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MINI MWT-1C

A Simple, yet Versatile, Medium-Wave Tuner

Mark Connelly -=- WA1ION DX Labs -=- 10 JAN 1986

Introduction

This article is a continuance of DX engineering work on the MWT family of tuners (previous articles: 18 DEC 1985, 07 JAN 1986).

The Mini-MWT-1C, to a certain degree, resembles the other Mini-MWT's; however, some less-necessary features of the -1A and -1B have been removed to permit simpler operation and to provide other capabilities possibly of greater worth to some DXers. Reducing the cost of the unit and the complexity of its construction are also design goals of Mini-MWT-1C. For instance, the BBA-B Broadband Amplifier Card (estimated cost to build = $ 10) is used rather than the RFE-A Front End Card which costs nearly twice as much to make.

Items that were removed: Q switch, car radio/car ant. jacks, special setting for wires shorter than 3 m. / 10', non-medium-wave tuning, and vernier (fine) tuning. For many DXers, these items are unneeded frills.

Added features are passive tuning (a feature shared with the larger MWT-1) and broadband amplification (a feature not provided by any other heretofore-released MWT-family tuner). The four functions of the Mini-MWT-1C are governed by the settings of two simple toggle switches, S2 and S3, in accordance with Table 1:

Table 1: Functions of the Mini-MWT-1C tuner

Desired Function	S2 setting	S3 setting
bypass (direct feed:ant. to RX)	broadband (BB)	amplifier off
broadband amplification	broadband (BB)	amplifier on
passive tuning	tuned	amplifier off
active tuning	tuned	amplifier on

The broadband amplification function is very useful in beefing up the anemic output of smaller tuned loop antennae such as the Palomar.

Construction details are being foregone other than to provide a schematic (Figure 1) and a hole list (Table 2). Much of the information (frequency coverage, operation, construction, parts lists, etc.) of the two previous MWT-family tuner articles may be applied here. The BBA-B Broadband Amplifier card is fully described in the article "MWDX-4 and Mini-MWDX-4 series Phasing Units", dated 11 OCT 1985.

The Mini-MWT-1C may be purchased, fully assembled, for $ 50 (US) plus $ 5 shipping within the continental USA / $ 10 shipping to Canada, Alaska, Hawaii, and US territories/ $ 15 shipping to anywhere else. Checks / money orders should be sent to Mark Connelly - 30 William Road - Billerica, MA 01866 USA. Note that this price is about $ 25 less than that of a Mini-MWT-1A or Mini-MWT-1B and about $ 50 less than that of the MWT-1 Regeneration-Capable tuner. An available option for longwave-only DXers is frequency coverage of 100 - 550 kHz by using different tank coils (L1 = 10000 uH, L2 = 3900, L3 = 1500, L4 = 560, L5 = 2200, L6 = 820, L7 = 330, L8 = 120) and a higher C4 (56 pF instead of 39 pF). There are no additional charges for this longwave version (which we'll call Mini-LWT-1C). Delivery time is approximately 4 weeks after receipt of order for the medium wave version and 6 weeks (because LW coils are not normally stocked) for the longwave model.

