A132-5-1

The RTL-2 Remotely-Tuned Loop

Mark Connelly - WA1ION - 23 AUG 1993

The RTL-2 is a remotely-tunable balanced loop antenna system with improved performance over the previously-released RTL-1 and RTL-1A. The RTL-2 amplifier box accommodates Quantum and Palomar loop heads as well as home-brew ferrite or air-core heads fitted with the necessary stereo phone plug. The RTL-2's remote-tuning capability is compatible with control by the DCP-1 Dual Controller / Phaser and by the MWT-3 Regenerative Preselector. The controller couples DC power to the RF (coaxial) line and provides varactor and relay control voltages. The loop head / loop amplifier assembly may be placed a considerable distance (e. g. 100 ft./ 30 m.) from the controller / receiver "shack" position with little degradation of performance. The RTL-2 can also be used for remotely-tuned whip / wire operation.

The major work of the RTL-2 is done by three subassembly cards M1 (the VRLY-A Varactor & Relay Card), A1 (the BFE-C Balanced front-end card), and A2 (the BUF-A (or BUF-B) output buffer amplifier). This modularity of design allows the builder to try out other subassemblies for improvements to performance at a later time without having to rebuild the entire RTL-2 box. Customizations could be done for even better dynamic range or higher sensitivity or lower power consumption.

The frequency range covered by a given medium wave loop head can be extended downwards by enabling the relay K1 on the M1 (VRLY-A) card. This parallels the main varactor with an additional varactor shunted by a 270 pF fixed capacitor. The normal varactor capacitance range is approximately 50 to 440 pF; with the shunt pulled in, a second range of about 370 to 1150 pF becomes available. As varactor diodes have a lower (maximum C / minimum C) ratio than air variable capacitors have, use of the relay is sometimes necessary for full medium wave band coverage. The relay control voltage at J2-B is typically 0 VDC (ground or open) for high-band / open-contacts and +12 VDC for low- band / closed-contacts. Varactor tuning voltage, supplied from a low to medium impedance source to J2-A, should be 0 VDC for maximum capacitance (minimum frequency) and about +9.1 VDC for minimum capacitance (maximum frequency). Controllers such as MWT-3 and DCP-1 supply these voltages.

Because a remotely-sited loop is generally set up in one position and not constantly moved about for nulling, head tiltability (and critical balancing of the front-end card) is not nearly as important as on an in-shack loop. Tilting and rotating of Quantum and Palomar heads is, of course, possible; mobility of larger heads (e. g. air-core) is left up to the ingenuity of the builder.

An obvious question, at this point, would be "How can I null anything with a remotely-sited loop ?" Short of employing tilting and rotating servo-motors (a project not for the faint of heart), nulls are most readily obtained by phasing the remote loop against a varactor-tuned whip or against a second remote loop. The ideal set-up would be two remote loops at right angles and a remote whip. The DXer could then pick the pair of remote antennae that would throw the stiffest null on the "pest" station (or noise) while simultaneously passing the greatest amount of desired DX station signal.

Remote loop versus remote whip phasing is done here regularly; it works quite well, providing a nulling scheme better suited to DXing from "field" sites (beaches, piers, etc.) than longwires that can get in the way of vehicular and pedestrian traffic. My standard beach DX set-up is a Sony ICF2010 or Realistic DX440 receiver connected to the DCP-1 Dual Controller / Phaser running one RTL-2 with a Quantum loop head and another RTL-2 with a whip of approximately 3 ft. height. The resultant cardioid pattern works well for nulling stations to the west, thereby improving Trans-Atlantic (TA) reception from the east. One RTL-2 box sits on the roof of the car, the other on the hood.

A two-loop phasing scheme can generate a cardioid pattern, as well. One loop should be aligned 45 degrees clockwise of the axis of interest and the other loop should be aligned 45 degrees counter-clockwise of this axis. For example, if two Quantum-head-equipped RTL-2's are being used to null stations to the west and receive stations from the east, a perpendicular line (direction of maximum pick-up) off the first Quantum head would be on the 45 / 225 degree (NE / SW) bearing and the perpendicular line from the other head would be on the 135 / 315 degree (SE / NW) bearing. If two loops not separated by a substantial distance are to be phased, there should be at least a 45 degree absolute angle between the two. Otherwise, stations from all directions tend to null together during the phasing process. Two-whip phasing at medium-wave requires at least a 100-ft. / 30-m. separation between the whips. Also, it helps if a bearing line from one whip to the other extends towards the station to be nulled or towards the DX to be received.

RTL-2 Control Usage

Although the RTL-2 is a remotely-controlled antenna system in most respects, three switches reside on the RTL-2 box. These controls are, in typical circumstances, rarely adjusted from the operator's "normal" set-ups. If necessary, the RTL-2 box could be overhauled for completely automated operation; of course this would require a considerable increase in the complexity of both the RTL-2 and the controller unit. This article does not address that scenario.

