ALTAZIMUTH LOOPANTENN I FÖRENKLAD FORM

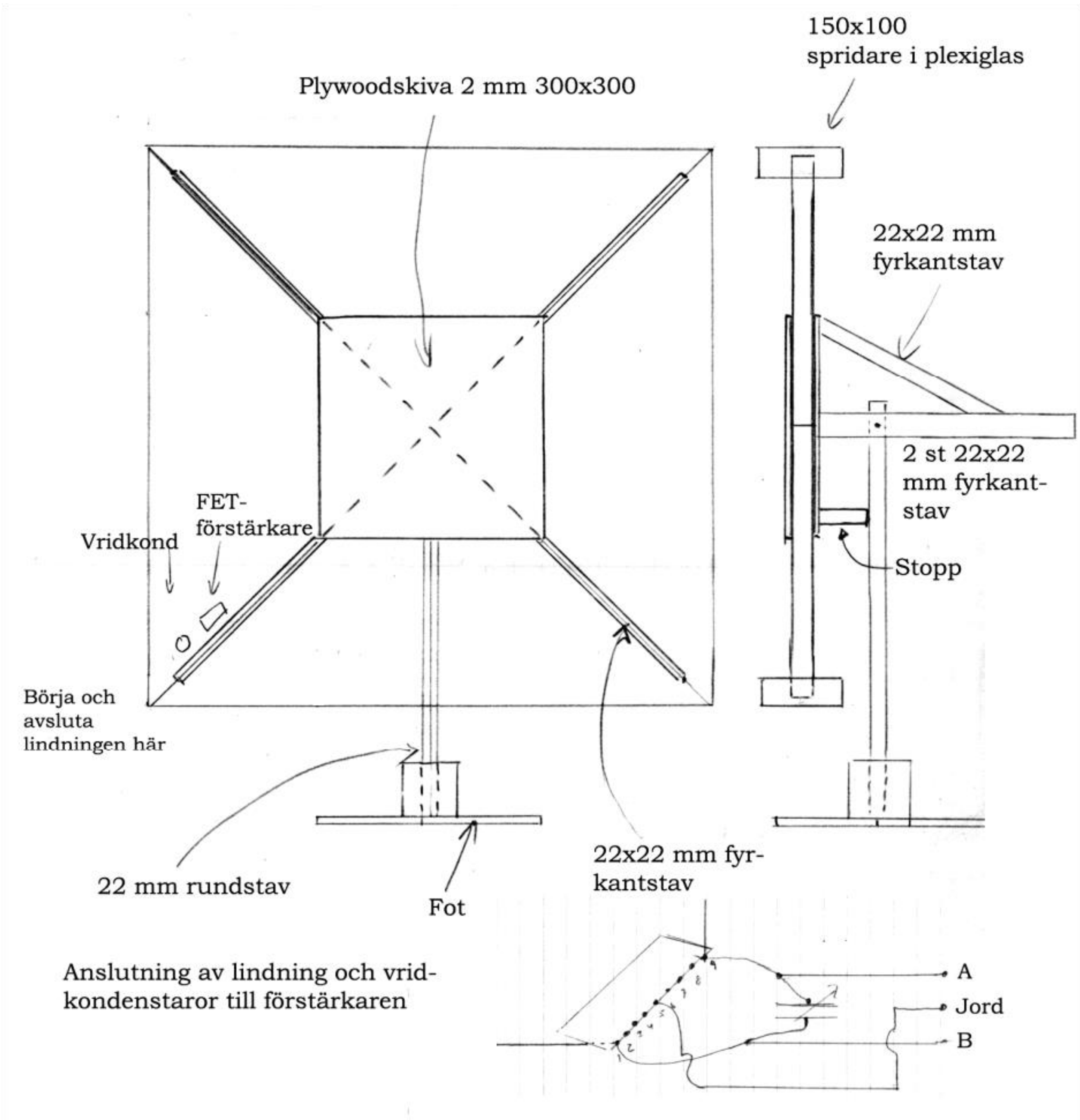
(Artikeln publicerad i MV-Ekot i slutet på 60-talet.)

Idén till den här altazimuth-loopen kommer ursprungligen från en artikel i DX News av Gordon P. Nelson (se hans beskrivning längre fram).

