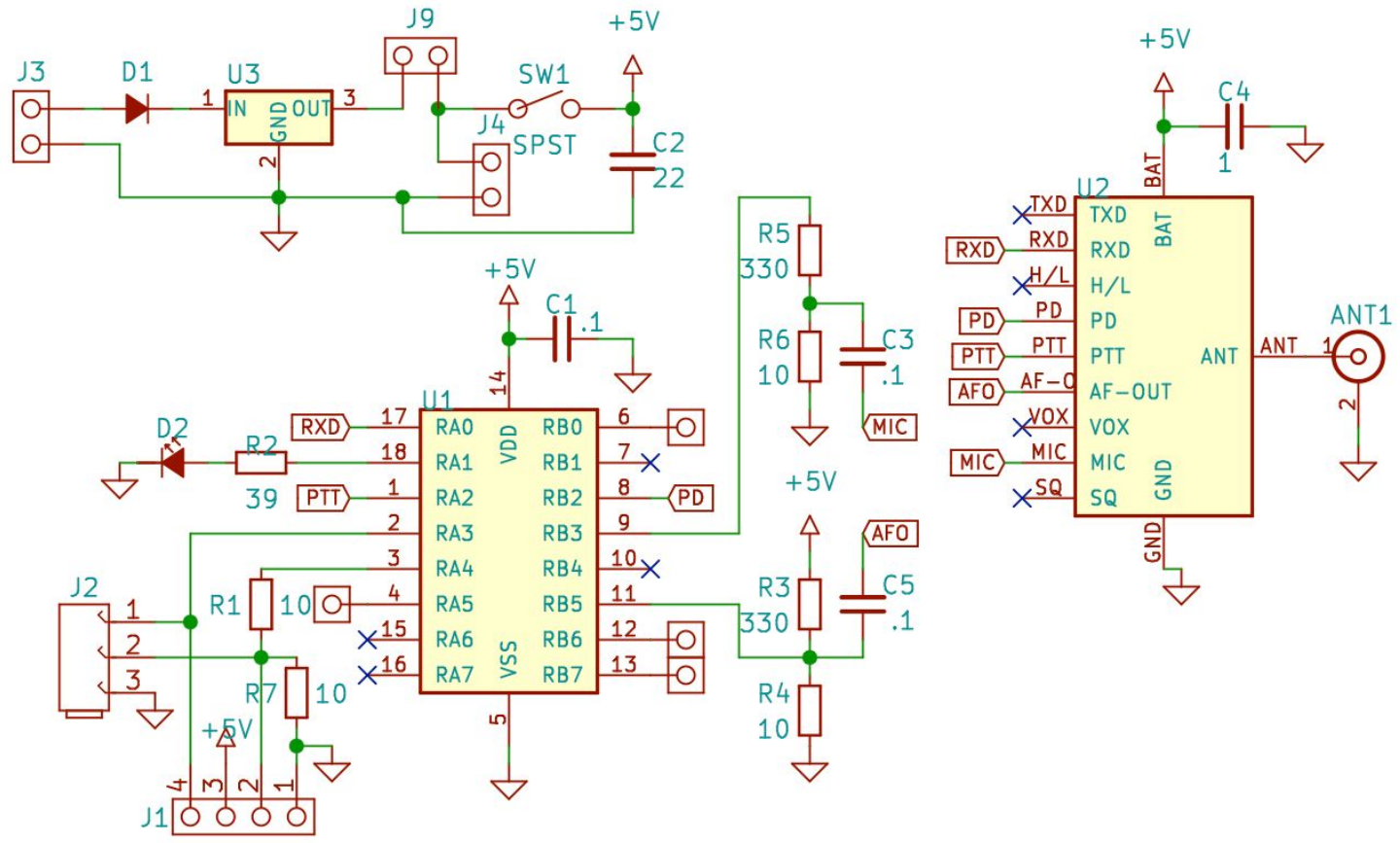
Specifications

Dimensions	Case is 60x30x18mm not including the SMA RF connector and switch which extend from the case
Weight	1.44g / 40.7g including battery but not including antenna
Serial Jack	2.5mm 3 conductor TRS. tip:serial from MF2, ring:serial to MF2, sleeve:ground
Power	2.5V (150mA transmit) to 5V (300mA transmit). Typical with include battery: 3.8V (230mA transmit).

PCB



Schematic


J3
D1
U3
IN
GND
OUT
J9
SW1
J4
SPST
+5V
C2
22
C1
.1
U1
VDD
VSS
RA0
RA1
RA2
RA3
RA4
RA5
RA6
RA7
RB0
RB1
RB2
RB3
RB4
RB5
RB6
RB7
RXD
PTT
PD
D2
R2
39
R1
10
R7
10
J2
J1
R5
330
R6
10
C3
.1
MIC
R3
330
R4
10
C5
.1
AFO
C4
1
U2
TXD
RXD
H/L
PD
PTT
AF-O
VOX
MIC
SQ
BAT
ANT
GND
AF-OUT
ANT1