S1 (Whip Bandswitch): This switch selects one of three frequency ranges for Whip / Wire operation by selecting an inductor to place in parallel with the capacitance developed by the VRLY-A card. Bands covered are Longwave (130 - 475 kHz), Medium Wave (475 - 1720 kHz), and Tropical Bands (1720 - 5500 kHz). These ranges are approximate; use of short whips (e. g. less than 1 m. / 3.3 ft.) will increase the high-frequency end of each range above that stated. Each range is divided into two sub-ranges controlled by the relay on the VRLY-A card: LW-low = 130 - 220, LW-high = 220 - 475; MW-low = 475 - 830, MW-high = 830 - 1720; TB-low = 1720 - 2700, TB-high = 2700 - 5500 (up to ~ 7500 kHz w/ short whips). It should be noted that, with S2 in the Loop mode, a Quantum head will tune about 450 - 850 kHz (low-band) and 750 kHz to 2000 kHz (high band), again depending upon the relay setting. Physical orientation of S1: TB = up, LW = center, MW = down.

S2 (Function Switch): This switch selects one of the two operating modes: Loop or Whip / Wire. In the Loop mode, a loop head coil is plugged into RTL-2 J1. The signal across the tank circuit formed by this coil and the varactors on the VRLY-A card is amplified by the A1 (BFE-C) card in a balanced-in / unbalanced- out configuration. The BFE-C's output is given a further boost by the T1 transformer / A2 (BUF-A or BUF-B) buffer amplifier card combination. In the Whip / Wire mode, a whip or wire antenna installed at J4 is coupled to a tank circuit comprised of the VRLY-A card varactors and an inductor selected by bandswitch S1. The signal thus developed is amplified by the A1 and A2 cards in an unbalanced in / out configuration. Physical orientation of S2: Loop = up, Whip / Wire = down.

S3 (Q Switch): This switch selects Normal Q or Low Q. Normal Q is generally used because it provides the best sensitivity and selectivity. Low Q may be usable in some phasing applications to ensure more thorough nulling of a "pest" station's sidebands as well as its carrier. Physical orientation of S3: Normal Q = up, Low Q = down.

For simplicity, the attenuation pot. of the older RTL-1 / RTL-1A designs was deleted. Those living in urban areas may find that installing a similar potentiometer between J4 and C1 may help to prevent overloading when longer wires are being used.

Building the RTL-2 Remotely-Tuned Loop

The documentation (schematics, assembly drawings, parts lists, hole lists, etc.) serves as the starting point. The following procedure should serve as an outline for the builder.

1. Gather all necessary parts (see parts lists to follow). Prepare work area with appropriate tools.
2. Drill out chassis box, in accordance with Table 1.
3. Assemble each of the circuit card subassemblies - these are:
   * VRLY-A Varactor & Relay Card (Fig's 3 & 4; Table 3)
   * BFE-C Balanced Front End Card (Fig's 5 & 6; Table 4)
   * BUF-A or BUF-B Buffer Amplifier Card (Fig's 8-11; Tables 5 & 6)
4. Mount each of the circuit cards at the hole locations noted in Table 1.
5. Install jacks, pots, and switches. Solder inductors onto S1 per Figure 1 and Table 8.
6. Install wiring and other components per Figures 1 & 2 and Tables 1, 2, 7, & 8. Place labels near controls and jacks.
7. Connect controller (e. g. MWT-3 or DCP-1) to the RTL-2: control cable to J2, RF/power cable to J3. Connect DC power to the controller and connect the controller's RF output to the receiver.
8. Install Quantum, Palomar, or home-brew loop head at RTL-2 J1, or a whip or wire to J4. The RTL-2 may now be tested and operated.

A132-5-2

Table 1: RTL-2 hole-drilling list

X = Horizontal distance, in inches, from the vertical centerline (VCL) on the side observed. Negative values of X are left of VCL, positive values of X are right of VCL.

Y = Vertical distance, in inches, from the bottom horizontal edge of the side observed.

D = Hole diameter in inches.

Hole loci are first marked on the box with a scriber and are then drilled with a .125" bit. Subsequently, as required, the holes are enlarged to the proper size by using progressively larger bits up to that corresponding to the final desired diameter.

Chassis Box = Mouser 537-TF-779 (metal): 5" X 4" X 3"

LEFT SIDE

Hole #	Comp. Desig.	Description	X	Y	D
--	----	------------------------	--.----	--.----	--.----
1	S1	Whip Freq. Range sw. - tab	-1.375	2.25	0.125
2	S1	Whip Freq. Range sw. - shaft	-1.375	2.0	0.25
3	S3	Q switch - tab	-0.625	2.25	0.125
4	S3	Q switch - shaft	-0.625	2.0	0.25
5	S2	Loop / Whip switch - tab	-1.0	1.0	0.125
6	S2	Loop / Whip switch - shaft	-1.0	0.75	0.25
7	M1	VRLY-A card - H/W 4	0.25	1.5	0.125
8	M1	VRLY-A card - H/W 3	0.25	0.5	0.125
9	M1	VRLY-A card - H/W 2	1.25	1.5	0.125
10	M1	VRLY-A card - H/W 1	1.25	0.5	0.125

TOP SIDE

Hole #	Comp. Desig.	Description	X	Y	D
--	----	------------------------	--.----	--.----	--.----
1	G1	internal ground lug hardware	-1.375	3.0	0.125
2	J4	Whip / Wire In - BNC jack	0.0	3.25	0.375
3	J1	Loop Head In-stereo phone jk	0.0	2.125	0.375
4	A1	BFE-C front-end card - H/W 2	-1.125	1.5	0.125
5	A1	BFE-C front-end card - H/W 4	-1.125	0.5	0.125
6	A1	BFE-C front-end card - H/W 1	0.375	1.5	0.125
7	A1	BFE-C front-end card - H/W 3	0.375	0.5	0.125
8a	A2	BUF-A buffer amp. card-H/W 2	1.375	3.5	0.125
9a	A2	BUF-A buffer amp. card-H/W 1	1.375	1.9	0.125
8b	A2	BUF-B buffer amp. card-H/W 2	1.375	3.625	0.125
9b	A2	BUF-B buffer amp. card-H/W 1	1.375	1.625	0.125

NOTE: Use holes 8a & 9a if using the BUF-A card as the output amplifier; use holes 8b & 9b if using the BUF-B card instead.

