AIMING FOR OPTIMUM PERFORMANCE ON 50 MHz

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There are several ways of getting on to this very interesting and exciting 50 MHz band. (1) By purchasing suitable commercial equipment, or (2) constructing your own homebrew gear, or (3) obtaining an ex-army VHF transceiver.

EQUIPMENT:

Currently there are a number of commercial transceivers available in South Africa. They are: Icom 551 (10 watts), Icom 551-D (85 watts), Kenwood TS-660 (10 watts), Kenwood TS-670 (10 watts), Yaesu FT 680R (10 watts), Yaesu FT 690R (2½ watts), and Yaesu FT 726R (10 watts). Transverters are also available such as the ten watt Microwave Modules 50 MHz SSB transverter (144 MHz to 50 MHz) and the Yaesu model FTV 700 (28 MHz to 50 MHz).

Alternatively, if your are technically inclined then you could "roll your own" by building one of many six metre transmitters or transverts described in the Radio Amateur Handbooks. With regard to reception, all that will be required is a crystal controlled converter such as a Microwaves Modules model MMC 50/28 in front of your HF communications receiver so that the 50-52 MHz channel can be tuned in on the ten-metre band.

However, if the coupons are scarce especially during this period of inflation, then an ex-army VHF transceiver such as the Plessey C42, B47 or PRC261 could put you on the air at very low cost. Likewise if you could lay your hands on a commercial two-way radio unit then it could also be adapted for amateur use on 50 MHz.

LOW-NOISE MASTHEAD AMPLIFIER:

Irrespective of what type of commercial six metre equipment you may fancy, the receiving side will be too insentitive for serious six metre work since it was mainly designed for F_2 operation. For example, stations such as ZS4BU, ZS6LW, ZS6BTL, ZS6TUK etc. have been romping in here in Port Elizabeth up to S9, yet they were unable to hear us or had great difficulty in copying our signals. Consequently, Graeme ZS2OD and the writer conducted extensive tests with the Icom 551-D transceiver and improved its sensitivity tremendously by adding an external low noise preamplifier. Provision has been made at the rear of the Icom 551-D to accommodate such a unit. We have also found during our tests that signals which were unreadable on SSB due to very noisy conditions could be retrieved on FM by increasing the RF preamplification up to a point just before limiting occurs. The level must be determined experimentally and

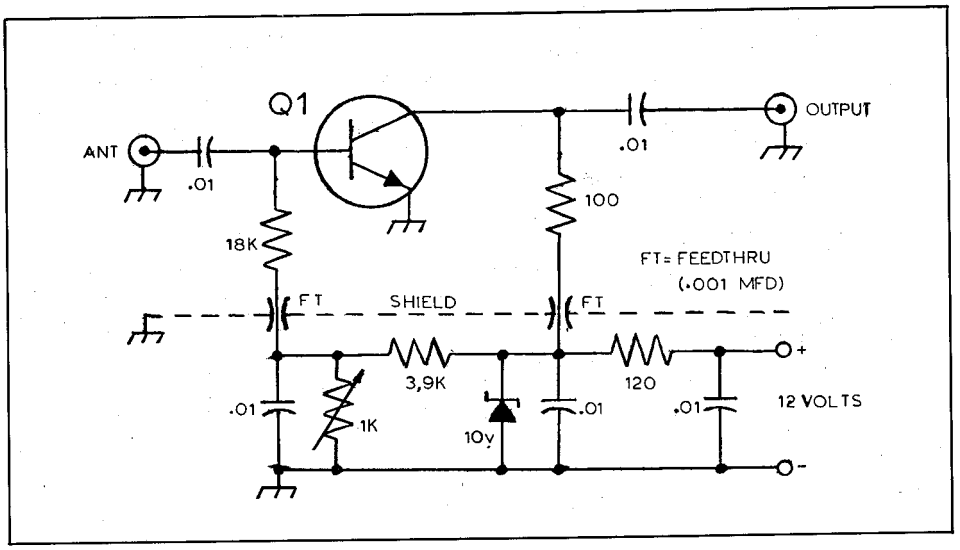

Fig. 1 Broadband amplifier.

will result in the FM receiver becoming hypersensitive to weak signals.

Solid state devices have been designed for a given range of frequencies and should therefore be selected for the band desired. It is wrong to believe that all UHF type solid state devices would also present better noise figures on VHF. Here is a list of devices with their noise figures which are suitable for 50 MHz operation:

TYPE	NF (dB)
MA 42001	0,95 dB NF.
2N4416 (ECG 452)	1,37 dB NF.
NE02135	1,55 dB NF.
MRF 901	1,67 dB NF.
KD6003	1,70 dB NF.
2N5109 (ECG 278)	1,72 dB NF.
MRF 904	2,00 dB NF.

