DX test ...
WYST-1010, Baltimore, MD is conducting a DX test for the NRC on Monday, November 6, 1969 from 0330 to 0400 ELT, at 1000 watts non-directional. Send reports, and return postage, to Mr. Dan O’641, Program Director, WYST-AM - 1111 Park Ave., "The Penthouse" - Baltimore, MD 21201. Test arranged by Bob Harrison and the Colorado CPC Machine.

From the Editor ...
For the first time since last spring we’re running a little light on member contributions this time, but that gives me a chance to drop in a longer article by Graham Maynard which has been waiting in my file basket since last summer. Feedback light as it was seems to indicate that most of you, especially those of you involved in broadcasting, enjoy reading the clippings, especially news of small-town stations which do not receive coverage in the trade papers. On the other hand, you’ll find the longer clippings only when I don’t have enough member contributions of DX happenings to fill the pages – so warm up those receivers and see what you can hear!

I received a package last week from my aunt, who grew up in Terre Haute, NE. Seems that her brother was a DXer in the early days of radio and kept a log of what he heard dating back to 1922, plus miscellaneous clippings. Thanks to her generosity, I am now in possession of Max Henry Watkins log, which contains entries like this one: "Dec. 29, 1922 - WTAJ, Radio Sales Dept., Ruegg Battery & Electric Company, Terre Haute. Dec. 28: Called WOGO, WOAM, WIFR. Dec. 29: Called WIOH, WOGQ, WOAM, WIFR. Phone, Dec. 29: concerts 7:00 pm to 7:45 pm, 10:00 pm to 10:40 pm. KDKA, Pittsburgh, Pa. Penn. Jan. 17, 1923: 9:00 phone; Jan. 26, 8:10: talk. KFCF, Walla Walla, Washington. Apr. 11, 1925:"

2:00 am: Bluejay’s program. Signed off about 2:08. Fire song. sirens & bells. Guy cries "Water!" Flay music. repeat. WJGQ, Capper (reπ). Topeka, Kansas, Feb. 3, 1923: 7:14: music. May 24, 1:02: markets. Naturally, I’m in hog ... cr, radio ... heaven! 388 stations heard through 1927 ending with WRLN, Lawrence. RS1 fill the log which is in a hard-back ledger. We’ll be sharing some of the listings from time to time, and the space fillers that you’ll see come from Radio News clippings.

DX Change ...
John H. McCaw - 6405 West Home Ave. - Worth, IL 60482 would like to buy a Kenwood R-300 or Panasonic RF-2200. Give him the condition, price and shipping cost on the first letter.

Catalog ...
DX Radio Supply - P. O. Box 360 - Wagontown, PA 17576 sent me a catalog last week. They sell only radio books, and the listing is quite comprehensive.

<table>
<thead>
<tr>
<th>DX Time Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>From the pages of DX News</td>
</tr>
<tr>
<td>Twenty-five years ago - from the Oct. 24, 1964</td>
</tr>
<tr>
<td>DX News: 21-year-old Jerry Conrad, Lexington, KY checked in for the first time, listing such caches as (10:4) CVA-266 Lisbon, 6:45 pm; (10:5) KRDJ-1190, Tolland, AZ; 1:30 am; WGOA-1510, Jackson, MI; 1:30 am; KWOA-730, Worthington, MN, 6:45 pm; (10:8) BTM-701, Schen-koia, Morocco, 6:55 pm; RNE-664 Madrid, Spain, 8:10 pm; Stan Morris, found so clairiers on the hilltops left over after the Buffalo convention.</td>
</tr>
<tr>
<td>Ten years ago - from the Nov. 12, 1975 DXN: Ted Fischlaker’s &quot;The Big Band Stand&quot; was accepted by NPR for national distribution, prompting him to take a few weeks off ... Gene Martin logged Shanghai, China, on 1044 (11:10) 1245-1325, country #69 from Denver ... Bill Bailey, Holden, MA logged Algiers-1242 Algeria (10-20) from 2230-2330 ... Dallas Lankford listed nine &quot;Easy&quot; TA's which could be heard from northern Louisiana ... convention photos showed your editor when he still had hair!</td>
</tr>
</tbody>
</table>
CALL LETTER CHANGES

None!

APPLICATIONS FOR NEW STATIONS

None!

