Introduction

A BFO ("beat frequency oscillator") is the circuitry which permits reception of CW (Morse code) and SSB (single sideband voice) signals by a superhet shortwave receiver. It is a standard feature in "communications receivers." Under the assumption that most listeners are interested only in voice/music foreign broadcasts, many popular-priced "world-band" receivers do not include a BFO. Without that BFO, Morse Code signals sound like hisses, and SSB voice signals have a muffled Donald Duck sound.

The T-KIT 1050 "Universal BFO" can be set up as a separate accessory for portables or it can be built into older shortwave radios. Its purpose is to let you try out casual reception of CW and SSB and other transmission modes on shortwave receivers designed for international AM broadcast reception.

If a CW signal DOES have the familiar beep tone on a radio with no BFO, it is because there is another signal VERY near its frequency which causes you to hear the difference between those two frequencies as an audio tone. For example: if a shortwave broadcast is at 7160 KHz and there is a ham radio CW signal at 7159 KHz, the 1000 Hz difference between the two signals is well within the audio spectrum, and you will hear the CW signal as a 1000 Hz audio tone (which is called the BEAT FREQUENCY!).

In fact, you could tune in any CW or SSB signal on an AM-only radio by tuning a variable low-power oscillator (such as an RF signal generator or ham radio VFO) to within a few hundred Hz of its frequency. A more practical approach to creating a beat frequency is to tune a low- powered oscillator very near the "IF" (intermediate frequency) of a superhet receiver. Because the IF remains constant around 455 KHz, you then can tune CW and SSB signals without readjusting the beat frequency.

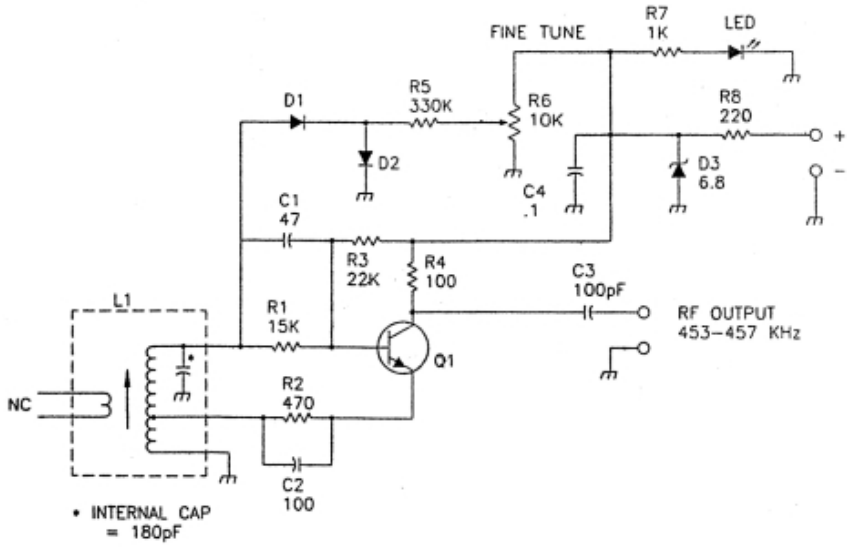
455 KHz has been the universal standard IF frequency for AM radios throughout radio history, even though other IF frequencies are used for FM radios and for communications-grade receivers. The T-KIT 1050 is a simple RF oscillator adjustable from 450 to 460 KHz. While it is normal practice to connect a BFO through a mixer stage to the 455 KHz IF of a receiver, satisfactory results are obtained with many receivers by simply coupling the T-KIT 1050 BFO to the antenna input or the receiver.

Circuit Description

The T-KIT 1050 uses a standard 455 KHz IF transformer and its built-in capacitor to form a traditional Hartley oscillator with transistor Q1 and its associated parts. The Hartley configuration is made possible by the center tap on the IF transformer coil. The other transformer winding is not used in this circuit. The oscillator frequency can be adjusted over a wide range by turning the slug inside the transformer. Theoretically, this is a one-time adjustment, generally changed only when using the unit with a different receiver. The oscillator is fine-tuned during actual use by potentiometer R6, which varies the voltage applied to diodes D1 and D2, ordinary silicon rectifier diodes serving as a varactor or voltage-variable-capacitor. This fine-tuning lets you adjust pitch of CW signals or the clarity of SSB signals. Zener diode D3 sets the operating voltage of the circuit at 6.8 volts, assuring reasonable frequency stability of the whole circuit.

