

QRM

BULLETIN ISSUED BY THE NORTHERN ZONES OF THE
WIRELESS INSTITUTE OF AUSTRALIA TASMANIAN DIVISION

P.O. BOX 1010,
LAUNCESTON,
TAS. 7250.

DECEMBER

VOL. 1. NO. 8

REGISTERED AT G.P.O. HOBBART
for transmission by post as
a Periodical. CATEGORY B.

PRICE 5¢.

PAGE 1.

An abundance of food, drink and sunshine helped to make the Harfest at Evandale a big success. Everything went in favour of the organisers with approximately 90 people attending including interstate and overseas visitors.

The 2 meter band was open all through the weekend and dozens of contacts with VK3s were made via the channel 4 repeater.

The R.D. contest results are out and we congratulate the VK4 Division on a job well done. I am sure that if we can talk 6 people into entering a log in excess of 1,000 points next year we can't help but win as we have the participation percentage to do so.

Due to holidays there will be no QRM of the printed variety in January. Deadline for the February issue is January 15th. If you have something that may be of interest please send it to our P.O. Box 1010 and help fill and improve your bulletin.

We wish you a Merry Christmas and a happy and prosperous 1972.

JOHN VK7JV.
EDITOR.

DECEMBER MEETINGS

Tuesday 7th North West Meeting at Lakin's Hall, Ulverstone.

Friday 10th Northern Zone Meeting A.E.B. Rooms, 8 High Street. There will be a lecture on Aircraft Navigational Aids.

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CONTESTS

December 11th - January 23rd Ross Hull Memorial VHF Contest.

February 12th & 13th John Moyle National Field Day.

The Northern Zone meeting held on 12th November was attended by 33 members and visitor MAX 7MX.

Kevin 7ZAH reported that equipment store sales for the month of October was a record \$278. 00.

John 7JV reported on the Council meeting and mentioned that the QSL Bureau has handled 14,000 outgoing QSL cards so far this year. John suggested that the load could be lightened for the QSL manager if amateurs could send their QSL cards direct to the bureaus of some of the more common countries .. like Russian cards to Box 88 Moscow. If you send 7 cards in one envelope direct to an overseas bureau by surface mail it works out about the same in cost.

Peter 7PF reported that the repeater was working fine and that recording of stations using the repeater the previous day had shown that 12 VK7s and 8 VK3s had used the repeater.

Chris 7UX reported that the operation in the Scout Jamboree on the air from Paper Beach camp was very successful and that great interest was shown. A letter was received from the Girl Guides Association thanking us for our participation.

The meeting was followed by the sale of some more equipment from the shack of 7BQ and 3 Mullard films titled "Girdle around the Earth", "Hand Soldered Joints" and "Micro Circuits".

Supper was served at 11.30pm.

THANKS

As with any function the hard work of a few people makes all the difference. In the case of the Hamfest, thanks must go to the LADIES, without their help the show wouldn't have existed. To those behind the scene in the kitchen organising food and to all those who prepared food dishes our sincere thanks for a job well done.

FIRST on the list of volunteer operators in Jamboree on the Air at Paper Beach next year is TREVOR 7TB. It appears the camp was named by Girl Guides around 18 years of age!

NORTH-WEST ZONE NOTES

By the time you read this, Ken 7KH will be back from the land of Nippon, having no doubt tried out his recently acquired knowledge of Japanese. ARIGATO GOZAIMASHITA Ken.

After many trials and tribulations Graham 7ZGS is now part of the Channel B net. Nice going Graham.

Harold 7MZ is also back in the net, after an overhaul of his 2M gear.

We now regard Noel 3NR Mobile Marine on the "Australian Trader" as a member of the local net. We work Noel out at Devonport, Burnie and Bell Bay on 2M. He has channel 4 crystals so look out for him. His solid state outfit is really an eyeful.

Les 7LH was off the air for a week having locked the shack. Understand a wedding in the family became very demanding. Our best wishes Annetto.

Was very pleased to hear from Les 7ZQF at Irishtown. We look forward to seeing you at our meeting soon Les.

Tony 7AX is back from the land of Miss Australia 1972 looking very brown. This time a genuine holiday with many experiences both Radio and otherwise. He assures me that working 2M and navigating city traffic is not compatible.