GRANTS FOR MW STATIONS

1100 NV Las Vegas: 50000/1600 U4

APPLICATIONS FROM EXISTING FACILITIES

810 WDDD IL Johnson City: night power to 300 watts
1460 WPTQ MA Worcester: antenna to 12

GRANTS TO EXISTING FACILITIES

540 WYLD WI Jackson: power to 400 watts
560 KMTD MO Springfield: changes in antenna system
830 WGGW CA Litchfield Springs: city of license to Sayre, GA, relocate Xr, powers to 50000/5000 (10000 CH) (CP, not yet on the air)
1050 KNHP CA Frazier Park: power to 10000 watts, relocate Xr (CP)
1080 WLYT IL Edwardsville: relocate Xr
1110 KRCX CA Roseville: changes in antenna system
1320 KEEV MO* Reidsville: power to 10000 watts, antenna to D3
1290 WBRX MI Houghton Lake: power to 4600/4900, relocate Xr
1370 WXXI NY Rochester: changes in antenna system
1440 KQRS MN Golden Valley: changes in antenna system
1470 KQO PQ Pointe Claire: to 650 kilowatts, with 10000/2500 U4
1550 KQZL CA Apple Valley: antenna to D3 (CP)
1590 KNIM MN Maryville: power to 10000 watts
1590 WOXQ IL Evanston: day power to 3500 watts, antenna to U4

OTHERWISE

680 WLSY KY Newburg: new station is ON THE AIR with Talknet
720 *App CA Atascadero: application for new station DISMISSED
820 KJPL IL Jasper: new station is ON THE AIR with Contemp Christian
850 CKBA AB Athabasca/Birdhead: new station is ON THE AIR, although the CRTC has released no such change, they ID on the air as Barrhead, AB. Towns are about 60 miles apart
1090 WESP SC Kingsport: FCC has initiated proceedings to decide if this station's license should be revoked due to the major owner's felony conviction for drug dealing stating that such a conviction raises questions of character qualifications under its 1986 policy statement on such circumstances
1250 WREN SS Topeka: the confusion continues. Following a recent report that the deal to move KTTP-1490 to this facility had fallen through, we now hear that this deal is on again. More when (and if) it happens
1320 CJISO PQ Sorel: station is SILENT again, this time permanently as their operations have moved to FM only
1340 WRCR PA Wilkes-Barre: silent station is back ON THE AIR with REL programming. Their announced address in the same as WRCR-1320 in Scranton, PA

1480 WQWQ GA Augusta: station is SILENT, reported to be temporary
1560 KBRK NE Imperial: as a follow-up to the question posed three issues ago, it appears that the CP for this new station has been CANCELLED, thus allowing KBRK-1300 to apply for KBBL as a new call
1570 WMMU NY Fredonia: despite this station's infamous battle to keep their license and the FCC's final decision to revoke it, it was still on the air as of mid-October as confirmed by monitoring in Fredonia. Apparently the FCC has granted them a certain grace period in which to wrap up business. Since the FCC and all available paths of appeal refused to allow the owners to sell this station, we expect to be reporting its silent permanency in the near future. Log this one while you can!

EDITORIAL COMMENT: Regarding the above situation at WQWQ-1090, while the FCC didn't ask us, we'll offer our personal opinion. Any person convicted of drug trafficking should suffer immediate removal of their station's license and it's a shame the penalties cannot be made even more severe, like being hung up by some very painful part of the anatomy!

THANKS to the following contributors: CHARLES REH, DICK TRUTCH, BILL HALLE, GEORGE VANISH and WAYNE REINMAN (who visited here at AM Switch Corporate Headquarters last weekend)

73 and Good DX, Jerry & KF Jerry Starr & Buffalo K. Fooman

NRC AM Radio Log

The most up-to-date listing of domestic MW stations available, anywhere! 200 pages, three-hole punched. $12.95 each, to U. S. NRC members; $13.95 Canadian NRC members; others write.
Midnight to Noon

690 KDST TX Lamesa 10/9 0445 fair w/ C&W mix. "The sports authority for (?) county, KPET." New, TX #6. (10-9)

870 KROL TX Laughlin 10/9 0900 fair in slot from KOA w/ L.A. Kings Hockey. Net. (10-9)

930 KLGY TX East Texas 10/9 0100 ID: "Classy 930 is KLGY East Texas." Back to synd pgm "Super Gold." Fair in WKY w/ QRM de KDST. CIA, others. New, MT #14. (10-9)

1010 CFBB ON Toronto 10/9 0521 "This is CFBB with The World at Dawn." New, ON #8. (10-9)

1230 KFUN NM Las Vegas 10/11 0145 S/off anent by anent "Michelle," no QRM. Fair w/ QRM. Unneeded. (10-9)

1340 KROC MN Rochester 10/9 0405 fair w/ ID: "This is AM 1340, KROC in Rochester," then into LK show #0406. New, MN #15. (10-9)

1370 CFOK AL Wickliffe 10/9 0556 fair w/ KSOE. "This is Central Alberta Nightwatch," then into "Goodtime Charlie." New, AB #19. (10-9)

1450 KWE WI Fond du Lac 10/9 0559 going thru QRM w/ a message from the AD Council, then ID: "This is Fond du Lac, AM 1620..." Last to QRM. At over 300 miles, this is one of my all-time best FY caches. New, WI #9. (10-9)

1550 KSFY SD St. Joseph 10/9 0737 Al nx, then C&W mx, "Ill Kickin' 1550" slogans. Good on peaks in KOQB null. (10-9)

Noon to Midnight

1130 WDGY MN Minneapolis 10/13 2237 good w/ CKBW x/ID then into LK. New, MN #16. (10-9)

UNIDS

1570 UNID 10/13 2245 "The New 1570, E-Z AM." Strong in XERF null then faded quickly. Any ideas? (10-9)

Contributors

(WO-OW) John Wilkins / Wheat Ridge, CO / R-1000 w/ 3 foot loop (10-9) Jeff Tymann / Parker, CO / Sony-2002 w/ LTS Loop

City Quiz

Only one city in the United States has stations operating at the five dial positions shown below, shown below. Of course, there may be other stations in this city too! Can you spot the city?