RIGHT SIDE

Hole #	Comp. Desig.	Description	X	Y	D
--	----	------------------------	--.----	--.----	--.----
1	J2	Control Cable-stereo phone jk	-1.125	0.625	0.375
2	G2	internal ground lug hardware	0.0	1.25	0.125
3	J3	RF out / DC in - BNC jack	0.0	0.5	0.375

Table 2: "upper level" parts list

*: Note follows parts list.

Vendor codes for this and subsequent parts lists:

DC = DC Electronics P. O. Box 3203
Scottsdale, AZ 85271
Tel. 1-800-467-7736

DK = Digi-Key P. O. Box 677
Thief River Falls, MN 56701-0677
Tel. 1-800-344-4539

GER = Gerber Electronics 128 Carnegie Row
Norwood, MA 02062
Tel. 1-617-769-4852, 769-6000

MCL = Mini-Circuits Lab. P. O. Box 350166
Brooklyn, NY 11235-0003
Tel. 1-800-654-7949

MOU = Mouser Electronics 11433 Woodside Ave.
Santee, CA 92071
Tel. 1-800-346-6873

RS = Radio Shack / Many locations worldwide

Schematic = Figures 1 & 2.

Item	Designator	Description/Value	Vendor	Vendor Stock #	QTY
====	=====	==================	===	===========	===
1	-	chassis box 5X4X3	MOU	537-TF-779	1
2	A1	BFE-C front-end		(see Table 4)	1
3*	A2	BUF-A buffer amp.		(see Table 5)	1
4	M1	VRLY-A var./relay		(see Table 3)	1
5	C1	capacitor, 43 pF	MOU	21CB043	1
6	C2,5	capacitor, 10 uF	MOU	581-10K35	2
7	C3,6	capacitor, 0.001uF	MOU	539-CK05102K	2
8	C4	capacitor, 0.1 uF	MOU	539-CK05104K	1
9	DS1	NE-2 neon bulb	MOU	36NE002	1
10	J1,2	stereo phone jack	MOU	10PJ080	2
11	J3,4	BNC jack	MOU	523-31-221	2
12	L1	inductor, 1.5 mH	MOU	434-1120-153K	1
13	L2	inductor, 82 uH	MOU	43LR825	1
14	L3	inductor, 6.8 uH	MOU	43LR686	1
15	R1,2	resistor, 270 ohm	MOU	29SJ250-270	2
16	R3,4	resistor, 15K	MOU	29SJ250-15K	2
17	R5	resistor, 470 ohm	MOU	29SJ250-470	1
18	RFC1,2	inductor, 4.7 mH	MOU	434-1120-473K	2
19	RFC3	inductor, 2.2 mH	MOU	434-05-222J	1
20	S1	switch, SPDT, on/off/on	MOU	10TA535	1
21	S2	switch, DPDT, on/on	MOU	10TA560	1
22	S3	switch, SPDT, on/on	MOU	10TA530	1
23	T1	RF transformer, 1:36	MCL	T36-1-X65	1

* Item 7: BUF-B (Table 6) may be used in place of BUF-A.

Misc. items: hook-up wire, buss wire, solder, labels "AS REQUIRED"

Table 3: (M1) VRLY-A Varactor & Relay Card parts list. See Table 2 for vendor codes.

Schematic = Figure 3 / Assembly = Figure 4.

Item	Designator	Description/Value	Vendor	Vendor Stock #	QTY
====	=====	==================	===	===========	===
1	-	perfboard: 1.4"X1.4"	RS	276-1396 (cut)	1
2	C1,2,4	capacitor, 0.1 uF	MOU	539-CK05104K	3
3	C3	capacitor, 270 pF	MOU	232-1900-270	1
4*	D1,2	varactor, MVAM109	DC	MVAM109	2
5	D3	zener, 1N4733 (5.1V)	RS	276-565	1
6	H1,2,3,4	screw, 4-40 X .25"	MOU	572-01880	4
7	H1,2,3,4	spacer, 4-40 X .5"	MOU	534-1450C	4
8	H1,2	split lockwasher, #4	MOU	572-00649	2
9	H3,4	solder lug, #4	MOU	534-7311	2
10	K1	relay (5V DIP SPST)	MOU	433-D31A311	1
11	(for K1)	DIP socket, 14 pin	RS	276-1999	1
12	P1-6	flea-clip/.042"hole	MOU	574-T42-1/100	6
13	R1	resistor, 1K	RS	271-1321	1
14	R2	resistor, 270 ohm	MOU	29SJ250-270	1
15	RFC1,2	inductor, 4.7 mH	MOU	434-1120-473K	2

+ buss wire, solder - as required

* Item 4: Motorola MVAM108 or Siemens BB112 may be substituted directly. NTE618 may be substituted if the maximum control voltage is raised from +9.1 VDC to approximately +11 VDC.

Table 4: (A1) BFE-C Balanced front-end Card parts list. See Table 2 for vendor codes.

