A84-3-1

The Micro-MWDX-4 Phasing Unit: A Small, Cheap, & Simple Approach

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Introduction

Since the '70s, many phasing unit designs have appeared in the DX press. Over two dozen medium-wave DXers have successfully implemented phasing systems of various types: they enjoy the ability to null out many unwanted stations & noises and, as a result, hear desired co-channel or adjacent-channel DX stations. Phasing (along with looping, audio filtering, active preselection, and IF-circuit enhancements) has become a useful weapon in the DXer's arsenal, a valuable tool in the "bag of tricks" necessary to log new stations in this age of broken-down "clear channels", extended hours for "daytime" stations, and new RF noise-pollution sources (light dimmers, digital appliances).

A frequent complaint heard about phasing systems is that they are too complicated for some DXers to operate. It is generally true that establishing a null with a phasing unit takes more control manipulations than establishing a null with a loop antenna. The main reason that phasing is used by serious international MW DXers is that it sometimes offers nulls not obtainable with looping. (In some cases - e. g. inside metal buildings - looping isn't viable at all.)

The Micro-MWDX-4 is an L-C type phaser that has simplified control operation as its major design goal. Other concepts embodied in the Micro-MWDX-4 are:

(1) passive design: no battery or mains power is required
(2) small size: practical for DXpedition purposes, especially when airplane travel is involved
(3) low cost: estimated parts cost $ 60 or less (the tuning capacitor is about 25 % of the entire cost)

The relationship between the fancier MWDX-4A and the Mini-MWDX-4 is somewhat akin to the relationship between a luxury car and a subcompact model. The MWDX-4A (with its more efficient coupling, more precise null-tuning, and amplification capability) certainly outclasses the Micro-MWDX-4, but the increased cost, size, and complexity of operation may not suit every DXer's tastes. For many DXers, more than 75% of the medium-wave stations that can be nulled with the MWDX-4A can also be nulled with Micro-MWDX-4.

In discussions to follow, please refer to the Micro-MWDX-4 schematic (Figure 1). Construction documentation is restricted to a chassis-hole list only. Other aspects of construction may be derived from information in my other recent phaser and active-tuner articles.

Single-Line Tuning: the Key to Micro-MWDX-4's Simplicity

Of the two antenna inputs required for phasing, only one of these (Line 1) has an L-C tuner associated with it. DX Lab. testing has determined that if a receiver can operate spur-free with the antennae-to-be-used connected directly to its input, it will work well with the Micro-MWDX-4. The spur-free stipulation must be met because there is no tuning on the Line 2 aerial. Those who experience overload when connecting their favourite longwires to their receivers are advised to pump the output of Micro-MWDX-4 through a tuner. Any member of the MWT and Mini-MWT families of tuners is ideally suited to be placed between the output of Micro-MWDX-4 and the input of the receiver. The normal way to set up a follow-up tuner is to set S2 of Micro-MWDX-4 to Line 2 (the untuned line) and peak the tuner (adjusting the tuner's attenuation pot if necessary) before proceeding to actual nulling procedures.