Here is a hint: It is one of these: Sacramento, Cincinnati, Kansas City (The answer will appear at the end of the next City Quiz in DX News.) The answer to City Quiz #35 is Tampa.
There are a few new developments on the AM dial in my back yard. WADS - 580, in Anamosa - Derby - Sheldon, in the Naukaukt River Valley (north of Council Bluffs) has dropped its AC format, and is now an ethnic station, simulcasting WACN - 1450, in West Springfield. The owners of the latter have now managed to cover both the Naukaukt - Springfield area and New Haven, with their station. This is the second of two pairs of stations to do so. . . . . in Naukaukt and 1320 in Manchester did the same about six months ago, offering Spanish to both the Springfield - Naukaukt and Waterbury markets.

WWMW-1260, in Westport has dumped the AM business bileble and has reinstated its fine oldies format. Hopefully the station will be able to weather the storm and be able to continue to provide the music that is so important to the community.

The contributors for this issue are Gary Parrish and The M Street Journal. How about some other contributions for FORMATS!!!?? We thank both our contributors greatly, and would love to hear from other areas of the country, and others.

Remember, this is YOUR column and your club's!! Here we go...

560 WSGG AM Altoona - CBMN (M).
560 WOOF WWOF Dothan - CBMN (M).
560 WROM AM Tuskegee - CBMN (M).
600 WGNR AM Reading - CBMN (M).
600 WADS CT Anamosa - Ethnic/WACN-1450 (M).
740 WSSR FL Boca Raton - Talk, business, sports (M).
730 KENO LA Gretna - Now station, Black gospel (M).
910 WWHO AM Atlanta - Now station, "Light & Up" (M).
850 WGKB AM Benton - Adult standards (GP).
850 CBEA AM Barnstead - CBMN/CFOS, 1370 and CWPA, 1210 (GP).
920 KALY AM Atlanta - CBMN/CFOS (M).
920 WGSS AM Alumacola - CBMN/CFOS (M).
920 WIEA AM Terrell Hills - CBMN/CFOS (M).
920 WNBW AM Ky London - CBMN/CFOS (M).
710 WCBG AM Alexandria - CBMN/CFOS (M).
1050 WJEF AM vernon - CBMN/CFOS (M).
2700 WBTU AM Toronto - Now station, Black gospel (M).
1240 WMFL AM Camden - CBMN/CFOS (M).
1240 WAFB AM Jasper - CBMN/CFOS (M).
1240 WCGG AM Gulfport - CBMN/CFOS (M).
1250 KTFJ NE Dakota City - CBMN/CFOS (M).
1240 WCNF AM Westport - CBMN/CFOS (M).
1240 WESF AM Santa Fe - CBMN/CFOS (M).
1240 WSCS AM Lake City - CBMN/CFOS (M).
1240 WASC AM Minneapolis - CBMN/CFOS (M).
1240 KELF TX Madison Falls - CBMN/CFOS (M).
1310 KLIX AM Chester - CBMN/CFOS (M).
1310 WCCM AM Traverse City - CBMN/CFOS (M).
1310 KSFT AM Hailey - CBMN/CFOS (M).
1310 WMTV AM Las Vegas - CBMN/CFOS (M).
1310 KSYX AM Santa Rosa - CBMN/CFOS (M).
1340 WMTT AM Philadelphia - CBMN/CFOS (M).
1340 WJQG AM Knoxville - CBMN/CFOS (M).
1340 WLVO AM San Angelo - CBMN/CFOS (M).
1350 KXLE CA Bakerfield - CBMN/CFOS (M).
1400 KVJR OR Cave Junction - CBMN/CFOS (M).
The following notes have been extracted from a series first published by the UK's Medium Wave Circle. They could use the authors' interest and outline a system that has remained unchanged and running for over three years - an indication of satisfactory signal gathering and noise isolating capabilities.

**Medium Wave a practical approach.**

by Graham Hayward

During the last twenty years I've tried bipolar, fet, integrated circuits and various valve designs with inductive, crystal, ceramic and mechanical filters, balanced mixers, differential stages etc., but for serious DXing I use an old fashioned valve set, a fifteen Colhins 2Y00-A military detailed receiver. Indeed, was it not power, size and weight disadvantages that started the thermionic decline and not willingness in attainable performance. What of today, progress is the reality, but oh how it costs! And, until I am able to find a modern receiver capable of good MW performance my choice remains to professional valve gear.