Schematic = Figure 5 / Assembly = Figure 6.

Item	Designator	Description/Value	Vendor	Vendor Stock #	QTY
====	=====	==================	===	===========	===
1	BD	perfboard: 1.9"X1.4"	RS	276-1396 (cut)	1
2	C1,2,3,4	capacitor, 0.1 uF	MOU	539-CK05104K	4
3	H1,2,3,4	screw, 4-40 X .25"	MOU	572-01880	4
4	H1,2,3,4	spacer, 4-40 X .5"	MOU	534-1450C	4
5	H1,2,3	split lockwasher, #4	MOU	572-00649	3
6	H4	solder lug, #4	MOU	534-7311	1
7	L1,2	inductor, 100 uH	MOU	43LS104	2
8	L3,4	inductor, 1 uH	MOU	43LS106	2
9	P1-P19	flea-clip,.042"hole	MOU	574-T42-1/100	19
10	Q1,2,3,4*	FET, MPF102	RS	276-2062	4
11	R1	resistor, 1K	RS	271-1321	1
12	R2	resistor, 47 ohm	MOU	29SJ500-47	1
13	R3,4,5,6	resistor, 2.21K,1%	DK	2.21KX	2
14	T1	balun transformer	MCL	T4-6T-X65	1

+ buss wire, solder - as required

* Item 10: Q1 should be matched to Q2; Q3 should be matched to Q4. See Figure 7.

Table 5: (A2) BUF-A Buffer Amplifier card parts list. Vendor codes per Table 2.
Schematic = Figure 8 / Assembly = Figure 9.

Item	Designator	Description/Value	Vendor	Vendor Stock #	QTY
====	=====	==================	===	===========	===
1	BD	perfboard: 1.2"X2.0"	RS	276-1396 (cut)	1
2	C1	capacitor, 0.01 uF	MOU	539-CK05103K	1
3	C2	capacitor, 10uF tant	MOU	581-10K35	1
4	C3	capacitor, 0.001 uF	MOU	539-CK05102K	1
5	C4,5	capacitor, 0.1 uF	MOU	539-CK05104K	2
6	H1,2	screw, 4-40 X .25"	MOU	572-01880	2
7	H1,2	spacer, 4-40 X .5"	MOU	534-1450C	2
8	H1,2	solder lug, #4	MOU	534-7311	2
9	P1-7	flea-clip/.042"hole	MOU	574-T42-1/100	7
10	R1,2	resistor, 680K	MOU	271-680K	2
11	R3	resistor, 100 ohm	MOU	271-100	1
12	R4,5	resistor, 4.7 ohm	MOU	295-4.7	2
13	T1	RF transformer, 4:1	MCL	T4-6T-X65	1
14	U1	buffer amplifier IC	GER	(National)LH0033CG	1

+ buss wire, solder - as required

Table 6: (A2) BUF-B Buffer Amplifier card parts list. Vendor codes per Table 2.
BUF-B may be substituted for BUF-A for more gain at rural locations.

Schematic = Figure 10 / Assembly = Figure 11.

Item	Designator	Description/Value	Vendor	Vendor Stock #	QTY
====	=====	==================	===	===========	===
1	BD	perfboard: 1.4"X2.4"	RS	276-1396 (cut)	1
2	C1,5,9	capacitor, 0.01 uF	MOU	539-CK05103K	3
3	C2,3,4,7,8	capacitor, 0.1 uF	MOU	539-CK05104K	5
4	C6,10	capacitor, 10uF tant	MOU	581-10K35	2

A132-5-3

5	H1,2	screw, 4-40 X .25"	MOU	572-01880	2
6	H1,2	spacer, 4-40 X .5"	MOU	534-1450C	2
7	H1,2	solder lug, #4	MOU	534-7311	2
8	P1-9	flea-clip/.042"hole	MOU	574-T42-1/100	9
9*	Q1	MOSFET, NTE222	MOU	526-NTE222	1
10	Q2	NPN, 2N5109	MOU	511-2N5109	1
11	R1	resistor, 330K	MOU	29SJ250-330K	1
12	R2	resistor, 51 ohm	MOU	29SJ500-51	1
13	R3,8	resistor, 270 ohm	MOU	29SJ250-270	2
14	R4	resistor, 100K	RS	271-1347	1
15	R5	resistor, 47K	RS	271-1342	1
16	R6	resistor, 680 ohm	RS	271-021	1
17	R7	resistor, 1K	RS	271-1321	1
18	R9,11,12	resistor, 4.7 ohm	MOU	295-4.7	3
19	R10	resistor, 39 ohm	MOU	29SJ500-39	1
20	RFC1	inductor, 2.2 mH	MOU	434-05-222J	1
21	T1	RF transformer, 4:1	MCL	T4-6T-X65	1

+ buss wire, solder - as required

* Item 9 - 3N201, 40673, or NTE454 may be substituted (Q1).

Table 7: small hardware parts list, comprised of tables 7A - 7D. See Table 2 for vendor codes.

Note: Mounting hardware is supplied with the following components: J1, J2, J3, J4, S1, S2, S3.