Det som kännetecknar en altazimuth loop är att den även är vridbar i horisontalplanet. Man uppnår på detta sätt en utomordentligt god utsläckning av starka stationer. Man kan bygga en sådan på konventionellt sätt med eller utan förstärkare. Båda varianterna beskrivs nedan.

Jag har själv haft tillfälle att prova denna loopförstärkare på en 1 x 1 m loop med 10 varv. Den har visat sig synnerligen exakt. Enligt GPN så är noggrannheten så stor som 0,05° och inom ½ dB i nolldjup mellan de båda sidorna när tiltvinkeln är lika med 0°. Dessa värden uppnår man endast när en dubbelbalanserad inkoppling enligt ritningen används. Dvs. det är alldeles nödvändigt att loopantennen är mittjordad till förstärkaren och radio via den dubbelbalanserade inkopplingen, Dessa två kablar kan helt enkelt vara två stycken koaxialkablar vars skärmstrumpor löds ihop i ändarna.

Principskiss av en 1x1 m loopantenn



Loop utan FET-förstärkare

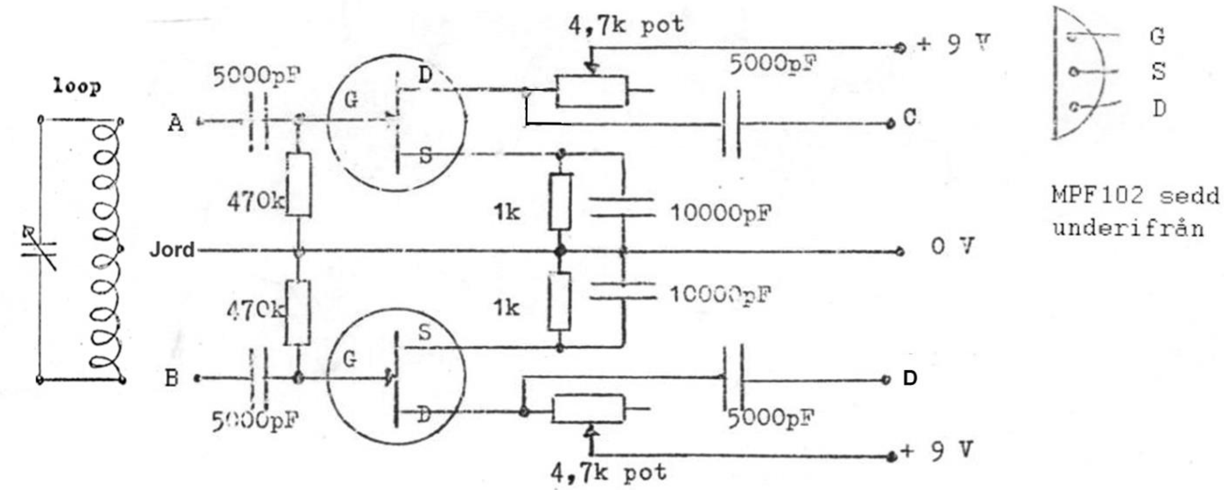
Jag har under ett år använt en sådan loop utan den FET-bestyckade förstärkare GPN beskrivit. Trots det förenklade utförandet med 2-varvs link, har jag bara haft enbart positiva erfarenheter. Skillnaden mellan en altazimuth loop (vridbar i såväl vertikal- som horisontalplanet) och en vanlig loop är egentligen inte stor. Samma antal varv (10) och samma avstånd mellan lindningarna (15 mm). Istället för ett varv på linken som går till radion, använder man i denna typ av loop en link med två varv med mittjordning. Detta är enda skillnaden.

Loop med FET-förstärkare

Jag har med ledning av en ritning från Eter-Aktuellt byggt en förenklad förstärkare som fungerar alldeles utmärkt. Denna är bestyckad med två vanliga, billiga FET-ar, (ej matchade).
Med en sådan här liten enkel förstärkare kommer loopens egenskaper att avsevärt förbättras, inte bara vad gäller förstärkningen utan ger även skarpare minima.

Till skillnad från den vanliga enkla loopen fungerar denna även lika bra i den högfrekventa delen av MV-bandet som på lägre frekvenser. Nolleffekten är således tydlig och klar över hela bandet.