I often wonder just how much useful information and knowledge is "lost", stored in books and old files, and how often "new" discoveries have turned out to be older than the people that have made them. Of recent years MW technology has advanced little, pushed aside by ssb, vhf, tv and other electronic development, but we must not allow useful experience to lie dormant, we must re-state the relevance of established information.

I found particularly interesting "Working with the Ethodne" Receivers by John Hayes G3KLG, P.W. Jan 60, which out-dated were when nearly 20’s. Jack was a staff at the Burndrett company. A Burndrett receiver holds the distinction of being the first to receive an American broadcast in Europe, i.e. a broadly cast programme rather than an individual transmission. At 0130 hours on 26th, Nov. 1922 WJZ New Jersey was heard at Blackheath, London by Mr. J. R. H. Magoffin of the Burndrett company, Ref.1. He used a Dictaphone to record one of four American stations received on many nights during that winter and spring. These American stations were using some 750 watts. During 1922 British amateurs were allocated 150 to 200m. and 440m, broadcasters 350 to 425m. and shipping 300 and 600m.

Application of these notes should afford improved medium wave reception with almost any receiver, though not all receivers are suitable for medium wave work. Latest models have fantastic book specifications but their medium frequency off air performance might be no more satisfactory than that of a well used, reasonably priced set some twenty, thirty or even forty years old. Guard against disappointment by seeking recommendations, and when possible ask for a possible trial before buying. Search for internal images and spurious responses of powerful locals at mid-day, check strong signal handling characteristics after dusk and use the dawn period to reveal cross modulation or inadequate dynamic range effects.

We are trying to discriminate really minute signals therefore it is most important that antenna eaf is fed to the receiver with respect to antenna ground, not with respect to receiver ground. Nor should antenna ground be used to "earth" a mains powered receiver, a separate ground should be used with electrical and spatial isolation between them.

Screened coaxial cable is a good feeder for transferring antenna/gound eaf to the receiver, and though it behaves like a short to low and medium frequency wires it cannot be usefully wired without bringing the antenna back into noise. Single coax cannot be grounded at both ends as earth loop noise on the outer wire is transferred to the inner; makes a quiet neighborhood sound electrically noisy. Balanced arrangements are inherently noise cancelling though more expensive and, depending on the receiver, require one or two matching transformers at cable ends. Ref.6.

Coaxial cables are low impedance by nature, whilst long medium wave antennas, excepting simple single turn loops, tend to be of medium or high impedance. When antenna and ground are connected directly to a coaxial cable charge flow within the coax is severely damped and eaf at the cable ends is very low.

An impedance matching transformer between antenna/groud and the coaxial eaf can optimise energy transfer, and at the same time, electrically isolate the antenna ground from feedback. This transformer is a step down type that lowers the system background noise floor yet raises eaf transferred to the receiver.

A suitable 2.5cm. diameter ferrite ring core costs only £1 post from Electrovalue Ltd., 28, St. Judes Road, Egham, Surrey, TW20 OHB, Selimens par no. 8642906.18030. It could be wound with 15 turns primary (antenna/groud) and 5 turns secondary (coax) of thin insulated connecting or 22 swg, enamelled copper wire. Try adjusting the numbers of turns whilst tuned to a signal between 900 and 1000kHz. A small price to pay for peace of mind and ear.

Coming back down the feeder, it is also important to match cable and receiver input impedances. Modern sets have 50mhm, 75mhm and balanced inputs capable of direct coaxial connection. Some sets were designed for use with medium impedance antennas and should not be directly connected to coaxial cable. There are two reasons for this: Firstly the input gain and signal to noise ratio will not be achieved, and (ii) a strong adjacent signal can be directly imposed upon their first r.f. amplifier because input tuning is severely damped by low impedance.

A second ferrite ring can be used for receiver impedance matching. Try 560 ohms in series with 20 turns between A and B, and 8 turns between coax inner and braid. This transformer and its leads should be screened and positioned close to the receiver. If the receiver is mains earthed do not link the transformer E and braid connections, separately connect the receiver earth to a nearby earth stake.

To ensure that antenna energy is not wasted in cable/feeder or receiver circuits and is fully allowed to create r.f. signal voltage I decided to try an outdoor pre-amplifier capable of taking antenna/groud and producing a 750mhm isolated output. Output is shown below. It covers medium frequencies with unity gain and has a dynamic range in excess of 100db. Any internal products have not been noticeable to received noise and the receiver is immune to noise. If the transmitter 20 and kilometers away is not a problem. Power consumption 36W at 24Vdc, it runs warm. All parts are available from Electrovalue Ltd., their catalogue is free, just write.

---

![Diagram of receiver setup](https://example.com/diagram.png)

Ref.1 - 8:8:8 turns, 22 swg. en. copper.

