

BFE-C Loop Amplifier Card

Original design: Dallas Lankford - 15 NOV 1991
 Article & modified version: Mark Connelly - 04 FEB 1992

The BFE-C (Balanced Front-End Card, model C) is a "WALION DX Labs" implementation of Dallas Lankford's Balanced Cascade Loop Amplifier. His design is under further testing and refinement: he expects to publish a comprehensive article on it in the not-too-distant future. Dallas's design differs slightly from BFE-C in minor ways that will be mentioned subsequently. In terms of electrical characteristics, both can be treated as the same entity. The design is an improvement on the Kolb-Sanserino amplifier long used in Radio West's loops as well as (in modified form) in the RTL-1 Remotely-Tuned Loop (BFE-A, BFE-B cards). Dallas maintains that the balanced configuration of the output transistors (Q3 and Q4) of the new design improves noise figure; using FET's in the output stage, rather than a bipolar transistor gives enhanced strong-signal performance (i. e. reduced spurious responses).

This article will not go into an in-depth design review: that will be left for Dallas's forthcoming article. Rather, the essential construction details will be supplied, so DXers can do testing of their own.

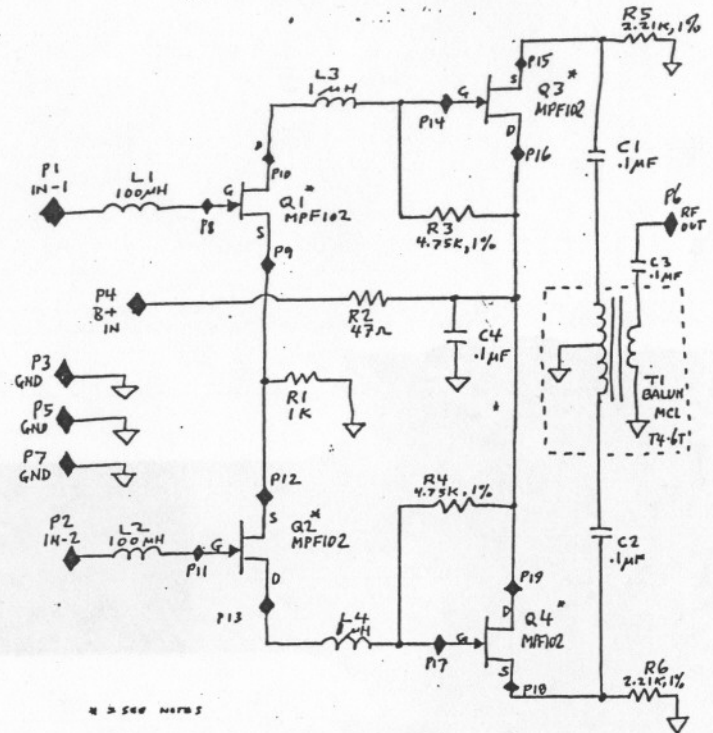
Figure 1 is the BFE-C schematic, Figure 2 is its assembly (component layout) drawing, and Table 1 is the parts list. For best results, Q1 should be matched to Q2; also, Q3 should be matched to Q4. Figure 3 shows the test circuit for measuring the voltage used to ascertain a matched condition. Two transistors producing voltage readings within 3% or better can be considered to be matched. For the purpose of getting two matched pairs of MPF102's, you should have a dozen or so transistors available.

Variations to the BFE-C design

Dallas Lankford suggests using an Amidon ferrite bead (part number FB-101-64) on the drain lead of Q1 and one on the drain lead of Q2 rather than using low-value chokes L3 and L4. The 100 uH input inductors L1 and L2, meant to reduce sensitivity above 9 MHz, can be removed if the loop amplifier is to be used with a shortwave, rather than with a medium wave, loop. R3 and R4 may each be reduced to 2.2K or to an even lower value. This will reduce gain, thereby reducing spurious responses that can occur in urban areas with large air-core loops. With lower-gain ferrite loops, it is unlikely that overloading would be much of a problem except in the worst "transmitter alley" locations like the New Jersey Meadowlands. Dallas has recommended that larger loops be tapped down part way on the coil - again to improve dynamic range and to reduce intermodulation distortion "spurs" in strong-signal areas. He also mentioned problems with Mouser inductors opening up (a problem I've seldom encountered); he winds homebrew 100 uH inductors using 39 turns of #26 wire on an Amidon FT-50-82 toroidal core. He also homebrews the output balun transformer (12 trifilar turns #22 on Amidon FT-82-43, or 33 trifilar turns #26 on Amidon FT-82-61). There's no parametric advantage to one approach (e. g. homebrew) over the other (e. g. using the Mini-Circuits T4-6T).

FIGURE 1:

BFE-C BALANCED FRONT-END CARD SCHEMATIC
 (WALION DX LABS VERSION OF LANKFORD LOOP AMP.)



NOTES FOR FIGURES 1 & 2

- ◆, ◀ = FLEA-CLIP PINS (OPEN SIDE →)
- ↓ = CIRCUIT CARD GROUND
- ↑ = LONG-LEAD SIDE OF VERTICALLY-MOUNTED COMPONENT

FIG. 2: DIMENSIONS ARE INCHES

* Q1 SHOULD BE MATCHED TO Q2. Q3 SHOULD BE MATCHED TO Q4.
 SEE FIGURE 3.

FIGURE 2

BFE-C Loop Amp. Updater - Mark Connelly - 01 MAR 1992

A couple of changes to the BFE-C article: First, there's a correction to the orientation of transformer T1 as shown on the BFE-C assembly drawing. I had put T1 onto the card correctly when I did my testing, but its position on the drawing was accidentally reversed. Also, as a result of urban testing, I've set resistors R3 and R4 to 2.21K, 1k rather than 4.75K. For these changes, please refer to the modified drawing below. R3 and R4 should also be changed on the schematic and parts list.