*** Table 7A = M1 mounting hardware (excluding Table 3 items) ***

Item	Designator	Description/Value	Vendor	Vendor Stock #	QTY
1	-	screw, 4-40 X.25"	MOU	572-01880	4
2	-	split lockwasher,#4	MOU	572-00649	4

*** Table 7B = A1 mounting hardware (excluding Table 4 items) ***

Item	Designator	Description/Value	Vendor	Vendor Stock #	QTY
1	-	screw, 4-40 X.25"	MOU	572-01880	4
2	-	split lockwasher,#4	MOU	572-00649	4

*** Table 7C = A2 mounting hardware (excluding Table 5/6 items) ***

Item	Designator	Description/Value	Vendor	Vendor Stock #	QTY
1	-	screw, 4-40 X.25"	MOU	572-01880	2
2	-	split lockwasher,#4	MOU	572-00649	2

*** Table 7D = grounding hardware ***

Item	Designator	Description/Value	Vendor	Vendor Stock #	QTY
1	G1,G2	screw, 4-40 X.375"	MOU	572-01881	2
2	G1,G2	solder lug, #4	MOU	534-7311	2
3	G1,G2	hex nut, 4-40	MOU	572-00484	2

See Table 1 for M1, A1, A2, G1, G2 locations.
Locate screw heads & lockwashers for M1, A1, & A2 on exterior surface of the chassis box.
Locate G1 & G2 screw heads on exterior surface of chassis box and locate G1 & G2 lugs and nuts inside the box.

Table 8: wiring / component connections

Notes:

1. Wire types: D = direct connection using component's own lead
   I = insulated wire, approx. #22 AWG
   B = bare solid (buss) wire
2. Lengths specified are the maximum amount typically required; in actual practice, use the shortest length possible to minimize stray coupling.
3. J1-C and J2-C (of Figure 1) are tied to chassis ground via direct mechanical connection. On J1 and J2, the following convention applies to the mating of stereo headphone plugs to these jacks:
   A = tip of plug
   B = center section of plug
   C = remaining (base) section of plug (= ground)

IINSIDE BOX

wire #	From	To	Description
1	J3	A2-P5	3" I
-	J3	RFC3 side 1/R5 side 1	D
-	RFC3 side 2/R5 side 2	C5 "+" /C6 side 1	D
-	C5 "-" /C6 side 2	G2	D
2	RFC3 side 2/R5 side 2	A1-P4	3.5" I
3	RFC3 side 2/R5 side 2	A2-P3	1.5" I
-	J2-A	RFC1 side 1	D
-	RFC1 side 2	R1 side 1	D
-	R1 side 2	C2 "+" /C3 side 1	D
-	C2 "-" /C3 side 2	G2	D
4	R1 side 2	M1-P3	4" I
-	J2-B	RFC2 side 1	D
-	RFC2 side 2	R2 side 1	D
-	R2 side 2	C4 side 1	D
-	C4 side 2	J2-C	D
5	R2 side 2	M1-P4	4" I
-	T1 pin 4	A2-P2	D
-	T1 pin 6	A2-P1	D
6	T1 pin 1	A1-P6	1" I
7	T1 pin 3	A1-P7	1" B
8	A1-P1	M1-P1	3" I
9	A1-P2	M1-P2	3" I
10	S2A arm	M1-P1	2" I
11	S2B arm	M1-P2	2" I
12	R3 side 1	M1-P1	0.5" B
-	R3 side 2	S3 'Low Q'	D
13	R4 side 1	M1-P2	0.5" B
-	R4 side 2	S3 arm	D
14	S2A 'Loop'	J1-A	3.5" I
15	S2B 'Loop'	J1-B	3.5" I
16	S2A 'Whip'	S1 arm	2" I
17	S2B 'Whip'	L1/L2/L3 side 1 jct's	2" I
18	L1/L2/L3 side 1 jct's	G1	1" B
-	L1 side 2	S1 arm	D
-	L2 side 2	S1 'MW'	D
-	L3 side 2	S1 'TB'	D
19	S1 arm	C1 side 1	2" I
-	C1 side 2	J4	D
-	J4	DS1 side 1	D
20	DS1 side 2	G1	1" B

Conclusion

The RTL-2 can provide remotely-tuned loop, whip, and wire operation that can allow DXing from apartments, parked vehicles, underground rooms, and other locations at which a loop or other antenna located right at the receiving position would not function due to excessive shielding and / or electrical noise. Two RTL-2's can be phased to produce a cardioid pattern to null interference from the direction opposite that of desired DX stations. Such dual RTL-2 operation is done with a DCP-1 Dual Controller / Phaser, or with an equivalent device. Regeneration provided by a controller such as the MWT-3 can make an RTL-2 with Quantum head comparable in performance to regeneration-equipped loops made by KIWA, Martens, and Ken Cornell. Both the MWT-3 (regen.) / single RTL-2 and the DCP-1 (phaser) / dual RTL-2's configurations have served me very well on DXpedition trips to beaches and other choice DX sites not offering sufficient space or privacy for large wire antennas.

The modular design of the RTL-2 makes it a good platform for further enhancements as DXers play with various circuit card designs. It is the author's intention that others will freely "tweak" the design and present their findings in the pages of the major DX journals.

For a treatment of an air-core remotely-tuned loop (for shortwave use), see Joe Farley's excellent article "A Remotely Tuned Loop Antenna" in Fine Tuning's Proceedings 1989. NRC Reprint A30, "A Remotely Tuned Directional Loop Antenna" by E. L. Cummins, is also a worthwhile article.