Figure 1: Mini-MWT-1C schematic

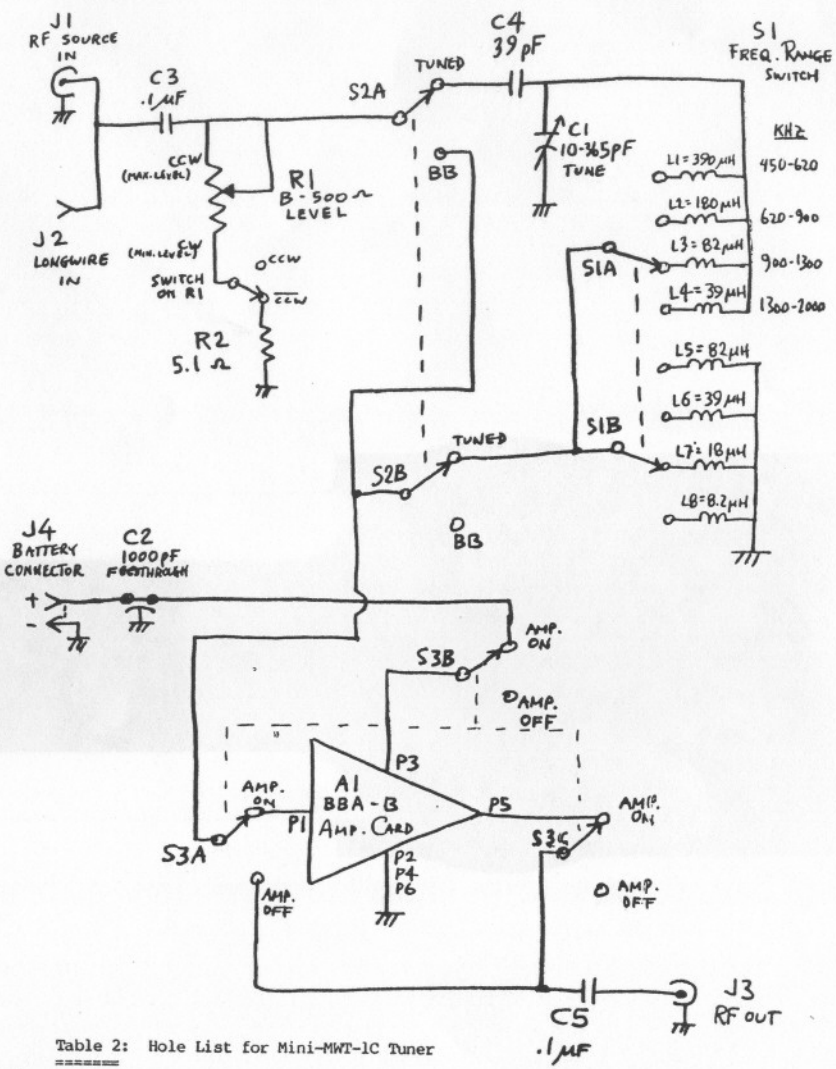

Table 2: Hole List for Mini-MWT-1C Tuner

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

X, Y, & D parameters are as described in previous articles on the MWT family of tuners.

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LEFT SIDE

Hole #	Comp. Desig.	Description	X	Y	D
1	J1	RF source in - BNC jack	0.0	0.5	0.375
2	G1	GND H/W - int.& ext. lugs	0.0	1.125	0.113
3	J2	Wire Ant.In - banana jack	1.0	0.5	0.3125

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TOP SIDE

Hole #	Comp. Desig.	Description	X	Y	D
1	S2	Tuned / BB switch - tab	-1.625	2.25	0.113
2	S2	Tuned / BB switch -shaft	-1.625	2.0	0.25
3	S1	Freq. Range switch - tab	-1.625	1.25	0.14
4	S1	Freq. Range switch - shaft	-1.625	0.75	0.375
5	C1	Tuning Cap. - H/W 1	-0.463	2.25	0.14
6	C1	Tuning Cap. - shaft	0.0	2.0	0.5
7	C1	Tuning Cap. - H/W 2	0.463	2.25	0.14
8	R1	Level Pot - tab	0.9375	2.375	0.14
9	R1	Level Pot - shaft	1.25	2.375	0.3125
10	S3	Amp. On / Off switch - tab	2.125	2.625	0.113
11	S3	Amp. On / Off switch-shaft	2.125	2.375	0.25
12	A1	BBA-B Amp. Card - H/W 2	1.125	1.5	0.113
13	A1	BBA-B Amp. Card - H/W 1	2.125	1.5	0.113
14	A1	BBA-B Amp. Card - H/W 4	1.125	0.5	0.113
15	A1	BBA-B Amp. Card - H/W 3	2.125	0.5	0.113