BFE-C CARD ASSEMBLY (UPDATED 1 MAR 1992)

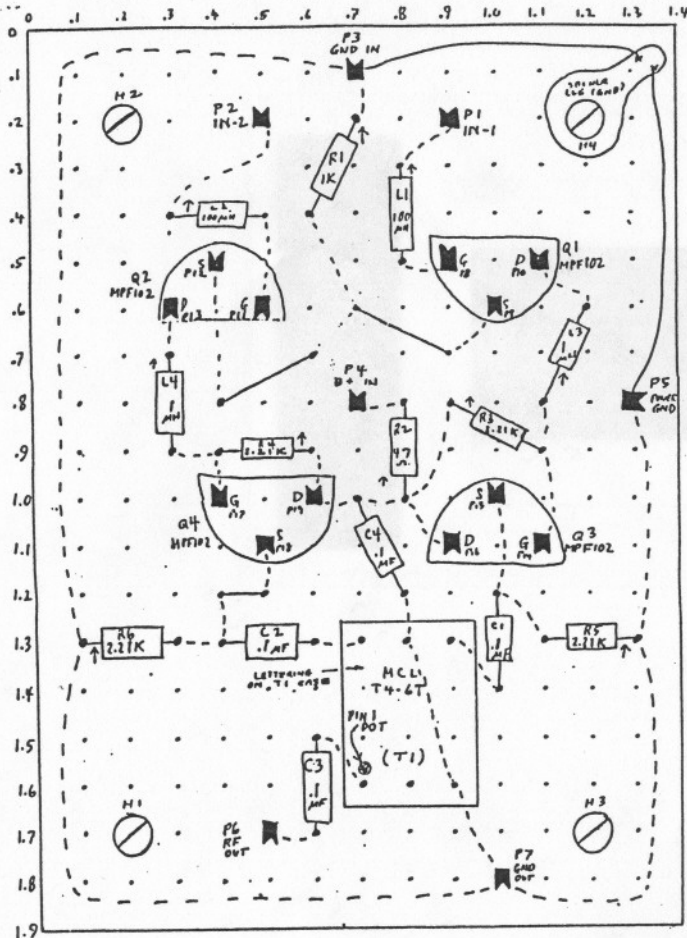


FIGURE 3 : FET-MATCHING TEST CIRCUIT

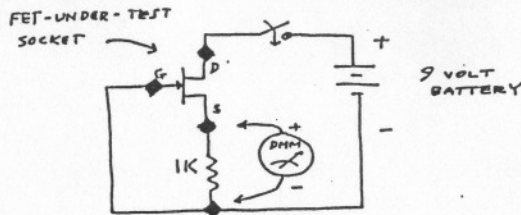


Table 1: (All) BFE-C balanced front-end card parts list

Vendor codes:

- DK = Digi-Key / P. O. Box-677
/ Chief River Falls, MN 56701-0677
/ Tel. 1-800-344-4539
- MCL = Mini-Circuits / P. O. Box 350166
/ Brooklyn, NY 11235-0003
- MCU = Mouser Electronics / 11433 Woodside Ave.
/ Santee, CA 92071
/ Tel. 1-800-346-6873
- RS = Radio Shack / Many locations worldwide

Item	Designator	Description/Value	Vendor	Vendor Stock #	QTY
1	BD	perfboard (1.9"x1.4")	RS	276-1396 (cut)	1
2	C1, C2, C3, C4	capacitor, 0.1 uF	DK	P4525	4
3	H1, H2, H3, H4	screw, 4-40 X .25"	MCU	572-01880	4
4	H1, H2, H3, H4	spacer, 4-40 X .5"	MCU	534-1450C	4
5	H1, H2, H3	split lockwasher, #4	MCU	572-00649	3
6	H4	solder lug, #4	MCU	534-7311	1
7	L1, L2	inductor, 100 uH	MCU	43LS104	2
8	L3, L4	inductor, 1 uH	MCU	43LS106	2
9	P1-P19	flea-clip, .042"hole	DK	V1069-ND	19
10	Q1, Q2, Q3, Q4	FET, MPF102	RS	276-2062 (see note)	4
11	R1	resistor, 1K	RS	271-1321	1
12	R2	resistor, 47 ohm	MCU	29S3500-47	1
13	R3, R4	resistor, 4.75K, 1k	DK	4.75KX	2
14	R5, R6	resistor, 2.21K, 1k	DK	2.21KX	2
15	T1	balun transformer	MCL	T4-6T-X65	1
16	W	buss wire	RS	278-1341	approx. 1'

Note: Q1 and Q2 should be matched. Q3 and Q4 should be matched. FET-matching method is given in the article's text and in Figure 3.

Tests versus the BFE-A
[Refer to the article "The RIL-1 Remotely-Tuned Loop" - M. Connelly - JUL 1991]

The BFE-C amplifier card was swapped into my homebrew RIL-1 loop in place of the BFE-A. A ferrite loop head was used. BFE-C sensitivity was comparable to (consistently within 3 dB of) that of the BFE-A card across the medium-wave band. BFE-C's strong-signal handling was a bit better and its noise floor seemed lower. Tests were done with each front-end amplifier's output routed directly to the receiver and then with each amplifier's output passed through the BBA-C broadband amplifier for additional gain. Although differences weren't dramatic, I'd recommend that DXers building the RIL-1 should use the BFE-C in place of the BFE-A.