FIGURE 1: RTL-2 REMOTELY - TUNED LOOP (SCHEMATIC : INPUT SECTION)

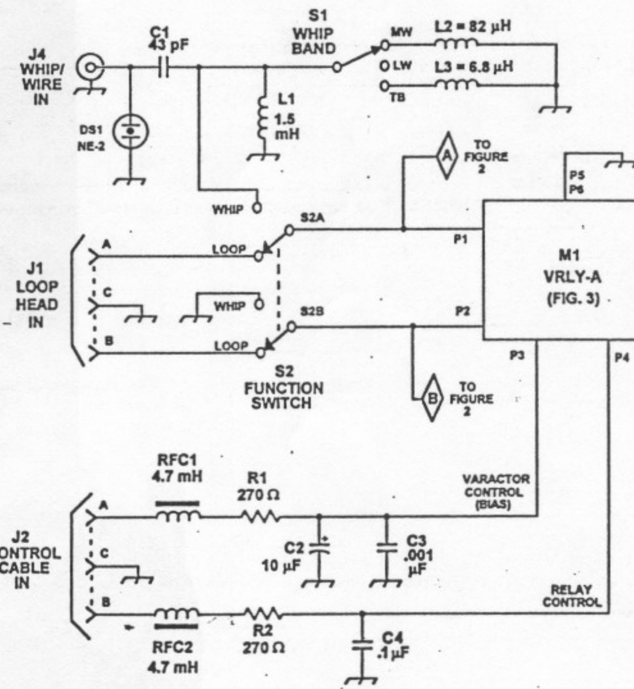
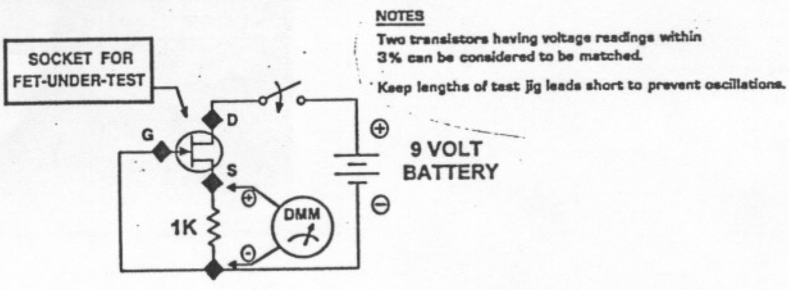
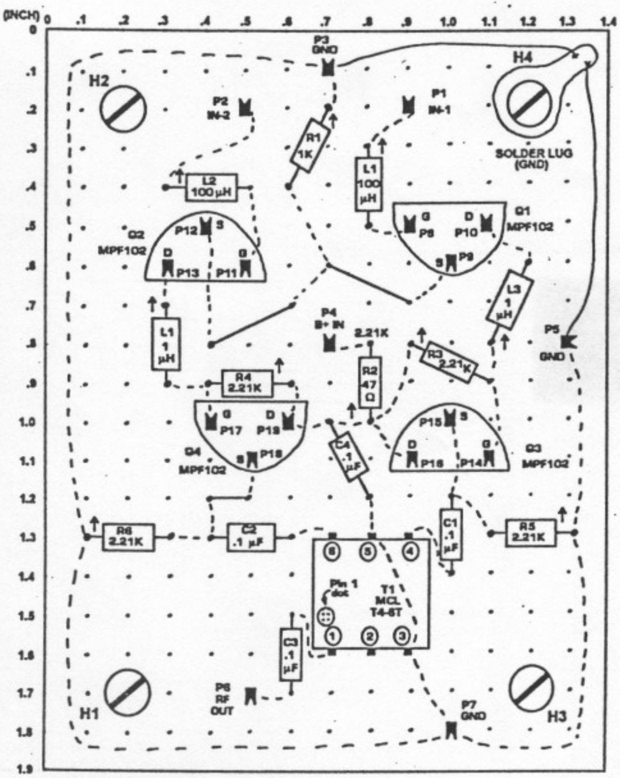


FIGURE 7: RTL-2 REMOTELY - TUNED LOOP FET-MATCHING TEST CIRCUIT FOR BFE-C CARD



A132-5-4

FIGURE 6: RTL-2 REMOTELY - TUNED LOOP (ASSEMBLY: BFE-C BALANCED FRONT-END CARD)



Assembly-drawing symbols are explained by the notes of Figure 4.

FIGURE 10: RTL-2 REMOTELY - TUNED LOOP (SCHEMATIC: BUF-B BUFFER AMPLIFIER CARD)

BUF-B may be used instead of BUF-A for more gain at rural locations.

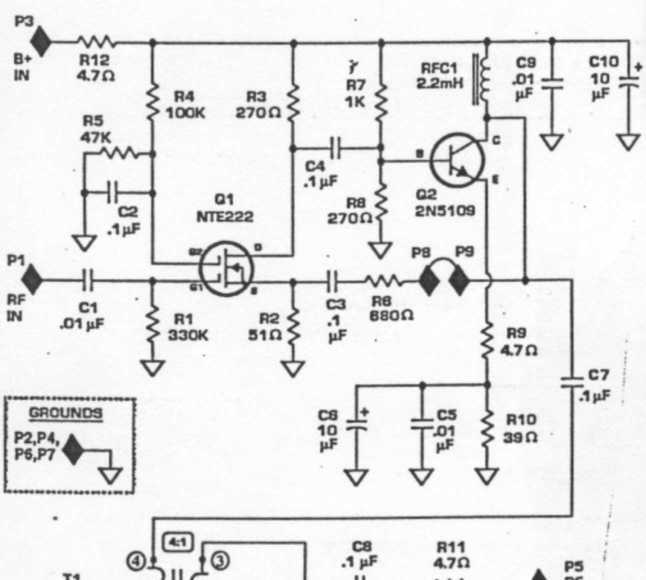


FIGURE 8: RTL-2 REMOTELY - TUNED LOOP (SCHEMATIC: BUF-A BUFFER AMPLIFIER CARD)