Schemat till förstärkaren:



Inkopplingsanvisningar med FET-förstärkare:

1. Linken (2 varv) på loopen tas bort, kommer ej att användas.
1. Tåtarna som går från vridkondensatorn kopplas in på punkterna A och B. Använd så korta ledningar som möjligt. Fäst helst förstärkaren vid vridkondensatorn i en hörna på loopen. Förstärkaren skall vara isolerad från resten. Får således ej röra vid vridkondensatorn eller varven på loopen.
2. Anslut mittuttaget på loopen till Jord.
3. Bandkabel eller dubbel koaxialkabel lödes till C och D. Skärmen har jag inte jordat varken i förstärkaren eller i radion. Använd helst dubbel ingång på radion, s.k. dipolingång.
4. Trimpotentiometrarna (4,7k) ställs in så att max förstärkning erhålles. Båda bör dock stå rätt lika. Läget bör bli någonstans i mitten.
5. Strömbrytare bör inkopplas, så att förstärkaren kan kopplas ifrån när lyssning ej sker. Batteriet tar annars fort slut.
6. Batteriet är av vanlig 9 V typ. Det finns en särskild klämma till detta, så att anslutningen blir så lätt som möjligt.

Genom att ta bort linken eliminerar man en del förluster som annars skulle uppstått. Nu kan man tillgodogöra sig hela loopens fina Q-värde.
Symmetrin blir fullständig med denna koppling, dvs loopen visar samma minima i båda riktningarna.

GPN:s förstärkare (se längre fram) är säkerligen bättre men den blir i gengäld både dyrare och krångligare. I denna koppling blir loopen ungefär så bra som en yttre antenn på 60 - 80 m skulle jag tro. Dessutom kan man dämpa störande stationer.

Förstärkaren byggs lämpligen på ett förtryckt mönsterkort typ Veroboard. Det blir då enkelt att montera det hela symmetriskt.

Denna förstärkare är så enkel att bygga att det verkligen är värt ett försök. Särskilt då för de som tidigare klagat på dåliga signalstyrkor från era loopantenner.

BALANCED FET AMPLIFIER FOR ALTAZIMUTH LOOP ANTENNA
(Extract from the original article "The NRC FET Altazimuth Loop Antenna" published by Gordon P. Nelson in DX NEWS circa 1965)

This amplifier, like all similar high gain RP circuits, can oscillate or show other signs of feedback instability if carelessly onstructed with overly long leads. The cross-neutralizing capacitors in this circuit should help to eliminate any such problems and the unit should operate properly the first if the instructions are followed carefully.

Needs: (preferred types)

T1, T2	2N4416 A (J-FET)
R1, R2	5 kohm dual matched potentiometer, linear taper
C1—C5	0,01 uF 75 V microminiature capacitor
L1, L2	10 mH miniature shielded coil
C6, C7	1,5–7 pF miniature trimmer capacitor

Aluminum minibox 72 x 142 x 46 mm
Veroboard 101 x 163 mm
Transistor sockets
Insulated feedthrough terminals

BUILDING INSTRUCTIONS:

1 Drill holes in chassis as shown in diagram.
2 Wire the Vectorboard. Lay out the parts on the board in roughly the same position as on the schematic.
3 Mount transistor sockets on board in position shown by pushing socket pins through board and bending over on far side, Note that the gate pins on the sockets will be very close to the input pins on the board.
4 Mount the reminder of the components on the board as shown: parts with dotted outlines are on the under-side of the board (not necessary). Leave installation of the cross-neutralizing capacitors (C6, C7) until last. Keep all leads as short as possible.
5 Since the neutralizing capacitors run diagonally across the board, their leads must pass over the rest of the circuitry. They must be mounted in a position such that the adjusting screws can be reached through the holes in the chassis box (A and B), and one terminal of each capacitor must be firmly soldered so that the capacitor won't rotate when it's adjusted.
6 Slide the board into the chassis box under the protruding input and output-terminals; the terminals should then line up with corresponding pins o n the board. After checking to make certain that the neutralizing capacitors, are lined up with the adjustment holes, solder the terminals to the board pins. From here on, anything that has to be done will require that these six terminals be unsoldered - so don't install the board too early.
7 Connect the leads from the board to the potentiometers to the appropriate places; trim the leads to the shortest possible length, Also connect the wires for the battery to the board; use a twisted pair of hookup wire.
8 Now comes the only tricky part; installing the FET's in-their sockets. Study the positions of the transistor leads as shown very carefully. Bend the leads on each transistor very carefully into a pattern that will permit them to be plugged into the sockets as shown. Trim the leads so that they'll be as short as possible without shorting when the transistor is seated. At this point it is very easy to make a mistake with the lead positions so go very carefully. This completes the assembly of the amplifier.