I again attended the Northern Zone meeting in November. Was privileged to try the new repeater. A remarkable effort chaps! Wish the good fairy would dish out some channel 4 xtals.

As I am on holiday until 30th December, have difficulty finding time to prepare these notes!

CUL 73

7MX.

MURPHY'S LAW

Presented by 7ZGR

Prototyping & Production.

1. Any wire cut to length will be too short.
2. Tolerances will accumulate unidirectly towards maximum difficulty of assembly.

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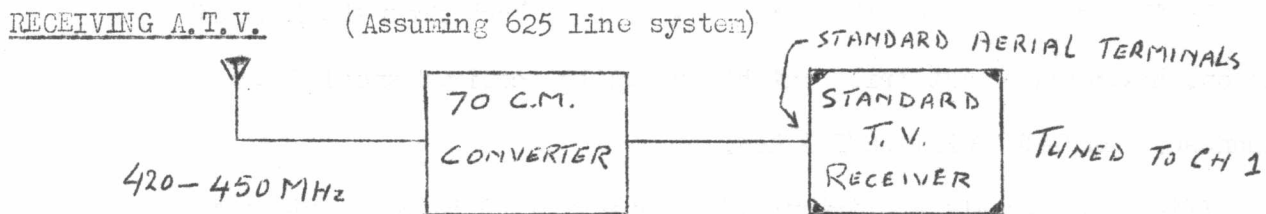
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1. Any wire cut to length will be too short.
2. Tolerances will accumulate unidirectly towards maximum difficulty of assembly.
3. Identical units tested under identical conditions will not be identical in the field.
4. The availability of a component is inversly proportional to the need for that component.



From the above diagram it can be seen that very little equipment is required to receive A.T.V.

AERIAL - This requires the use of a broadly tuned (6MHZ) array on the 70 CM band (420 - 450 MHZ). More about aerials in later articles.

70 CM CONVERTER.

Solid state techniques these days, allow for relatively easy construction of 70 CM converter. The main aim in building an A.T.V. converter is that of optimum bandwidth (6MHZ). Because of the widebandwidth requirement, the converter usually consists of only one stage of frequency conversion. Two types of local oscillator in the converter can be employed.

1. Crystal CSC. chain.
2. L, C CSC.

The crystal osc. is to be preferred because of the good frequency stability, however this is not a major factor. One disadvantage of using a crystal osc. is the extra multiplying stages required for the osc. chain.

An L, C oscillator can work quite satisfactory as a fair amount of frequency drift can usually be tolerated. e.g. 100KHZ drift is not excessive when the bandwidth of the T.V. channel is in the vicinity of 6 MHZ. At the present time I have two of these types of converters under construction. If they come up to expectations, I will endeavour to produce same in a future issue of Q.R.M.

RECEIVER.

As mentioned previously a standard T.V. receiver can be used (when using 625 line system). The receiver does not need modifying in any way. The reason for using channel 1 was not just by accident. When deciding what channel to use, many factors emerge.

1. 1st and most obvious, do not use a channel which is in use in your viewing area.
2. One must take into account all the birdies and spurioses which could occur. As far as I know most A.T.V. ers try to use channel 1 if possible, as this appears to be relatively free from birdies and spurious signals from oscillators etc.

Next time a short article on transmitting A.T.V.

TONY (VK7AX)

WANTED

A good quality all-wave receiver having good AGC action, sensitivity

420-450 MHz
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A good quality all-wave receiver having good AGC action, sensitivity and selectivity.

The receiver need not have a product detector etc. as it will be used primarily for Commercial Broadcast DX.

R.L. GUNTHER, VK7RG,
32 WATERWORKS ROAD,
DYNYRNE. TAS. 7005.

OPERATION WITH THE DJ4ZC/DJ5KQ 432 - to - 144 MHZ REPEATER(COPY FROM AMSAT
NEWSLETTER)

The DJ4ZC/DJ5KQ "H" repeater, described in the March 1971 issue of the "Amsat" Newsletter, is a multiple-access, linear translator, receiving uplink signals between 432.125 and 432.175 MHz and repeating them between 145.975 and 145.925 MHz on the downlink. Sideband inversion occurs in the translation process (i.e., upper sideband becomes lower sideband, and vice versa).