RIGHT SIDE

Hole #	Comp. Desig.	Description	X	Y	D
1	J4	battery holder - H/W 1	-0.125	1.875	0.113
2	J4	battery holder - H/W 2	-0.125	1.0	0.113
3	J3	RF out - BNC jack	0.0	0.5	0.375
4	G2	GND H/W - int.& ext. lugs	0.5625	0.5	0.113
5	C2	B+ input feedthrough cap.	1.0625	0.5	0.188

Operating the Mini-MWT-1C

The tuned modes of a standard Mini-MWT-1C provide coverage of 450 - 2000 kHz (ship traffic, standard AM broadcast band, and 160-metre ham band).

The controls and connector lists (below), coupled with the schematic given in the 10 JAN 1986 article, should be referenced during the operating instructions.

Mini-MWT-1C Controls and Input / Output Connectors

Controls

location	designation	operational description
top	C1	main tuning capacitor
"	R1	level pot (input attenuator)
"	S1	frequency range (tank coil) switch
"	S2	function [broadband (BB) / tuned] switch
"	S3	amplifier on / off switch

Input / Output Connectors

location	designation	operational description	connector type
left side	J1	RF source (loop, phaser) input	BNC jack
" "	J2	wire antenna input	banana jack
right side	J3	RF output to receiver	BNC jack
" "	J4	9V battery holder	Keystone 1290

Applications Notes

Use Radio Shack 278-120 adapter to convert J3 to SO-239 (VHF) type jack.
Use Radio Shack 278-251 adapter to convert J3 to "F" type jack.
Use Radio Shack 278-254 adapter to convert J3 to RCA phono-jack.
These adapters may be used to convert J1 similarly.

Initial Set Up (all modes)

****
* NOTE: NEVER CONNECT A WIRE OR OTHER RF SOURCE TO J1 OR J2 *
* UNLESS THE S3 SWITCH IS SET TO "AMPLIFIER OFF" (= DOWN). *
****
(Failure to do this may result in damage to the Broadband Amplifier Card.)

Before operating any of the four modes, connections to/from the Mini-MWT-1C must be made. The antenna or other signal source may be connected to J1 or J2. Earth ground should be connected, via clip-lead, to the "G1" ground lug (on the left side of the unit) if the cable to the receiver will be longer than 10'/3 m. or if the receiver is not grounded through mains or by some other connection. Grounding may help to reduce RF noise conducted or radiated by nearby power lines. Connect a coaxial cable to the receiver input from J3. A shielded communications-type receiver should be used; successful tuner operation with receivers using ferrite rod aerials (e. g. portable radios) is not always possible because of the inherent stray pickup of ferrite rods.

Standard Operating Procedures

1.0 Mode (1) direct feed of antenna to receiver

Note: C1 and S1 are not used in Mode (1); their positions are irrelevant.

1.1 Set S3 to Amplifier Off (= down).

1.2 Set R1 initially to fully CCW (the switch on R1 takes this attenuation pot out of the line).

1.3 Set S2 to Broadband (= down).

1.4 With receiver on desired frequency, check that the wanted signal is of sufficient strength and has no spurious mixing signals or images from strong local stations. If spurs / images are present, adjust R1 until they go away. If the wanted station is now too weak, use of operating mode (2) or (3) is suggested.

2.0 Mode (2) passive tuning

Note: Minimum suggested wire length for passive tuning is 33'/10 m.

2.1 Set S3 to Amplifier Off (= down).

2.2 Set R1 to fully CCW (attenuator out of line).

2.3 Set S1 for operating frequency range desired, per chart below:

S1 Frequency Range Switch Settings Chart

S1 Position #	S1 Knob Pointer "o'clock"	Min. Freq. kHz	Max. Freq. kHz
1	11:30	450	620
2	12:30	620	900
3	1:30	900	1300
4	2:30	1300	2000

2.4 Set S2 to Tuned (= up).

2.5 Adjust C1 for maximum desired-frequency signal.

2.6 If overloading-caused spurious responses QRM the desired signal when C1 is properly peaked, adjust R1 to make the spurs go away. Slight re-peaking of C1 may then be necessary.