Figure 1 depicts a preamplifier which was successfully used by Sel ZS6SS. It is built around a broadband device such as the MRF 904 or equivalent, has no tuned circuits and is matched to a low impedance input and output of about 50 ohms. The potentiometer shown is adjusted for minimum noise figure. Depending on the time of day or night, a low noise figure is usable on 50 MHz whenever the directional antenna system points toward a colder part of the "radio sky". Another preamplifier is illustrated in Figure 2 and uses a matched pair of ECG 452 FET's and is substituted but will show a higher noise figure. This circuit provides considerably more gain than the circuit of Figure 1 and is ideally suited for FM, since a great deal more front end amplification can be tolerated on FM than on SSB.

If desried this preamplifier could be used inside the shack itself by omitting the antenna relays and changing the output circuit as indicated in dotted lines. Should the gain be too high for a particular type of receiver then it could readily be reduced by shunting coil L2 with a low value resistance of 2N,2K ohms or less. Alternatively, a suitable attenuator could be fitted at the bottom end of the receiving co-axial cable.

Coils L1 and L2 consist of 13 turns of No. 20 gauge wire (preferably silver plated) air-wound on 7 mm. diameter. L2 is tapped at 4 turns from ground end. The RF choke is wound with No. 28 enam. wire over the full length of a 1 m 2 watt resistor. C1 and C2 as well as the bias potentiometer must be adjusted with the aid of a noise generator for minimum noise figure and consequent maximum sensitivity for weak signal reception. Many amateurs have an erroneous concept of noise figure as it should not be confused with the amount of noise emanating from the loudspeaker when the volume is turned up. It is the ratio of the noise generated in the first stage including its input circuit and the reference which is level from a given weak noise source.

Owen ZR5HZ/2 has effectively used a wideband TV masthead amplifier, i.e. a Labgear model CM 8065, which has a range of 42-800 MHz and a noise figure under 2 dB. This unit and an Icom 551-D enabled him to listen frequently to the Gweru Zimbabwe TV sound channel on 53,750 MHz over a VHF path of almost 1500 kilometres. But if you really want the ultimate masthead amplifier then settle for nothing less than a GaAsfet job such as the model FV50VDG with a noise figure of 0,5 dB for 50-54 MHz. This unit is manufactured by Advanced Receiver Research, P.O. Box 1242, Burlington CT 06013 U.S.A.

HIGH GAIN ANTENNA ARRAY:

An efficient antenna system is a pre-requisite for more successful six metre operation. Most amateurs start off with a four element yagi which is more than suitable for F_2 propagation when signals are very strong. But when it comes to scatter and tropo work then results could be improved a great deal by increasing the antenna gain. Figure 3a depicts a nine element long yagi on a 9,2 metre boom, which is effective over a range of 50,0-51,5 MHz and if carefully constructed and tuned then the forward gain could exceed 12,5 dB with reference to a dipole. Figure 3b shows the details of the gamma match and the dotted lines indicate which part should be enclosed in a weatherproof plastic box. The latter could also house the masthead amplifier and the antenna relay RL1. Another approach would be to stack two five over five or even six over six yagis.

Muncipal by-laws in many cities limit the maximum height of an amateur radio mast to 40 feet (about 12½ metres). A 50 MHz beam should be erected at this height or even higher if legally possible, to produce low angle radiation and thus improve both transmission and reception. For instance, if a yagi is raised from 8 to 12 metres then an improvement in performance of at least 3 dB could be realized. Another fringe benefit would be the elimination or reduction of any possible RFI to your next door neighbour when operating on high power.

Many amateurs make use of the old medium priced RG-8U type of co-axial cable to feed their six metre beams. Thinner cable such as the RG-58U should be avoided at all cost since its attenuation is considerable at VHF frequencies. Different makes of co-axial cable may have higher losses than indicated in the handbooks. A 100 foot (30½ metres) length of RG-8U cable could register a loss of 2 dB at 50 MHz. This attenuation in the co-axial cable would spoil the low noise figure of an efficient preamplifier. It is for this reason that the use of masthead amplifiers should be encouraged.

HIGH POWER LINEAR AMPLIFIER:

Most commercial six metre rigs have a very low output of about ten watts and this power level is not sufficient to operate effectively on any of the more difficult modes of propagation. It should be increased to at least 100 watts without exceeding the legal input power of 150 watts for CW and FM. Many excellent country-wide QSO's have taken place at this power level on both FM and SSB. However, if you really want to go to town on SSB then the legal limit is 400 watts P.E.P.

Solid state linear power amplifiers are very compact and easy to construct. A 100 watt solid state linear was described in the August 1982 edition of RADIO ZS. Commercial models are also on the market. e.g. the Mirage model A1015 linear etc.

There are also numerous circuits which cover a wide range of transmitting tubes e.g. QQE/QQV 06-40, 4CX250B, or push-pull 6146's, 807's, 8111's and so forth. Class C operation is recommended for CW and FM due to its higher efficiency, but it will have to be rebiased to linear operation for SSB. When operating high power it is imperative to feed the antenna through a strip line filter which will help to reduce the harmonics and other spurious radiation to the desired minimum level. Suitable circuits are given in all the Amateur Radio Handbooks.

Here are a few pointers which will make six metre operating easy.

(a) Keep an eye on the TV weather reports at night for an approaching low pressure system which could produce a temperature inversion and consequent tropo opening.