To transmit signals through this repeater, a 432 MHz transmitter and antenna delivering 200-300 watts of effective radiated power (ERP) is recommended. For best results SSB and CW should be used. Although AM, FM, MCW and AFSK will work with the repeater, these modes do not make efficient use of the limited repeater power and should be avoided. We recommend that a "transverter" be used to frequency-translate from 28 or 144 MHz to 432 MHz. In this way, a ten or two-meter SSB or CW transmitter can be converted for VFO-controlled transmission on 432 MHz. For CW operation, an amplifier/tripler can be used to frequency-multiply the output of a two-meter transmitter to 432 MHz (see, for example, Ham Radio, Feb. 1970). A varactor tripler can also be used (see the ARRL Handbook). Perhaps the least expensive method of generating CW power on 432 MHz is to obtain a surplus 450 MHz FM transmitter strip and modify it for CW operation on 432 MHz. An article on this approach is planned by the ARRL Headquarters staff for a future issue of QST. It is strongly recommended that some provision for adjusting the power output of the transmitter be included. This is desirable to be able to adjust for the proper balance of satellite repeater power among users.

The antenna gain recommended for transmission to the satellite repeater will depend upon the transmitter output power. A 20 watt transmitter will require a 10-12 dB antenna gain to obtain the recommended ERP of 200-300 watts. A better approach would be to add a 200 watt power amplifier, in which case a dipole or ground plane should provide enough uplink signal to the satellite, and then there will be no need to keep the antenna pointed toward the satellite. The satellite antennas for this repeater will be circularly polarized, so that linear polarization (either horizontal or vertical) can be employed on the ground. Circular polarization can be expected to provide as much as 3 dB over linear and is probably worth the effort. Because the spacecraft will be magnetically stabilized, the orientation of the satellite will be constantly changing and the sense of polarization will depend upon ground station location. Stations in the northern hemisphere should use right-hand circular polarization, and those in the southern hemisphere, left-hand circular.

For receiving, any good two-meter converter should be suitable, and a two-meter receiving antenna having a gain on the order of 10dB should provide good results. Linear polarization is satisfactory, but again, circular polarization can be expected to provide as much as 3 dB improvement (use right-hand circular in the northern hemisphere, left-hand circular in the southern hemisphere). If a 10-dB antenna is not available, a ground plane or crossed-dipole should provide detectable signals from the repeater's ten-watt PEP transmitter. The receiver should be capable of receiving SSB and CW (i.e., have a BFO, and a bandwidth less than 4 KHz), and most HF receivers should be suitable for the purpose. Transceive operation is not recommended, because it is highly desirable that all stations be able to monitor their own downlink signals during the periods in which they are transmitting.

OPERATION WITH THE AMSAT TWO-TO- TEN METER REPEATER

The Amsat two-to-ten meter repeater, described in the March 1971 issue of the "Amsat" Newsletter, is a multiple-access linear translator which receives uplink signals between 145.900 and 146.000 MHz, and retransmits them between 29.550 and 29.450 MHz on the downlink. Sideband inversion takes place in the translation process (i.e., upper-sideband becomes lower-sideband,

vice versa).

To transmit signals through this repeater, a 432 MHz transmitter and antenna delivering 200-300 watts of effective radiated power (ERP) is recommended. For best results SSB and CW should be used. Although AM, FM, MCW and AFSK will work with the repeater, these modes do not make efficient use of the limited repeater power and should be avoided. We recommend that a "transverter" be used to frequency-translate from 28 or 144 MHz to 432 MHz. In this way, a ten or two-meter SSB or CW transmitter can be converted for VFO-controlled transmission on 432 MHz. For CW operation, an amplifier/tripler can be used to frequency-multiply the output of a two-meter transmitter to 432 MHz (see, for example, Ham Radio, Feb. 1970). A varactor tripler can also be used (see the ARRL Handbook). Perhaps the least expensive method of generating CW power on 432 MHz is to obtain a surplus 450 MHz FM transmitter strip and modify it for CW operation on 432 MHz. An article on this approach is planned by the ARRL Headquarters staff for a future issue of QST. It is strongly recommended that some provision for adjusting the power output of the transmitter be included. This is desirable to be able to adjust for the proper balance of satellite repeater power among users.