Figure 1: Micro-MWDX-4 Schematic

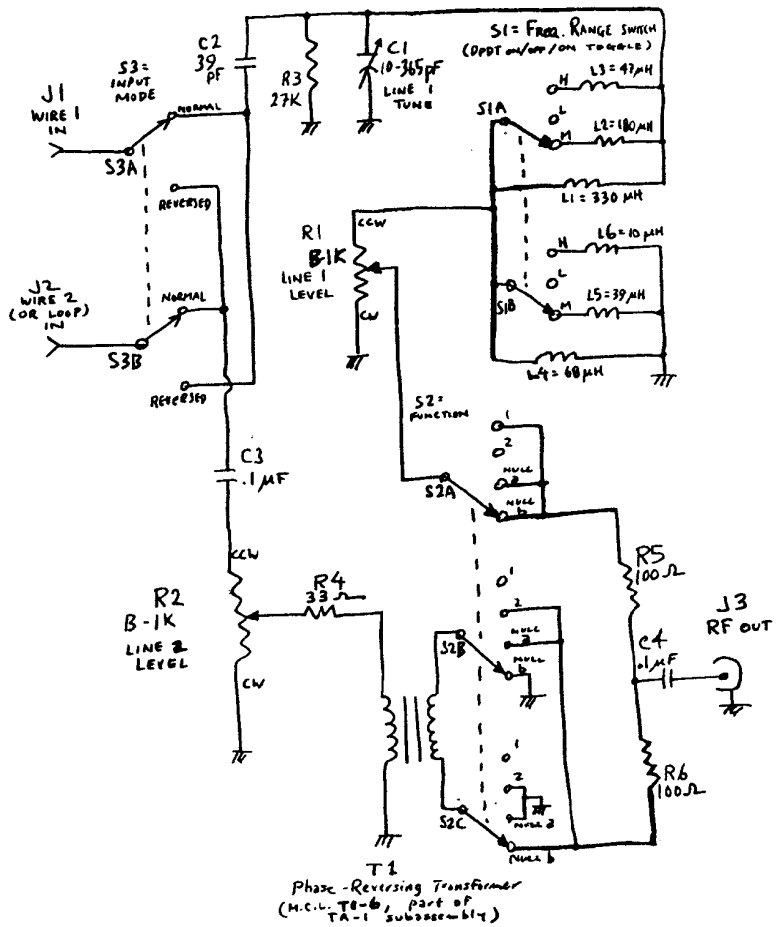

Table 1: S1 Frequency Range Switch Settings Guide

Freq. Range, kHz	S1 position	S1 orientation	Equiv. L, uH S1A	S1B
500 - 750	lowband (L)	middle	330	68
750 - 1250	midband (M)	down	116.5	24.8
1250 - 1800	highband (H)	up	41.1	8.7

Ranges may vary slightly from those above.

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Table 2: Hole List for Micro-MWDX-4

BOX USED = Radio Shack 270-238 (5.2" x 2.92" x 2.125")

X = horizontal distance, in inches, from the vertical centreline (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.

LEFT SIDE

Hole #	Comp. Desig.	Description	X	Y	D
1	J1	Wire 1 In - banana jack	-0.75	0.5	0.3125
2	J3	Earth GND In - banana jack	0.0	0.5	0.3125
3	G1	GND H/W - int. lug	0.0	1.125	0.113
4	J2	Wire 2 In - banana jack	0.75	0.5	0.3125

TOP SIDE

Hole #	Comp. Desig.	Description	X	Y	D
1	S3	Input Mode switch - tab	-2.125	2.375	0.113
2	S3	Input Mode switch - shaft	-2.125	2.125	0.25
3	S1	Freq. Range switch - shaft	-2.125	0.75	0.25
4	S1	Freq. Range switch - tab	-2.125	0.5	0.113
5	C1	Main Tuning Cap. - H/W 1	-1.088	1.625	0.14
6	C1	Main Tuning Cap. - shaft	-0.625	1.375	0.5
7	C1	Main Tuning Cap. - H/W 2	-0.162	1.625	0.14
8	-	C1's vernier knob - H/W 1	-1.28125	0.75	0.113
9	-	C1's vernier knob - H/W 2	0.03125	0.75	0.113
10	R1	Line 1 Pot - shaft	0.9375	2.125	0.3125
11	R1	Line 1 Pot - tab	1.25	2.125	0.14
12	R2	Line 2 Pot - shaft	0.9375	0.625	0.3125
13	R2	Line 2 Pot - tab	1.25	0.625	0.14
14	S2	Function switch - tab	1.875	2.0	0.14
15	S2	Function switch - shaft	1.875	1.5	0.375

RIGHT SIDE

Hole #	Comp. Desig.	Description	X	Y	D
1	TA1	Phase Rev. card - H/W 1	-0.875	1.25	0.113
2	TA1	Phase Rev. card - H/W 2	-0.875	0.45	0.113
3	J4	RF out - BNC jack	0.0	0.5	0.375

Micro-MWDX-4 Phasing Unit Procedure

Refer to schematic & to labels on unit.

1.0 2-wire phasing

1.1 Connect longwire 1 to J1. Connect longwire 2 to J2. Connect receiver input (via coax. cable) to J4. Connect earth ground to J3.

1.2 Set R1 & R2 fully counterclockwise.

1.3 Set S2 to 2. Switch S3 between NORMAL position and REVERSED position. Leave S3 on the position which yields the weaker level of the station to be nulled, or - if levels are within a few dB - the position which shows greater evidence of subdominant signals. (If there's no clear-cut difference between the two S3 positions, set S3 to NORMAL position.)
Note (from the schematic) that if S3 is on REVERSED, the Line 1 controls (C1, S1, R1) will actually be operating on the wire connected to J2 rather than on that connected to J1; similarly, R2 will act upon the wire connected to J1.

1.4 Set S2 to 1.
Set S1 to correct range for frequency of operation (per Table 1).

1.5 Tune Line 1 by peaking desired-frequency signal strength with C1 (then, leave C1 at peaked-signal position).

1.6 Switch S2 back & forth between position 1 & position 2:
If "1" is stronger than "2", adjust R1 until the levels of "1" & "2" are equal.
If "2" is stronger than "1", adjust R2 until the levels of "1" & "2" are equal.

1.7 Switch S2 back & forth between Null a & Null b positions; leave S2 on the position yielding more cancellation (= weaker level) of the dominant station to be nulled. Subdominant signals, if present, should become more apparent if the proper S2 null position has been chosen.