TESTING THE AMPLIFIER

After the amplifier has been completed it wise to check it out before connecting it to the loop or beginning the neutralization procedure. These checks can be omitted if you never make errors - or they'll have to be skipped if you don't have the equipment. The worst that can happen is a burned-out FET, fortunately.

1 With battery power disconnected, measure the resistance from each of the input leads -terminals- to ground with a VTVM (voltmeter). If the transistors have been correctly fitted into the sockets and are both good, the resistance should be about 4 Mohm. If something has gone wrong, it'll either be much lover or infinite. This simple check can be used to check the FET's if you suspect damage from nearby lightning strikes, etc.

2 Now short both input terminals to ground. Connect VTVM to one of the Source terminals and measure the DC voltage to ground; with an 18 Volt battery, this voltage should vary from zero to + 3 or 4 Volts as the bias pot is rotated from one side to the other. For any particular setting, the Source voltage on both FET's should agree within 10% or better; this indicates that both units are at the same operating point.

FINAL ADJUSTMENT OF AMPLIFIER.

1. Connect the amplifier to loop as shown; connect amplifier output to receiver with double balanced line, connect battery power and set bias pots in mid-range; if a current meter is used it will indicate a total current of 8 mA. Tune receiver to a fairly strong station in the bottom of the band and try to peak the signal with the loop tuning capacitor. If all this is well, the station should peak up very sharp with the tuning capacitor most of the way closed; the signal output and tuning sharpness should vary over a wide range as the Q-gain control is rotated. If the amplifier breaks into oscillation at this point, it will have to be neutralised. If oscillation does not occur, keep tuning up into the band until it does.

2 When instability is finally encountered, neutralization can be started. With the amplifier oscillating (it may appear to be totally blocked), try rotating first one and then the other of the neutralization capacitors; at one particular pair of settings the amplifier should come out of oscillation and operate properly. Now tune up to a station at the very top of the band; if instability is again encountered, a further very slight adjustment of the neutralizing caps will clear up. Once the amplifier is neutralized for operation at the top of the band it will operate throughout the rest of the band; once set, these caps should require no further adjustment unless FET's are changed.

USING THE FET ALTAZIMUTH ANTENNA

Controls.

a) Tuning capacitor, Rotate to peak desired station.
b) Q-gain control, Rotate to reduce antenna pickup as desired.
c) FET bias control, Adjust for maximum gain without distortion or spurious pickup.
d) Neutralization capacitors, ignore once properly set.

To eliminate a local station

Starting with the loop frame vertical (tilt angle = 0), route the loop until the station pickup is minimized. Now unlock the tilt arm and tilt the loop about 20 degrees; rotation will now give a deeper null on one side than on the other.

Continue to increase the tilt angle while rotating back and forth through the null position. At one particular combination of tilt and rotation (and one position only;) the local signal will suddenly drop to a very low level or completely disappear into the background noise. This setting is extremely critical - movement of the loop frame by only a fraction of an inch from this setting often changes the pickup by 20 to 40 dB; this i s the reason for the unusually sturdy nature of this loop design. On some stations this setting will appear to slowly drift about by a small amount because of small amounts of signal scattered from the ionosphere directly overhead.

The actual null depth (i.e. how much a local can be eliminated) depends upon a number of uncontrollable factors, including the nature of the transmitting antenna the ground between transmitter and receiver, and the presence of reradiation from local power and phone lines. Under the best conditions the unwanted station can be reduced by at least 80 dB; in the worst case observed by the author the null was still 38 dB. When a very powerful local is very deeply nulled out, the remaining audio will sound extremely distorted - almost like single sideband; in this case the signal is being picked up as the result of scattering from the overhead ionosphere and no deeper null is possible.