The antenna gain recommended for transmission to the satellite repeater will depend upon the transmitter output power. A 20 watt transmitter will require a 10-12 dB antenna gain to obtain the recommended ERP of 200-300 watts. A better approach would be to add a 200 watt power amplifier, in which case a dipole or ground plane should provide enough uplink signal to the satellite, and then there will be no need to keep the antenna pointed toward the satellite. The satellite antennas for this repeater will be circularly polarized, so that linear polarization (either horizontal or vertical) can be employed on the ground. Circular polarization can be expected to provide as much as 3 dB over linear and is probably worth the effort. Because the spacecraft will be magnetically stabilized, the orientation of the satellite will be constantly changing and the sense of polarization will depend upon ground station location. Stations in the northern hemisphere should use right-hand circular polarization, and those in the southern hemisphere, left-hand circular.

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To transmit signals through the two-to-ten meter repeater, a two-meter transmitter and antenna capable of providing 80-100 watts of ERP is recommended. For best results SSB and CW should be used. Flight tests with the repeater aboard aircraft demonstrated that AM and FM signals are not very readable when relayed by the repeater, and they make very inefficient use of the limited repeater power (1-2 watts). CW operation is generally possible with most two-meter transmitters. The most expedient means of achieving an SSB capability on two meters is through the use of a transverter which can up-convert the output of a ten, twenty or six-meter SSB or CW transmitter to two meters. Transverters of this type are available from several amateur radio equipment manufacturers, and are also described in the ARRL Handbook and the VHF Manuals published by the RSGB and ARRL. Transverters are also usable on CW, and have the added advantage that they provide a VFO capability if the basic transmitter already has a VFO.

The antenna gain recommended for transmission to the two-to-ten meter satellite repeater will depend upon the transmitter output power. A 20 watt transmitter will require a 6-7 dB antenna gain to obtain the recommended ERP of 80-100 watts. It would be preferable to use a transmitter in the 50-100 watt power output class, so that a nondirectional dipole or ground plane antenna can be employed and pointing of the antenna toward the satellite will not be necessary. The satellite two-meter receiving antenna will be circularly polarized so that linear polarization (either horizontal or vertical) can be employed on the ground. If circular polarization is available at the ground station, as much as 3 dB less transmitter power will be required for good communications. (Stations in the northern hemisphere should use right-hand circular polarization and those in the southern hemisphere should use left-hand polarization).

Any good HF receiver capable of receiving SSB and CW on the ten-meter band should be suitable for receiving the ten-meter downlink signals if the receiver sensitivity is one-microvolt/meter or better and the local noise level does not exceed this level. A circularly polarized crossed-dipole should be adequate for receiving in low-noise environments, but a higher gain antenna, such as a three-element beam should provide better results, especially if it is circularly polarized. The satellite ten-meter transmitting antenna will be linearly polarized (a dipole), and Faraday fading can be expected to occur just as was the case for Australis-OSCAR-5, unless a circularly polarized receiving antenna is used at the ground station. The use of transceivers is not recommended. Separate transmitting and receiving equipment should be used because it is highly desirable that all stations be able to monitor their own down-link signals while transmitting.

OPERATION WITH THE AUSTRALIS 144-to-435 MHz FM REPEATER

The Australis 144 - 435 MHz repeater is now a one channel only hard-limiting repeater of the demodulation-remodulation type, and is designed to handle FM signals only (CW, SSB and AM cannot be used with this repeater). The repeater receives FM uplink signal on 145.80 and retransmits on 435.10 on the downlink. Telemetry 435.2 out.

Transmission of signals through the 144-435 MHz repeater will require a two-meter transmitter and antenna capable of providing a minimum ERP of 200-300 watts. Only FM should be used, with a deviation of ± 7.5 KHz. Available two-meter FM amateur transceivers and converted taxicab radios should operate satisfactorily, but a power amplifier should be used to increase the output power. If the power output is 50 watts, a 6-8 dB antenna gain should be sufficient. It would be advantageous, however, to use a power amplifier in the 100-200 watt power output class so that a non-directional dipole, ground plane or vertical antenna can be employed without requiring pointing toward the satellite. The satellite two-meter receiving antenna will be circularly polarized, so that linear polarization (either horizontal or vertical) can be used on the ground. The use of circular polarization on the ground will reduce the transmitter power requirements by as much as 3 DB (use right-hand circular polarization in the northern hemisphere, and left-hand circular in the southern hemisphere. Reception can perhaps most easily be achieved through the use of a good, low-noise 435-to-144 MHz receiving converter, which will convert the same two-meter FM transceiver that is used for transmission.