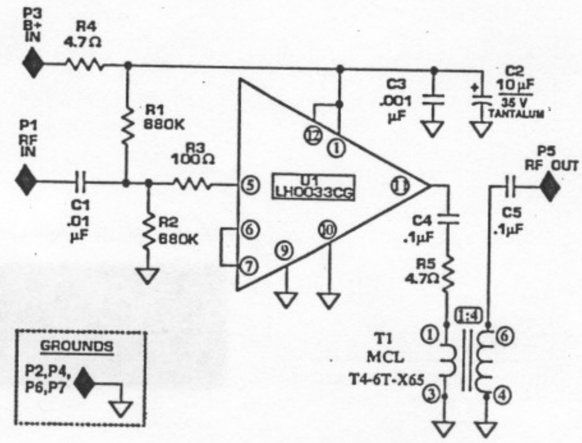
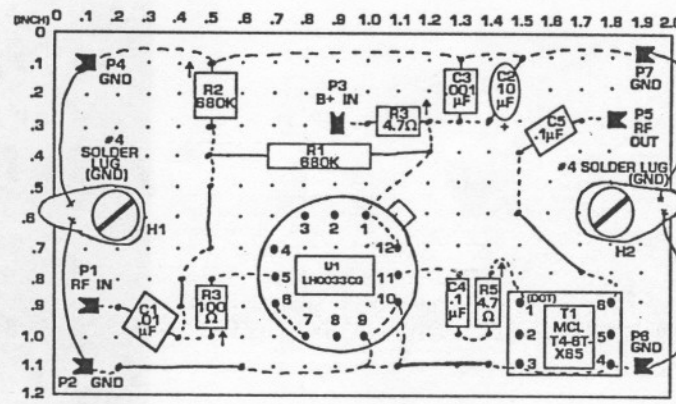


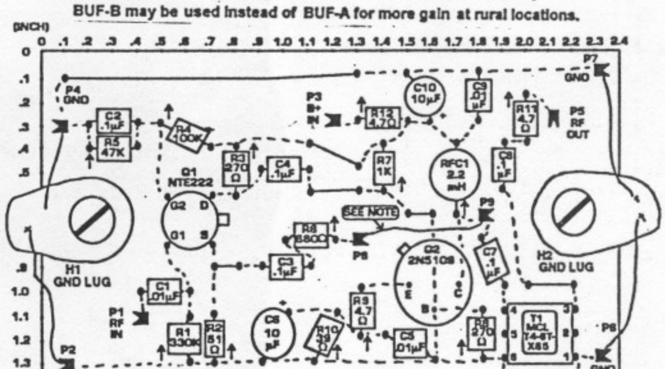
FIGURE 9: RTL-2 REMOTELY - TUNED LOOP (ASSEMBLY: BUF-A BUFFER AMPLIFIER CARD)



Notes
For schematic, see Figure 8.
For parts list, see Table 5.
↑ = Long lead side of vertically-mounted component
- - - = Buss wire on solder side of board
—— = Buss wire on component side of board
= "Flea clip" terminal pin, OPEN SIDE

FIGURE 11: RTL-2 REMOTELY - TUNED LOOP (ASSEMBLY: BUF-B BUFFER AMPLIFIER CARD)

BUF-B may be used instead of BUF-A for more gain at rural locations.

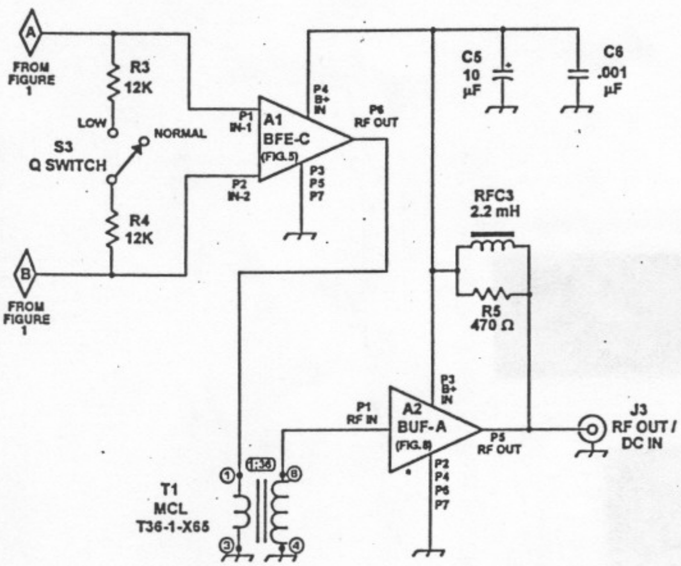


Notes
For schematic, see Figure 10.
For parts list, see Table 6.
↑ = Long lead side of vertically-mounted component
- - - = Buss wire on solder side of board
—— = Buss wire on component side of board
Wire from P8 to P9 should be insulated.