(b) Tune in to one of the distant six metre beacons such as ZS6SIX – 50,025 MHz (Kempton Park), ZS6SS – 50,110 MHz (Roodepoort) or ZS2SIX – 50,005 MHz (Port Elizabeth), to observe band conditions or any possible openings.

(c) We have pioneered a simple technique to establish meteor contacts, i.e. by monitoring a distant six metre beacon and when a meteor burst occurs, to switch immediately over to the calling frequency and give a short CQ call. The ham who is listening at the other end will respond instantly. Modern sets can readily be programmed for dual frequency operation. See meteor chart and start skeds several hours before Radiant Transit time as given in SAST.

(d) If your QTH is located in a very noisy area then try the FM mode with a high level of preamplification as suggested earlier in this article – the results may surprise you!

(e) Continue monitoring the long distance FM channel on 51,400 MHz which is very active from about 17h30 to 20h00 SAST in the evenings and all day during Saturdays and Sundays.

Once you have brought your equipment up to the standard required, then you could expect some fascinating and unexpected results from this unique 50 MHz band in the VHF spectrum.

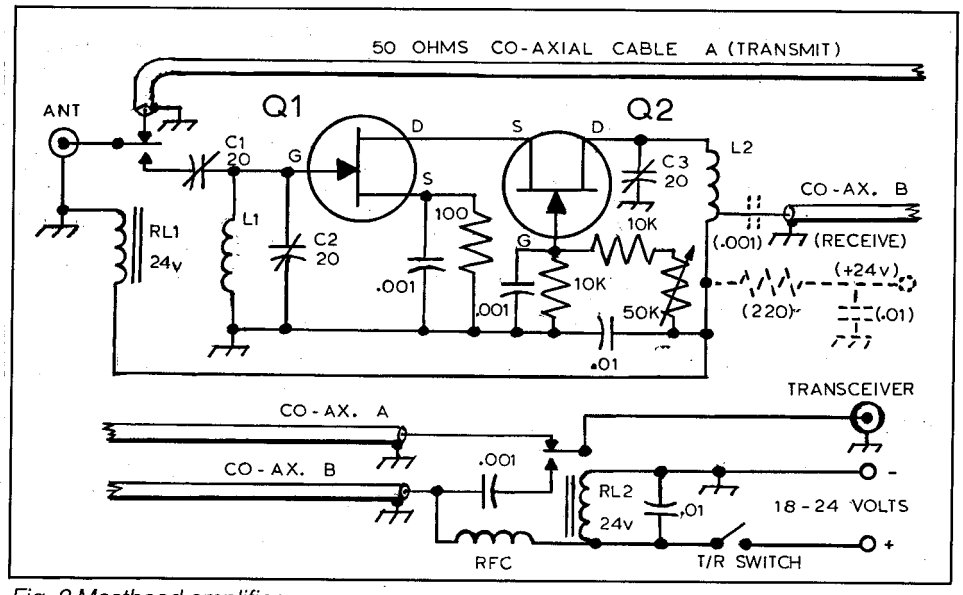

Fig. 2 Masthead amplifier.

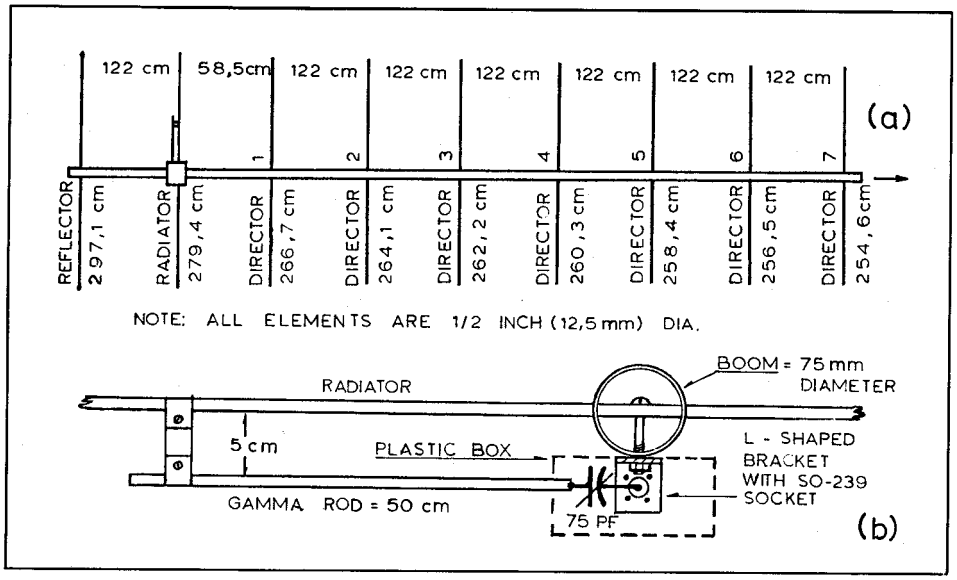

Fig. 3 Long Yagi for 50 MHz.

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