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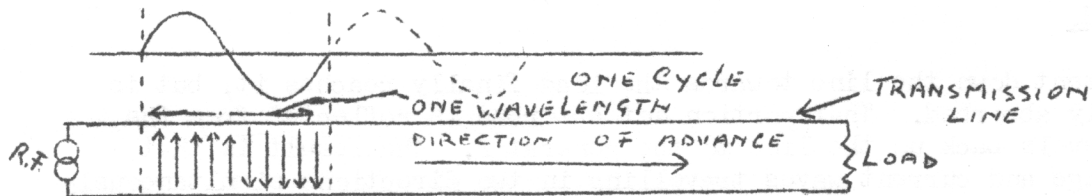
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PART 2 : ELECTRICAL WAVELENGTH.

One wavelength is the dimension occupied by the electromagnetic field for a single cycle of the applied R-F voltage.



1 electrical wavelength is designated by the Greek symbol (λ). A definition of 1 wavelength could be the lineal dimension occupied by the electric lines of force created by all the amplitude variations of voltage in 1 cycle.

wavelength in meters (λ)

$$\lambda = \frac{\text{Velocity of the energy in meters per second}}{\text{Frequency in cycles per second}}$$

Frequency in cycles per second

VELOCITY OF PROPAGATION (V.P.)

The velocity of propagation electromagnetic energy, (as it is advancing) varies with physical media. Different kinds of transmission lines bear different V.P. constants.

Some examples :

$$\text{IN METERS } \lambda = \frac{300 \times 10^6}{f \text{ Hz}} \quad (\text{FREE SPACE})$$

A frequency of 30 MHz has an electrical wavelength of 10 meters in free space, therefore a velocity factor of 1 exists! But if the same 30 MHz signal was connected to a transmission line, the wavelength would be somewhat shorter than 10 meters. This length would depend on the V.P. of the transmission line.

Typical figures :