In most set-ups, it is usually sufficient to couple the output wire from the BFO to the antenna input of the receiver. Sometimes a common ground connection between the BFO and receiver can improve performance. Other times, this makes no difference or even detracts from the performance desired.

T-KIT 1050 BFO Schematic:



T-KIT 1050 BFO
KIT PARTS LIST

Please check and organize all parts before starting construction. See T-KIT Warranty if you suspect any parts are missing.

Quantity	Description and Value	Schematic	Part No.
	Fixed Resistors		
	The 3 color bands denote resistance value. The 4th band (gold) denotes 5% tolerance.		
1 ☐	100 ohm (brown-black-brown)	R4	30126
1 ☐	220 ohm (red-red-brown)	R8	30130
1 ☐	470 ohm (yellow-violet-brown)	R2	30134
1 ☐	1K (brown-black-red)	R7	30138
1 ☐	15K (brown-green-orange)	R1	30076
1 ☐	22K (red-red-orange)	R3	30154
1 ☐	330K (orange-orange-yellow)	R5	30167
	Fixed Capacitors		
1 ☐	47 pF	C1	23378
2 ☐	100 pF disc capacitor (marked 101)	C2,C3	23385
1 ☐	.1 μF (marked 104)	C4	23261
	Inductor		
1 ☐	455 KHz IF transformer	L1	21093
	Semiconductor Devices: Transistor, Diodes		
1 ☐	NPN transistor type MPS6514	Q1	25054
2 ☐	1N4002 silicon rectifier diode	D1,D2	28000
1 ☐	6.8 volt zener diode	D3	28006
1 ☐	LED diode	LED1	28024
	Other Components, Hardware, Misc:		
1 ☐	10K potentiometer	R6	30267
1 ☐	Circuit Board for Model 1050		93083-2A
1 ☐	Instruction Manual for Model 1050		74302

REQUIRED, NOT SUPPLIED:

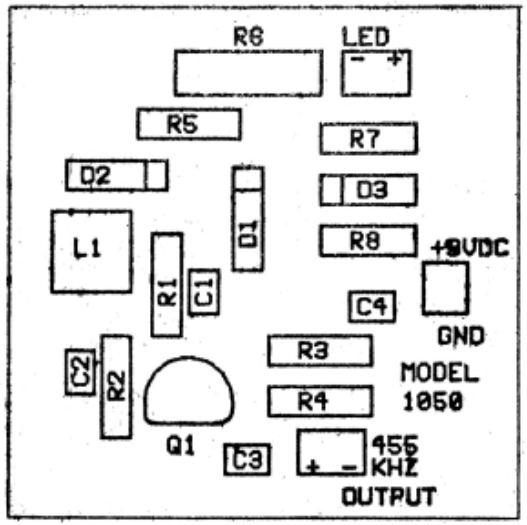
- ☐ Battery or regulated, well-filtered 8-15 Volts DC
- ☐ Hookup wire or mini-coax to couple BFO to receiver

MINIMUM TOOLS AND TEST EQUIPMENT:

- ☐ 15 to 35 watt soldering iron
- ☐ diagonal cutters or wire "nippers"
- ☐ needle-nose pliers
- ☐ adjustable wire stripping tool
- ☐ Alignment tool for L1 (mini screwdriver is OK)

T-KIT Model 1050 Universal BFO
X-RAY View of Circuit Board

NOTE: Your T-KIT circuit board is quality glass epoxy, etched, cleaned and screen-printed in the TEN-TEC plant to the high standards required by our transceiver assembly lines and modernized wave-soldering system.



Installing Parts on the Circuit Board:

When we say "**INSTALL**" a part, we mean:

- ☐ Choose correct part value
- ☐ Insert in correct PC Board location
- ☐ Insert *correctly,* if there is a right way and wrong way such as for diodes, IC's, electrolytic capacitors transistors etc.
- ☐ Solder all wires or pins
- ☐ Trim or "nip" excess wire lengths

USE ROSIN-CORE SOLDER ONLY,
of a type intended for electronic PC-board assembly.
(Available at electronics distributors or Radio Shack stores.)
DO NOT use hardware store solder, paste or flux.
Solder contains LEAD: wash hands before eating!