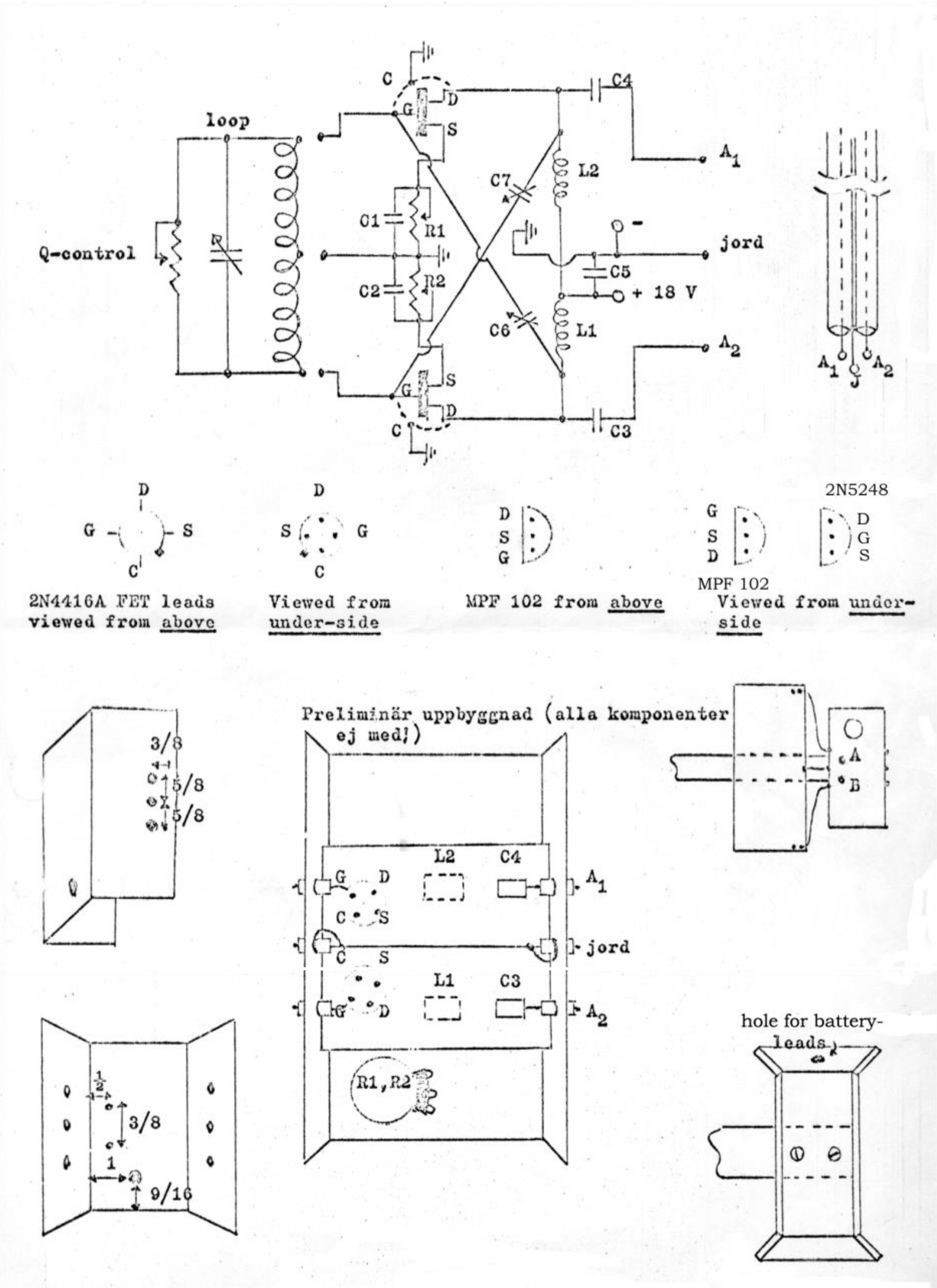
To eliminate a distant station

Adjust both rotation and tilt to minimize the undesired signal; because the polarization figure for a skywave changes with time, frequent readjustments will be necessary.

To make direction finding measurements

Set the bearing pointer on the loop shaft so that it is pointing perpendicular to the face of the loop, Adjust the setting circle s o that 0° corresponds to due north. Lock the loop in vertical position (ALL DP'S MUST BE DONE WITH TILT ANGLE = 0°). The angle shown on the setting circle when a particular station nulled out to its lowest level will then correspond to the great circle bearing to the station. Average a number of readings taken over a space of several minutes to obtain greatest DF accuracy.

Schematic of Gordon P Nelson’s Altazimuth FET loop amplifier.