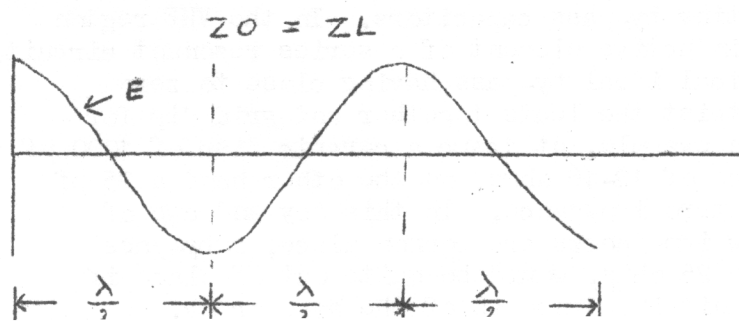
Open wire = V.P. 98%

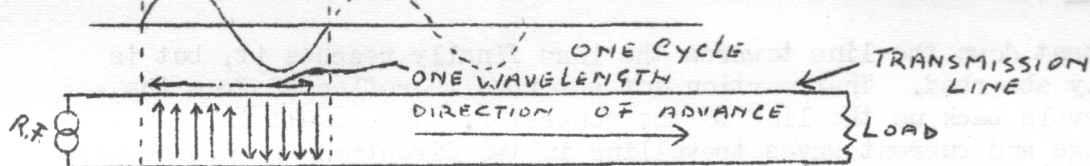
Twin lead = V.P. 82%

Coaxial cable = V.P. 66%

at 30 MHz in free space = 10 meters or 393.7 inches

at 30 MHz in coaxial cable having a V.P. of 0.66 = 259.8 inches

PHASE RELATIONSHIP IN A TERMINATED LINE



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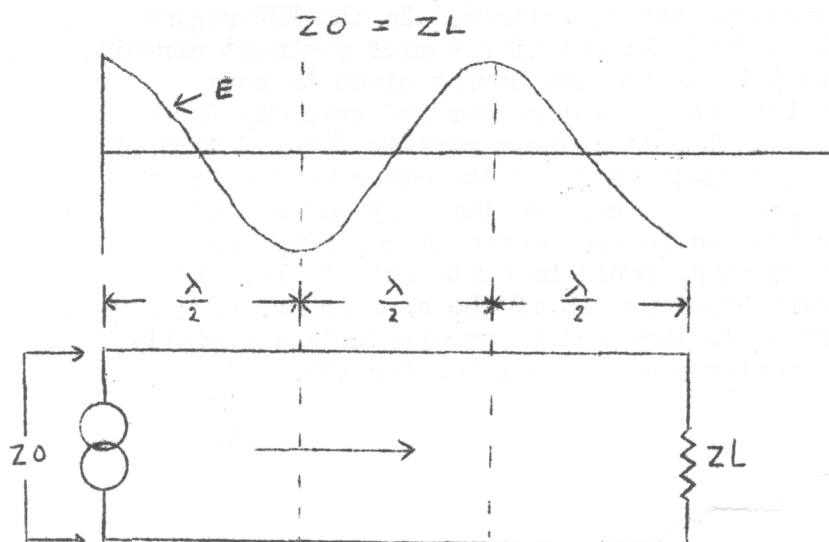
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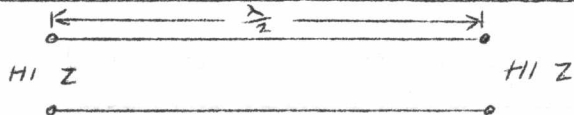
The phase of Voltage and Current changes every half-wavelength :
therefore in phase at 1 wavelength.

TRANSMISSION LINE NOT TERMINATED TO ITS CHARACTERISTIC IMPEDANCE Z_0 .

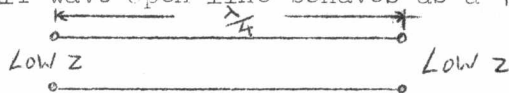
MISMATCH.

Energy sent down the line towards the load finally reaches it, but is only partially absorbed. That portion not absorbed is reflected from the load, and travels back up the line to the generator. The result is that we have voltage and current waves travelling in two directions simultaneously in the line. The forward and reflected voltage waves combine and produce resultant sum voltage waves known as standing waves. The useful energy absorbed by the load is the difference between the forward energy and the reflected energy.

RESONANT TRANSMISSION LINES (OPEN CIRCUITED).

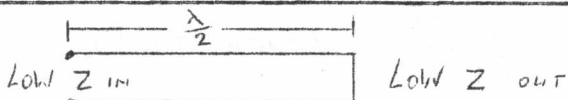


A half wave open line behaves as a 1 to 1 impedance transformer.

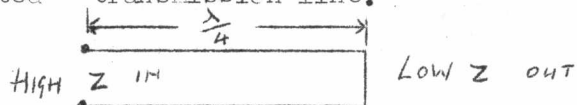


A quarter wave open line behaves as a low Z at its input and a high Z at its output.

RESONANT TRANSMISSION LINE SHORT CIRCUITED.



A low impedance will appear at the input terminals of a short circuited transmission line.



Behaves as a very high impedance at the input.

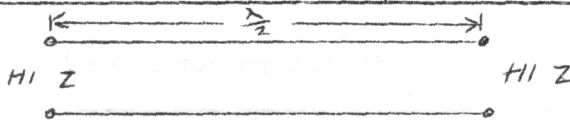
TREVOR VK7TB

VHF CONSTRUCTION TIP

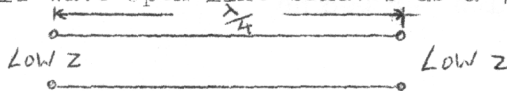
The generally accepted method of by-passing at VHF is to connect the capacitors with the shortest possible leads, but this may not be the real answer. At 50mc and above the lead inductance and internal inductance must be considered when selecting by-pass capacitors. In the VHF region the leads can be used as the inductive element of a series resonant circuit. Such a circuit is the theoretical ideal by-pass having close to zero impedance. The method is to twist the leads together and grid dip for frequency of operation. As an example, at 144mc a ceramic disc of 1000 pf with 3/8 leads has an impedance of 12-16 ohms, on the other hand a 25 pf with 1 inch leads is close to zero impedance. In this day and age of transistor circuitry where low impedances are common place, a by-pass whose impedance is around, say 25 ohms, would be quite out of place if used at a point where the circuit impedance is of the same order. A