1.8 Adjust C1 to get a null of the dominant station.
If a null or "dip" at a given C1 setting does occur, leave C1 at that setting and proceed to step 1.11.

1.9 If a null doesn't occur [an unlikely possibility], set S2 to the 'other' null position (to Null b if it had been on Null a, to Null a if it had been on Null b) & adjust C1 for null.
If a null or "dip" at a given C1 setting does occur, leave C1 at that setting and proceed to step 1.11.

1.10 If, at this point a decided null still can't be discerned, set S3 to its 'other' position (to REVERSED if it had been on NORMAL; to NORMAL if it had been on REVERSED). Steps 1.5, 1.6, 1.7, & 1.8 must then be re-done. In all likelihood, a null should now be established (thereby obviating the need to re-do step 1.9).

1.11 Try to enhance the null by adjusting R1. If best null is with R1 fully CCW, leave R1 there.
Try to enhance the null by adjusting R2. If best null is with R2 fully CCW, leave R2 there.

1.12 Make successive adjustments of C1 and whichever pot (R1 or R2) was found to have the greatest effect on null enhancement in step 1.11. After several of these successive adjustments, a very good null should be obtained. Occasional re-adjustment may be necessary when the station to be nulled is arriving via skywave and is closer than 500 mi./800 km. The need for re-adjustment is more common on the high end of the band (above 1100 kHz).

2.0 loop vs. wire phasing

Loop must have fixed 15K (Q-spoiling) resistor across LC tank.

The fixed 15K resistor should be switchable in (= low Q) or out (= high Q): the switch used will be referred to as the Q switch.

Loop's tuning capacitor will be referred to as the Loop cap.

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2.1 Connect longwire to J1. Connect loop output cable inner conductor to J2. Connect loop cable shield and earth ground to J3. Connect receiver input (via coax. cable) to J4.

2.2 Set R1 & R2 fully counterclockwise. Set S3 to NORMAL position.

2.3 Set S2 to 1.
Set S1 to correct range for frequency of operation (per Table 1).

2.4 Tune Line 1 by peaking desired-frequency signal strength with C1 (then, leave C1 at peaked-signal position).

2.5 Set loop's Q switch to High Q. Turn loop power on. Set S2 to 2 & peak the desired-frequency signal with the Loop cap. Then, set the loop's Q switch to Low Q.

2.6 Switch S2 back & forth between position 1 & position 2:
If "1" is stronger than "2", adjust R1 until the levels of "1" & "2" are equal.
If "2" is stronger than "1", adjust R2 until the levels of "1" & "2" are equal.

2.7 Switch S2 back & forth between Null a & Null b positions; leave S2 on the position yielding more cancellation (= weaker level) of the dominant station to be nulled. Subdominant signals, if present, should become more apparent if the proper S2 null position has been chosen.

2.8 Adjust C1 to get a null of the dominant station.

2.9 Try to enhance the null by adjusting R1. If best null is with R1 fully CCW, leave R1 there.
Try to enhance the null by adjusting R2. If best null is with R2 fully CCW, leave R2 there.

2.10 Make successive adjustments of C1 and whichever pot (R1 or R2) was found to have the greatest effect on null enhancement in step 2.9. After several of these successive adjustments, a very good null should be obtained. Occasional re-adjustment may be necessary, especially on high-angle skip. If you've reached a deep & steady null and the C1 / pot adjustments to get additional nulling become too touchy, try slight physical re-positioning of the loop to help in establishing the maximum null.

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Please write to me if you have any questions about Micro-MWDX-4 use, construction, availability, etc.

(address = 30 William Road - Billerica, MA 01866 USA)

/* end */

Experimental booster

The FCC has authorized an experimental synchronous AM transmitter—the first in many years—for use with a Nevada AM station set to go on the air next July. The synchronous transmitter, or "booster," will be built in East Las Vegas to complement the signal of KROL(AM) Laughlin, Nev., 90 miles south.

Synchronous transmitter technology, in which identical programing is aired by two separately located transmitters on identical frequencies to fill coverage gaps or extend service areas, is common outside the U.S., but has been unused here in recent years until advances in transmitter technology led the FCC last year to reconsider allowing its application. Only one other synchronous AM transmitter is reported to be in operation in the U.S., in Lowell, Mass., with its authorization granted decades ago.

The experimental operation at KROL is expected to provide the commission with information on the potential benefits of this type of facility, according to Gary Thayer, a staff engineer in the commission's AM branch. The station will be required to report to the FCC at least every six months once the facility goes on the air, he said.

The station filed the synchronous transmitter application after an engineering survey showed that the construction permit granted the station would not cover the entire service area because predicted ground conductivity was lower than the FCC had indicated, according to KROL owner Thomas Letizia of Laughlin Roughrider Broadcasting.