= "Flea clip" terminal pin, OPEN SIDE

A132-5-5

FIGURE 2: RTL-2 REMOTELY - TUNED LOOP (SCHEMATIC: OUTPUT SECTION)



* BUF-B (FIG. 10) may be substituted for BUF-A for use as the A2 amplifier.

FIGURE 3: RTL-2 REMOTELY - TUNED LOOP (SCHEMATIC: VRLY-A VARACTOR / RELAY CARD)

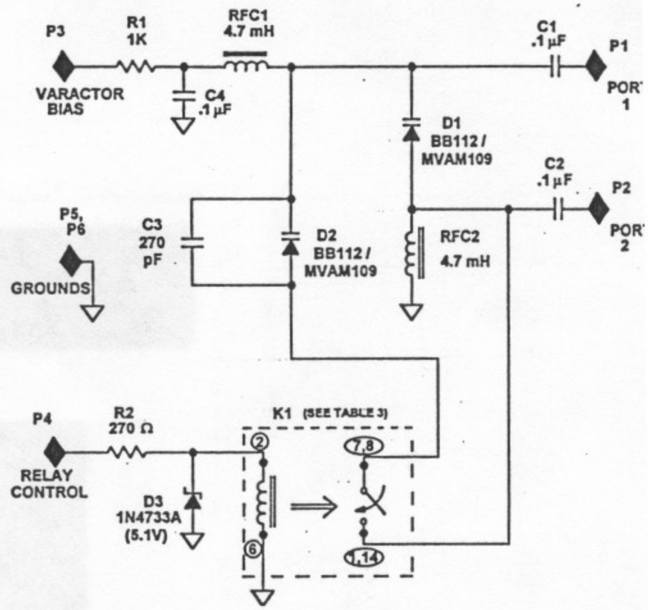
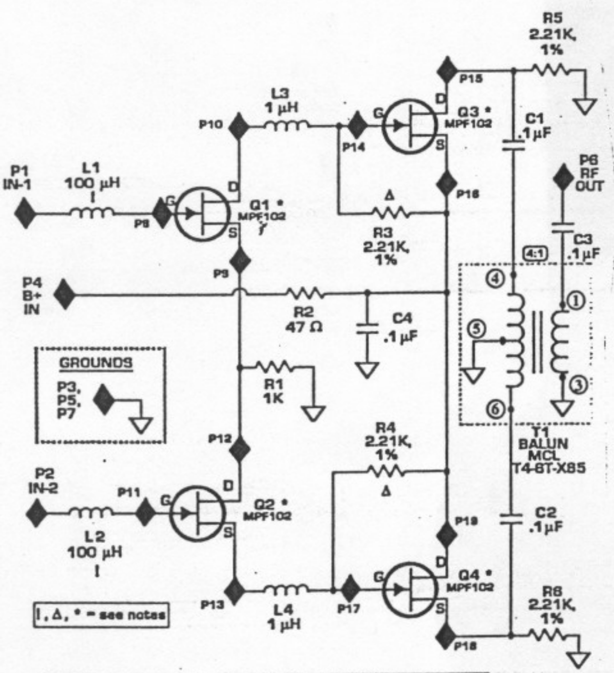


FIGURE 5: RTL-2 REMOTELY - TUNED LOOP (SCHEMATIC: BFE-C BALANCED FRONT-END CARD)

WA1ION DX Labs version of Dallas Lankford loop amplifier



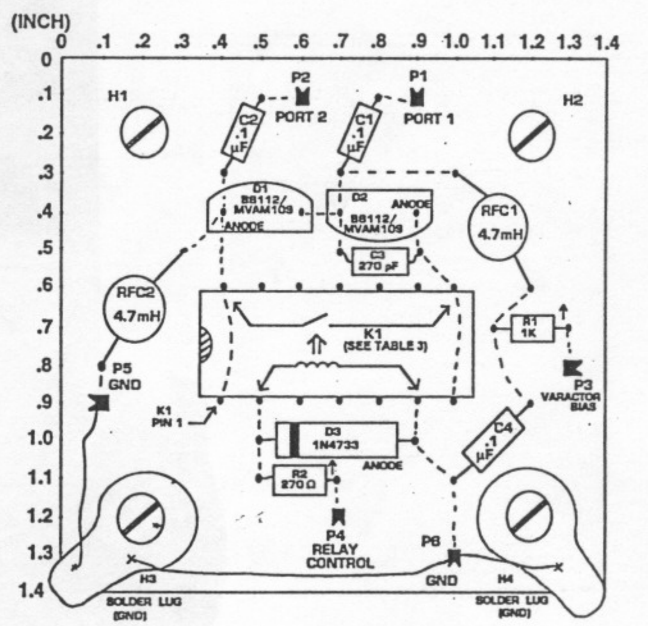
NOTES

Δ = R3, R4 can be increased to 4.75K, 1% for higher gain.

* = Q1 should be matched to Q2. Q3 should be matched to Q4. } See Figure 7.

! = Reduce value of L1, L2 (e. g. to 22 µH) or replace by jumpers (shorts) if shortwave spurs are not a problem.

FIGURE 4: RTL-2 REMOTELY - TUNED LOOP (ASSEMBLY: VRLY-A VARACTOR / RELAY CARD)



Notes

↑ = Long lead side of vertically-mounted component
- - - = Buss wire on solder side of board
—— = Buss wire on component side of board
"Flea clip" terminal pin OPEN SIDE