****
* FOR SECTIONS 3 & 4 TO FOLLOW, A 9-VOLT BATTERY MUST BE *
* INSTALLED IN THE J4 BATTERY CONNECTOR. *
****

3.0 Mode (3) active tuning

3.1 Do all passive tuning steps 2.1 through 2.6.
Note: If R1 adjustment was required in step 2.6, active tuning might not offer any signal-to-noise improvement.

3.2 Set S3 to Amplifier On (= up).

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3.3 If overloading-caused spurious responses QRM the desired signal when C1 is properly peaked, adjust R1 to make the spurs go away. Slight re-peaking of C1 may then be necessary.

4.0 Mode (4) broadband amplification

Note: C1 and S1 are not used in Mode (4); their positions are irrelevant.
Note: This mode is not recommended for wire antenna inputs (medium-wave and shortwave spurs will likely result). The following procedure outlines broadband amplification of the output of a tuned loop antenna (e. g. Radio West loop, NRC loop) or a phaser (e. g. Mini-MWPX-1A, Phase One).

4.1 Set S3 to Amplifier Off (= down).

4.2 Set R1 initially to fully CCW (the switch on R1 takes this attenuation pot out of the line).

4.3 Set S2 to Broadband (= down).

4.4 Connect loop or phaser output coaxial cable to J1; connect nothing to J2. (Receiver is still connected to J3; battery to J4.)

4.5 Adjust loop or phaser controls as you normally would.

4.6 Set S3 to Amplifier On (= up).

4.7 If overloading-caused spurious responses QRM the desired signal, adjust R1 to make the spurs go away.

Possible Mini-MWT-1C Enhancements / Modifications

* For those who habitually use shorter aerials (i. e. less than 100'/ 30 m.), the coupling capacitor (C4) could be increased to 47, 56, or 62 pF with no degradation of unattenuated-input tank-circuit Q. Greater coupling efficiency would be the result.

* The CCW pin of R1 may be separated from the R1 wiper arm. (The CCW pin would go to C3; the arm to switch S2 - section A - arm.) This has been found to give somewhat smoother level adjustment with certain lengths of antennae in strong-signal urban/suburban environments.

* A 1K linear pot with switch may be substituted for the 500 ohm R1 pot (if no 500 ohm pots are available). There are no detrimental effects on level-adjustment-smoothness as long as the CCW pin and wiper arm of R1 are not tied together (see previous item).

* Some might want to try putting the R1 pot on the line between the S2B arm and the S3A arm rather than in its present position (see schematic in 10 JAN 1986 article). Doing this will improve tank Q under some circumstances requiring attenuation; however, certain inductively-reactive inputs could cause poorer Q tuning if not shunted by the attenuator pot. The beauty of the Mini-MWT-1C design is that it's so simple that it lends itself to easy experimentation, modification, and restoration to its original state (should a given experiment not result in a performance improvement for the particular user).

* A different broadband amplifier (A1) could be used. If the unit was going to be used with an external power supply yielding higher current and/or voltage than a 9-volt battery, a more "muscular" amplifier (giving much better dynamic range, gain, and noise characteristics) could be incorporated. AGC (automatic gain control) might be an amplifier feature worth investigating.

* A six-position two-pole switch could be used for S1 (along with additional coils / à la Mini-MWT-1A) to provide extra frequency ranges.

* Other types of connectors could be used for J1 & J3 if a given user is not happy with industry-standard BNC types.

* Those who use many wire lengths could install a "length switch" SPDT toggle at the present C4 (electrical) location. This switch could select one of two different coupling capacitor values: a low value (e. g. 33 pF) for longer wires and a higher value (e. g. 100 pF) for shorter wires. I left this feature out because the whole idea of Mini-MWT-1C is simplicity. 39 pF or 47 pF is a good "middle-of-the-road" C4 coupling capacitor value usable with most of the wire aerials that MW DXers employ.