The $1-million station construction project has begun on the primary transmitter, which will operate on 870 khz with 10 kw, directional daytime, and 1 kw, directional nighttime, according to the FCC. The synchronous transmitter facility, with construction scheduled to begin in February, will operate on 870 khz at 300 w, nondirectional daytime, 500 w, directional nighttime.

Designing and building the transmission plant for Laughlin Roughrider, which also owns KKJY-FM Albuquerque, N.M., and KFAH(FM) Tonopah, Nev., is consulting engineer Slim Sulyma of Williamstown, N.J. The station, added Letizia, will air the Drake-Chenault Enterprises "Evergreen" format in stereo and make extensive use of compact disk technology.

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John H. Demmitt, Box A K0848, Bellefonte, Pennsylvania 16823

Finally found a null to get rid of WHLO on 640 but instead of getting KFI, I am now getting WFHC on that frequency. Had them on Jan. 23rd at 0322 and again on Jan. 25th at 0454. The station gives its QTH as in Fayetteville but the transmitter may or may not be located in Goldsboro. Does anyone know? (The two towns are 58 miles apart--rce) I'd also like to know when they made the switch from 730. WPIX-TV is airing what looks at first to be an ad for a rock radio station - WMFP complete with a fast talkin' DJ and several musical jingles singing "WMFP" but watching it further, it is an ad for Colgate toothpaste. A great way of using a TV ad to get several groups of people's attention.

Western DX Forum ★★★★

IRCA—Serving the Broadcast Band DX'er Since 1964

Editor: Ric Heald, 8539 Bellamy Way, Sacramento, CA 95828 USA

1986 DEADLINES — WEEKLY ON TUESDAY, 12 DAYS PRIOR TO PUBLICATION DATE

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W. GEORGE ELLIOTT, P.O. BOX 312, PENTICTON, BC V2A 6K4, CANADA

Hello and Happy New Year to all. The weekend of 18 January I went to Kelowna and of course I spent a few hours with the radios. Although both the DX-160 and FRG-7000 were plugged in, the Yaesu was the only radio I turned on. Now that I've put my four-foot loop back together, I rarely go to the Radio Shack machine. I had forgotten how nice it was to be able to null out a pest when trying for that weak station in the background.

I wasn't sure what I'd get on the radio, so I tried for a couple things and ended up getting a couple other things. I worked on catching CJWW on the new frequency of 750 and got KERR Montana instead; I looked for KHWY 1030 and got KMAS Washington as I tried. Both of which had never been heard in Kelowna before. Only one call change heard this time: KBIT (ex-KOOK). I still want KHWY though. (I'll be more than happy to give ALL of K-HWY to you, hi-RtH.)

Ric, CKOK will soon be no longer a pest to California as the CE has finally put together a power switcher so we'll be 10000/1000. This has to do with a warning/threat by the CRTC. If you want a job at a country station, half the staff at CKSP has resigned. They're having problems with the limited hours they operate on their own. It's too bad as the town of Summerland are really with the station as a part of their "small town family" and aren't afraid to show it.

Not much else to say about life in the Okanagan, except you all are missing out on a great deal of beauty if you've never been through the valley. Will be touch again next time I get to Kelowna. 3's de WGE.

NIEL J. WOLFISH, 31 SOUTHLAWN STROLL, WINNIPEG, MANITOBA R3T 5E9 CANADA

My first verie of the 1985/6 DX season came this week from 1010 KKGZ Brush, Colorado. This my first Winnipeg QSL. There's lots of stations I'd love to try and verify from here, but obviously time is limited. I'll have to avoid the easy stations, or ones already verified from Toronto, such as KWTO, KOA, KGHL, KFXR, KFNW and CBU. I thought KKGZ was an ideal station to report considering that I grew up in the city dominated by 1010 CFRB. Now if only 950 KIMN would reply.

I spent 20 minutes in the backyard fixing the antenna the other day. I've now got 60 feet pointing southwest and then another 35 feet along the wooden backyard fence towards the east. It was a tough 20 minutes. At noon the Winnipeg temperature was -33 degrees Celcius! It was a typically sunny and windy day. However, the foot-and-a-half of snow we've had since November had drifted another foot higher against the fence. I'm not really sure if the new-improved antenna makes a difference or not. Some of the better stations noted around noon or 1 PM have included 1510 KCCV Missouri and KIFG Iowa, and 1600 KLGA Iowa, normally only noted at sunset.

I'm still plagued by a few mixing products and harmonics. Nulling 1110 KFAB gets CBW (the difference between CKSB and CBW's frequencies added to CKSB - 1050 + 60 = 1110). 680 CJOB shows up on 1360 which is a harmonic,