1. 1 off 68k, 3m, 50, R+.
2. 1 off 5k, 3m, 50, R1.
3. 1 off 5k, 3m, 50, R2, R5.
4. 1 off 5k, 3m, 50, R3, R4.
5. 1 off 150k, 2m, 50, R6, R7.
6. 1 off 100n, B2560, C1, 3, 5, 9.
7. 1 off 100n, B41326, C4, 10.
8. 1 off 47n, B2560, C6, 7, 8.
9. 1 off 40673. TR1.
10. 1 off 40140, TR2.
11. 1 off 40140, TR3.
Three design specifications for this active whip antenna are:
(a) distant background noise received by the antenna during quiet periods must dominate system noise,
(b) input filtering should reduce high frequency response, so that signals received at the antenna’s natural frequencies can not generate appreciable amplifier products,
(c) signal handling capability to exceed 1V r.m.s. when feeding 50 to 75 ohm receiver inputs.

RF frequency potentials develop across the antenna- L2-ground circuit, and are little affected by T1’s ground connection. Three stages of unity gain current amplification in T1, T2 and T3,4 gradually reduce impedance, the output transistors share quiescent current and therefore operate with better linearity and lower temperature. Passive filters reduce gain beyond medium frequencies; low-pass are (1) L1+R1 with the natural capacitance of L2+T1, and (ii) L4, high pass are (1) natural antenna capacitance with 0.22μF, (ii) C2, and (iii) C7. R4 is 6KΩ divided by the whip length in metres or 15Ω. The neon and 1N1 limit electrostatic discharge through the substrate diodes of T1, T2.

T1’s ground potential; T2 isolates T1 from variable impedance effects occurring within T3,4 and equalizes amplitude very with signal; T3,4 feed the trifilar wound l:11 transformer T4, at the 75 ohms via R6,7. To prevent power induced noise the amplifier chassis operates at antenna ground potential, isolated via L5 and L6. The isolated output winding of T2 connects directly to T4. The braid and signal is transferred by C7. T4 has two primary windings, with flux in parallel at B but opposing at C, so that core bias can not cause asymmetrical signal distortion. Di prevents possible damage by accidental reversal of remote power supply connections.

Comparing the antenna to receiver gain figures of straight and active systems we have:

- Reference input. $E = 1$VUS.
- Active system.

Gain of antenna into 6KΩ ref. 600Ω
Amplifier gain $g_{1}=-7$dB.
Termination gain 75Ω output into 75Ω load $g_{2}=-6$dB.
Total gain of the active system with respect to the reference one is therefore $g_{1}+g_{2} = -13$dB, at 500IMS it is approx. 16dB, and at 1.5MHz approx 60dB. These gains, though not large, are achieved with relatively self resonant components, ground and feeder arrangements; signals are transferred with undiminished level at lower impedance.

Use of a step down transformer + coaxial feeders + step up transformer with our reference system will also reduce interference, but the potential for ingress remains worse than when active. The amplifier also introduces antenna/ground isolation, see part two, on the 10 to 20dB, possible reduction of antenna circuit noise can be added to the active system gain to create an overall 20 to 30dB improvement in signal dynamic range at receiver input.

My 10m whip antenna is only 8 to 20m away from five neighbouring family bungalows and 220m from industrial pylons, yet I enjoy excellent medium frequency reception using the remote amplifier and a Collins type 804A-type receiver. The R300A’s 0 to 1000kHz, carrier levelolean diode. The 804A’s 0 to 1000kHz, carrier level 150mV, do not indicate noise between weak channels, yet night-time continental stations register up to 50dB carrier level 50mV, and all local pin the needle; readings taken using the 1kHz IF bandwidth. Weak signal resolution is substantially improved at all medium wave frequencies, and marks our own television timebase interferometers are rendered almost inaudible!

Both R300A and Marconi Mercury type receivers possess triple IF tuned front ends with impressive image and spurious protection, yet both generate small, though different, tunable interference errors when correctly matched to the active whip. These errors do not occur when using a good loop, for although loop output is much larger, it is sharply tuned and directional.

An extra tuning stage between any wideband source and the receiver input is effective both in reducing internal products and boosting weak wanted signals with respect to "powerhouse" transmissions on adjacent channels. However, for optimum low noise performance the feeder should be unbalanced and correctly terminated because tuned circuits or transformers can introduce losses, earth loop noise or screening problems. The pre-amplifier in my own system is combined with the phase amplitude mixer detailed later, but before that some general notes on loop antennas.

A loop of wire is an effective and self contained sensing element for electromagnetic radiation. It's sensitivity can be improved by increasing loop area, either by making the loop larger or by winding more turns.

When the area of a single turn loop is increased it's inductance rises and its electrical self resonant frequency falls. Now, although area increases at a faster rate than circumference, wave delays around the circumference create transduction phase change before resonance drops to medium frequencies, and while a single single turn loop is insensitive much larger ones possess frequency dependent phase and sensitivity characteristics. Transition is gradual however, and a medium sized loop, though quite inefficient and requiring input matching, has good wideband sensitivity and is useful as a bidirectional source for cardiodaring.