/* end */

EXISTING CONSTRUCTION PERMITS

The following list is of Construction Permits granted by the FCC for new stations and for changes of frequency. Effective as of February 2, 1986. Through NRC V53 #16 & IRCA V23 #18.....

540--CKCY--ON	Sault Ste. Marie	U	15000/ 2500	(PO--920)
550--CJOK--AB	Fort McMurray	U2	10000/ 5000	(PO-1230)
590--WAFC--FL	Clewiston	D1	1000/	
600--WKLW--KY	Paintsville	D1	500/	
620--WKND--CT	Windsor	U4	500/ 1000	(PO-1480)
640--WLVJ--FL	Royal Palm Beach	U4	10000/ 500	
--WPMA--FL	Wildwood	U1	1000/ 1000	
-- --GA	Atlanta	U4	50000/ 1000	
--WWJZ--NJ	Mount Holly	U4	5000/ 1000	
--WNOW--TN	Blountville	U4	5000/ 1000	
--CFOB--ON	Fort Frances	U2	1000/ 1000	(PO--800)
650--WGNZ--FL	Christmas	D3	10000/	
--WBSO--MA	Clinton	U4	10000/ 1000	
--KBKK--NV	North Las Vegas	U3	10000/10000	
660--KTNN--AZ	Window Rock	U2	50000/50000	
--KGDP--CA	Orcutt	U4	10000/ 1000	
--WVAL--MN	Sauk Rapids	U4	10000/ 1000	(PO--800)
--WTUJ--MS	Ridgeland	U2	50000/ 1000	
-- --ND	Williston	U4	5000/ 5000	
670-- --CO	Commerce City	U2	5000/ 1000	
--WWFE--FL	Miami	U4	50000/ 1000	
680--KLDY--WA	Lacey	D1	250/	
700--KVOI--AZ	Oro Valley	U4	10000/ 1000	(PO--690)
--KRMW--CO	Silt	U4	50000/ 1000	
--KTBT--TX	Tomball	U4	2500/ 1000	
--KZUN--WA	Newport	U2	10000/ 1000	
--CKRD--AB	Red Deer	U2	50000/25000	(PO--850)
--CHSJ--NB	St. John	U4	10000/10000	(PO-1150)
720--WRBR--MS	Richland	D1	5000/	
--WWII--PA	Shiremanstown	D3	5000/	
--KSAH--TX	Universal City	U4	10000/ 1000	
730--WLPF--FL	Lake Placid	D1	250/	
750--WZOM--IL	Brockport	D1	500/	
--WNDZ--IN	Portage	D3	2500/	
--KMGF--MN	La Crescent	U4	10000/ 1000	
--WYHF--NY	Canton	U4	5000/ 1000	
--WRGE--PA	Olyphant	D3	2500/	
--KOAL--UT	Price	U2	10000/10000	(PO-1230)
760--KJIM--CO	Thornton	U4	5000/ 1000	
-- --FL	Brandon	U4	5000/ 1000	
--WJEA--FL	Palm City	U4	2500/ 250	
--WVNE--MA	Leicester	D1	5000/	
-- --NC	Morganton	D1	500/	
770--KPLA--CA	Riverbank	U2	50000/ 1000	
-- --FL	Lynn Haven	U4	5000/ 500	
--WZEL--GA	Young Harris	D1	750/	(PO-1380)
--WKYJ--KY	Nicholasville	D1	1000/	
--KBEC--TX	Waxahachie	U2	1000/ 1000	(PO-1390)
--CHQR--AB	Edmonton	U2	50000/50000	(PO--810)
780--WJKB--FL	Siesta Key	U4	5000/ 1000	
--CKOK--BC	Penticton	U2	20000/10000	(PO--800)
800--WKBC--NC	North Wilkesboro	D1	1000/	(PO--810)
--KJMD--TX	Laneville	D3	500/	
--CKDR--ON	Dryden	U1	700/ 700	(PO--900)
810--WJXL--AL**	Jacksonville	U4	50000/ 500	
-- --GA	Hahira	D1	2500/	
820--WRFA--FL	Largo	U4	50000/ 1000	(PO--800)
--WZYQ--MD	Frederick	U4	5000/ 1000	(PO-1370)
-- --NC	Charlotte	U4	10000/ 1000	
820--WGGM--VA	Chester	U2	50000/ 1000	(PO-1410)
830--KGLR--AZ	Tucson	U2	50000/ 1000	
--KSRT--CA	Orange	U2	2500/ 1000	
--WTIW--FL	Hialeah	U1	1000/ 1000	
--WACN--KY	Franklin	D1	250/	
--WADU--LA	Norco	U1	1000/ 500	
--WMMI--MI	Marshall	D1	2500/	
--WJIK--NC	Camp Lejune	U4	10000/ 2500	(PO-1580)
--WCBX--NC	Eden	U2	1000/ 1000	(PO-1130)
--WHBE--SC	St. Andrews	U1	10000/ 1000	