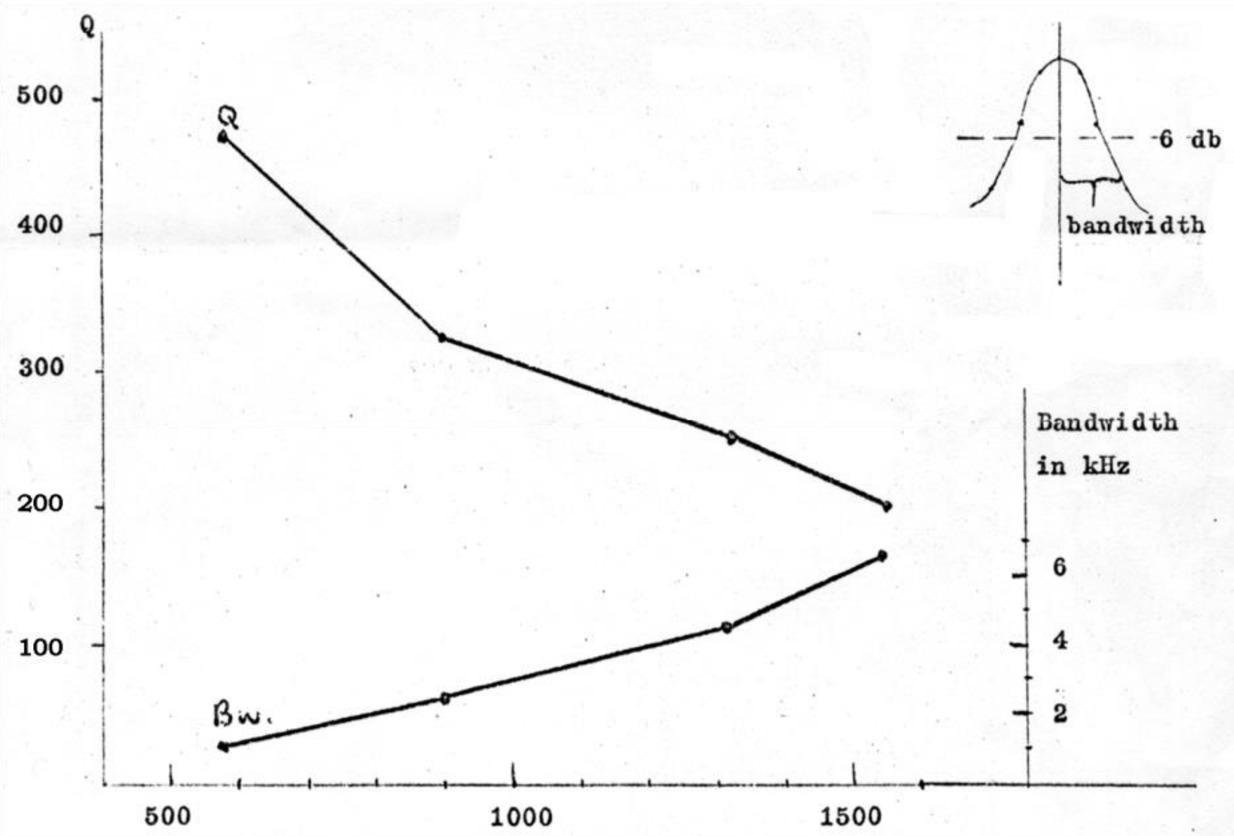


EXTRACT FROM AN ARTICLE IN THE DX-NEWS ABOUT LOOPS (vol. 38 No.10)

Tuning sharpness or Q of the antenna

Up to a point, the higher the Q the better; the high antenna selectivity helps greatly to reduce overload and spurious responses from powerful locals. Too high a loop Q, however, is frequently undesirable because the "sharpness" of the tuning can actually cut sidebands on the desired signal and produce "muddy" audio. This is particularly damaging if you have gone to the time and trouble to get a flat IF-passband with the use of mechanical filters. In the Altazimuth loop design the Q-control permits the operator to "open up" the tuning characteristic to obtain better audio when he so desires; this is most important at the bottom of the band.

In addition to the relative Q-values, we have also plotted the 6 db bandwidth for that frequency and Q; as shown in the diagram this is how wide the loop passband is from center to a point 6 db down.



From the passband figure it is obvious that the antenna has high enough Q on the bottom of the band to cut sidebands by a significant amount; the lack of a Q control is thus a real disadvantage.

The diagram shows the relations between Q and bandwith. Notice the sharpness at lower frequencies.