Since antennas are based upon the circumferential length of semicircles, with small less than say 0.05A and large greater than 0.5A, where A is the shortest wavelength to be received.

When more turns are wound over a given area then loop inductance increases much faster than the rate of circumferential increase and natural resonance at medium frequencies becomes possible. The resonant self amplifiers induced signals and greatly improves antenna efficiency.

Matrix board layout for the active antenna isolating amplifier.
Again circumferential length is limited by wave motion along the wire, and windings must be shorter than 0.25A for homologous interturn flux linking. Most solenoid and spiral wind loop holes have circumferential lengths of 0.13, though 0.2A is possible by using appropriate wire and winding forms.

The tuned loop antenna's ability to peak a carrier and direct nulls towards unwanted transmitters has been popular with DXers. Ref 10

Refinements have led to improved, compact and solidified designs, but some inherent weaknesses are seldom overcome:

(i) Whether screened or balanced these loops are rarely used outside.

(ii) At radio frequencies a tuned winding has an effective resistance many times that of the wire alone, and thermal agitation can generate noise potentials up to 200nV between loop terminals. Ref 11

(iii) Another problem occurs with cardiod reception, for when tuned loop output is mixed with that from a wideband whip/wire source the null occurs at only one frequency. A carrier can be notched out but disturbing levels of sideband splitter normally remain.

Tuning the wire signal helps, but this causes further complications and effectiveness varies across the band. If an amplified loop is available it may be tuned 20 to 500kHz away from the wanted signal. Here loop phase changes less with frequency, and mixing produces good carrier plus sideband nulls. Overall sensitivity is little reduced.

Comparisons between indoor loops and the active whip antenna clearly showed advantages of outdoor siting and prompted a series of experiments with medium-size, single turn outdoor loops. General conclusions were:- the bigger the better, though exceeding a 0.5A circumference could distort response; more simple to use coaxial cable capacitance to reduce and dampen the main resonance and skirt reactance, the step-up transformer must be carefully wound; using an isolating amplifier and sitting the loop away from buildings reduces mains borne interferences by 20 to 30 dB.

The present construction is shown above, inductance L1, 4.7µH, reduces system damping at higher medium wave frequencies. The toroidal matching transformer is wound on a one inch core as earlier. Primary and secondary windings spaced evenly around the ring, secondary eight-pile of ten between the primary turns. This loop is less capable of high frequency reception than the isolating whip, therefore some isolating ferrite components (L2, L3, L4, R2, R1 and C1) may be omitted if desired, though the antenna pin must then be linked to T11 end of capacitor C2.

Performance is outstanding. When mounted on poles down the garden, with the bottom 16 metres concealed by grass, this loop looks like a thick wire antenna. The only planned improvement is a washing line suspension for the top span of coax. Cable weathering is inevitable, but extra support should at least minimise internal gain. Transatlantic reception is favoured by a West-Nor-West alignment, and sensitivity, noise levels and dynamic range are commensurate with those of the active while the double winding encloses a wound area more than ten times that of resonant loops, and its output is stepped up by a similar ratio. These factors equate closely with the figure of resonant coils, approx. 120, and though both types have similar outputs the large one does not require tuning.

Outdoor, single turn construction is also quieter. It responds less to domestic interferences, and, since thermally aged winding noise is proportional to the inductance by Q product, it can hear weaker signals. Indeed, tuned loop winding noise often causes a response that makes the background sound erroneously quiet. Signals and noise are still there, but antenna gain fails at frequencies above and below resonance, and to an AM receiver this appears as a carrier with quiet sidebands. Broadband antennas are not always affected.

The tuned loop is useful where domestic or environmental circumstances limit antenna choice to an indoor type. Selective designs assist receivers in finding weak carriers, and one that can be rotated to eliminate both vertical and horizontal axes may be more accurately adjusted for deep signal nulls.


All loop antennas are broadly sensitive in line with the winding wire, but sharply insensitive along their axes. Therefore, at any site directly between two transmitters attempts to null will be reduced. Simultaneously upset reception of the other, Britain lies on a global path between Europe and America, so a single loop can not be expected to null continental signals and, at the same time, favour transatlantic reception.

Cardiod or heart shaped, sensitivity patterns are well known and may be generated by mixing equal amounts of phase matched loops and whip/wire signals. A moderately sensitive lobe predominates, and the now

From length indicates directional sensitivity.

single minimum is in line with the winding; forward sensitivity is increased and the null arc widened. In practice a cardiod response can almost double the transatlantic signal to noise ratio whilst maintaining general insensitivity towards the continent and one deep null for accurate alignment.