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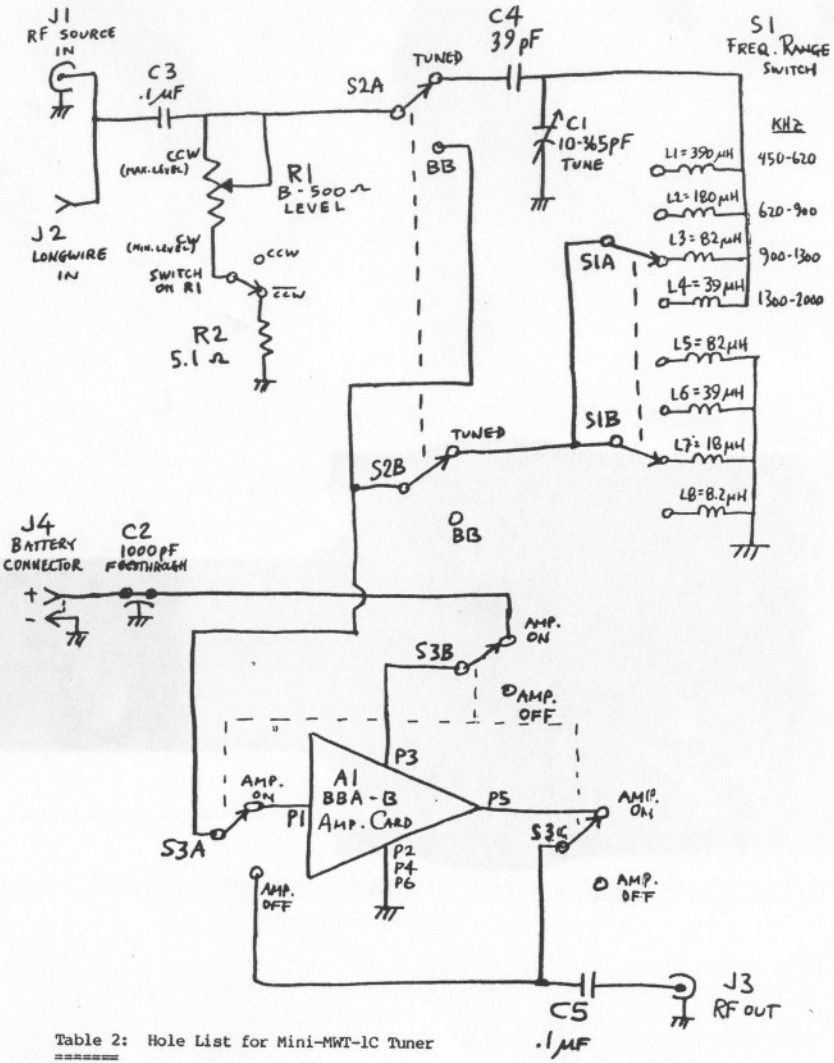

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