For a loop null of 60° with respect to main lobe

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>6.0</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loop alignment tolerance</td>
<td>30</td>
<td>6</td>
<td>0.6</td>
<td>difficulty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical cardiod and horizontal mixed</td>
<td>36</td>
<td>11</td>
<td>3.6</td>
<td>1.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Though loop and cardiod reception patterns are well documented in DXing and radio direction finding publications, there is little mention of unilateral reception. Ref 7. Unilateral refers to a polar response that has a single branch, a single figure of eight or cardioid, possessing enough asymmetry to indicate direction. It might have two minima less than 180 degrees apart and be termed a "cottage lawn diagram", see (a), or show a single rather indistinct minimum, see (b). Navigators avoided using unilateral responses because accurate determination of transmitter bearing was not possible.
Loop plus 26% whip produces 4 UNI-TERM (b)

Response (b) is generated by mixing loop antenna signal with less whip/wire signal than is required for the cardiod pattern. The relationship between the nulling angle w.r.t. the loop antenna wire and the level of mixed omni-directional signal as a percentage of loop output, is tabulated below.

<table>
<thead>
<tr>
<th>Null angle, degrees</th>
<th>90</th>
<th>75</th>
<th>60</th>
<th>45</th>
<th>30</th>
<th>15</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whip signal percent</td>
<td>0</td>
<td>26</td>
<td>50</td>
<td>71</td>
<td>87</td>
<td>97</td>
<td>100</td>
</tr>
</tbody>
</table>

Ninety degree nulls at 0% represent the normal loop response, i.e. no signal mixing, and >0 degrees at 100% is of course full cardiod with the single null. Phase reversal of either antenna signal reverses the direction of a cardiod response and makes unilateral minima traverse oppositely.

As a result, the ability (i) to match and reverse the phase of loop and whip antenna signals, and (ii) to control their relative amplitudes, would be a basis for nulling ANY steady signal without rotating or tuning either antenna. The phase amplitude mixer described below is a practical development of this approach. It incorporates a sharply tuned mixing circuit which helps alleviate most intermodulation problems associated with the wide range of local to distant signal levels, and is capable of generating deep minima for use against Direct and Group Fading signals, or compromise settings for optimum nulling of Selective Fading and Medium-Effect signals. See circuit diagram.

This tuned mixer accepts dipole, loop, whip and wire inputs at low impedance and works with most screened feeders. Signal nulling may be achieved using a bidirectional/omni-directional antenna pair, two similar but widely spaced antennas or impedance transformed angled Beverage dipoles. Phase variation is produced by a standard, 6V early, three turn slug on a variable capacitor working as a passive (linear), three stage R-C network. At RF frequencies 15 to 105 degree adjustable lag is available on either input, and to prevent loss of overlap the undergones a fixed 15 degree lag. The phase variation of one signal with respect to the other may therefore range between minus 90 and plus 90 degrees. If one signal is now reversed this range becomes plus 90 to plus 270 degrees and hence a fully variable 0 to 360 degree phase shift is realized. Two controls, the variable capacitor and a four way, ninety degree, quadrant selector switch, thus allow all possible antenna/insertion characteristics. Amplitude mixing levels are controlled by a dual gang cross fading potentiometer kindly made for this project by Electronics Ltd. Cross fading allows one control to cover a wide range of input signal amplitudes.

Sensitivity and linearity are maintained by tuned circuit mixing. Proportional mixing introduces losses and active mixing generates products, whilst isolated differential coupling to a resonant circuit produces frequency selective amplification. A second knob at this tuned circuit adjusts positive feedback, so selectivity is sharp and may be controlled to the point where an individual sideband can be chosen for enhanced carrier reception.

The ON-OFF switch combines input control and enables direct comparisons between the mixed output and either individual input. Choice of R1, L0-2 and Balanced outputs are available and a PP9 battery lasts for more than 430 hours. To prevent noise ingress and improve stability if use of a close case should be considered inside the closed metal case. Internal layout and screening are not as important as layout are automatically compensated by mix and phase control adjustment as reception patterns are generated.

The tuned mixer at my C/H has become indispensable. It is built into a 10x7x3 inch aluminum box and provides five distinct modes of operation. The are:-

1. **Cardiod reception** With a whip/wire antenna and 'W' input selected, the signal from the 'tune' and 'regen' controls. Usefulness is determined solely by antenna characteristics.

2. **Bidirectional reception**. The normal figure of eight response produced by an amplified, pan and tilt, loop or dipole antenna system is selected with the mixer input switched to 'L'. Extra selectivity assists reception but the mixer does nothing to improve an antenna's basic transduction performance.

The TUNED MIXER CIRCUIT DIAGRAM and SHOPPING LIST.

(The Mixers Select switch allows instant choice and comparison between (1) and (2) above, or one of the generated responses below.)

ZO CLEANING. Where the less than perfect null of a vertically rotating or environmentally imbalanced loop antenna is depressed by mixing small amounts of oppositely phased cancellation signal from another antenna, first obtain the best null as in (2), then select for the mixing facility. Rotate the 'mix' control 30 degrees from the local end and enhance the phase control by 45 degrees. Select the only 'quadrant' position which provides a null and then repeatedly adjust 'phase' and 'mix' controls to sharpen it. Note that electrical or mechanical cleaning of one figure of eight minimum simultaneously makes the other one less distinct.
(4) Cardioid reception, where the mixer offers a switchable choice. When nulling capabilities are more important:
Tune up the desired signal as in (3) and then loop null the unwanted signal to establish its direction. Then tune the loop through 90 degrees so that it's winding is in line with the signal, select 'N', center the 'mix' control and ush the 'phase' capacitor by about 60 degrees. Select the best nulling quadrant and then deepen the response using 'phase' and 'mix' controls.

When nulling sensitivity is more important, either:
(a) generate a null cardioid null on the wanted signal and then turn the 'quad' selector two positions to reverse the polar response. i.e., transpose the minimum and maximum lobes characteristics, or,
(b) null an unwanted signal from the opposite direction, for good decible sensitivity is so broad that this signal need not be exactly in line with the wanted one.

Once set a cardioid pattern holds well with loop rotation, though fine phase and mix control adjustment should be tried when tuning other signals.

(5) Unilateral reception, for fixed loop/dipole applications or where unwanted signals cannot be nulled using loops or cardioid patterns. One deep and one shallow null may be generated at equal angles with no opposite sides of any loop antenna winding. Using a rotatable loop antenna axial nulling, (2), will establish two unwanted transmitter directions. Aim one between transmitters then adjust the mixer as in (4). This method might help alleviate noise from multi-source jamming operations; try repeated sequential adjustment of loop bearing / tilt and mixer phase / mix to obtain the most useful double nulling response. Four interacting variables introduce a trial and error aspect, so comparative listening checks are essential after each adjustment.

With a fixed loop antenna any single transmission from any direction can be nulled by adjustment of quadran, phase and mix controls.

NOTES:
Phase amplitude mixers have been in use at my QTH for about seven years, the tuned mixer is a more recent and very successful development. Mixes well with the similar low impedance outputs from active 10m whip and active 5 x 156. loop antennas. Deep, stable and broadband directable minima are easily generated for nulling an interfering signal and the output is essentially constant without nulling modulation or problems of it.

Don't worry that a 10m whip will overload the isolating amplifier; if it is set to a level at which it's loading allows adequate sensitivity with good noise to signal ratio. Any particular strong or troublesome local can be tamed by using a series tuned, high Q medium wave coil and variable capacitor across it, see drawing. This method only as a last resort, transduction phase is disturbed and responses become distorted.

The high output WQ loop is useful for 'off tune' mixer reception; it can be deliberately positioned up to 100kHz off channel so that the generator nulls are essentially quiet, yet frequency broad; signals are taken out over several channels for transmitters that are in the same direction. Non resonant loop + whip + mixer responses are stable and little affected by environmental changes, necessary pre-receiver selectivity is simultaneously provided for both antennas and subsequent mixer tuning does not disturb the generated polar patterns. By notching out unwanted bands this system removes the heterodynes and splatter that often spoil transatlantic reception, widen i.f. passbands become suitable and listening is much more comfortable. Previously I had to use 1.2 to 4kHz bandwidths for TA's, now I can use 5kHz and many 20kHz or wider bands for TA's without echo and echoes are rare.

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Ground connections are simply 2m steel rods driven into wet clay, or a 50cm diameter wooden sleeper is topped by a 50cm diameter wooden sleeper which prevents it's electrostatic point and prevents ionised air discharging.
Greetings from the Dogwood City, where the first sign of Fall, the color change of the pampas, the piep of the season's already matured, and it is amazing how the lower temperatures raise the desire to turn on the radio! The first Dippelation of the season is already witnessed, and it was the results were only fair. On Sat., 9/23 Chuck and I headed up to Duluth 69, a small suburb of Atlanta, to the Dogwood Park where I had worked there for three years. It was lovely, and there was a large, open area. So we strung them up close to 2000' in a 64th direction, paralleling the Chattahoochee (711-313) radio station. I was using my Sangean ATS-909 and it worked well until I sometimes had to fiddle with the tuning and get it over to 9 WFR. At about 11 am, we were sitting in my car to avoid the cold wind, we were visited by a local Duluth's closest. The officer stepped up to the car, observed the equipment in the car, and asked us what we were doing. We told him we were radio amateurs and were listening to the emergency traffic coming from the Caribbean due to the hurricane. He nodded, told us to be careful and left. We thought for sure we were safe, but then an hour or so later, we received a call about a possible tornado in the area, but it was not related to the thought of rolling up 2000' of wire in the dark and cold...we got covering closer to Duluth's Bob on 313 (before R. Tatum at 1009). By 7:30 pm, I received a call from the office asking if we could leave the equipment up for a few more hours of observation before being picked up by a co-worker. We did so, and the equipment was left up for a few more hours of observation before being picked up by a co-worker. We did so, and the equipment was left up for a few more hours of observation before being picked up by a co-worker.