Energy sent down the line towards the load finally reaches it, but is only partially absorbed. That portion not absorbed is reflected from the load, and travels back up the line to the generator. The result is that we have voltage and current waves travelling in two directions simultaneously in the line. The forward and reflected voltage waves combine and produce resultant sum voltage waves known as standing waves. The useful energy absorbed by the load is the difference between the forward energy and the reflected energy.

RESONANT TRANSMISSION LINES (OPEN CIRCUITED).

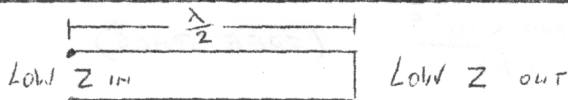


A half wave open line behaves as a 1 to 1 impedance transformer.



A quarter wave open line behaves as a low Z at its input and a high Z at its output.

RESONANT TRANSMISSION LINE SHORT CIRCUITED.



A low impedance will appear at the input terminals of a short circuited transmission line.



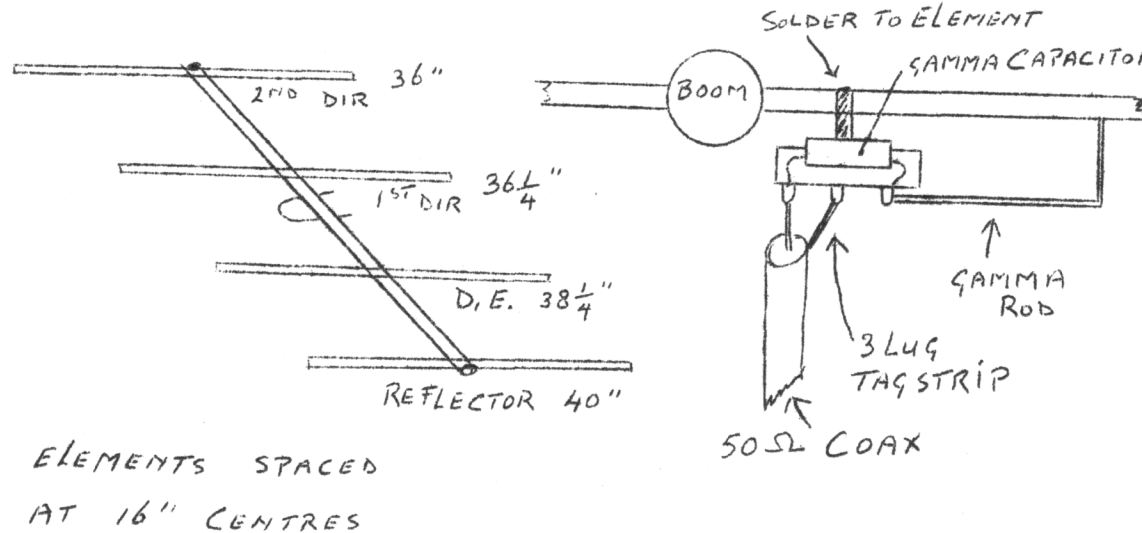
Behaves as a very high impedance at the input.

TREVOR VK7TB

VHF CONSTRUCTION TIP

The generally accepted method of by-passing at VHF is to connect the capacitors with the shortest possible leads, but this may not be the real answer. At 50mc and above the lead inductance and internal inductance must be considered when selecting by-pass capacitors. In the VHF region the leads can be used as the inductive element of a series resonant circuit. Such a circuit is the theoretical ideal by-pass having close to zero impedance. The method is to twist the leads together and grid dip for frequency of operation. As an example, at 144mc a ceramic disc of 1000 pf with 3/8 leads has an impedance of 12-16 ohms, on the other hand a 25 pf with 1 inch leads is close to zero impedance. In this day and age of transistor circuitry where low impedances are common place, a by-pass whose impedance is around, say 25 ohms, would be quite out of place if used at a point where the circuit impedance is of the same order. A little attention to this important feature, will pay dividends especially in that high gain low noise converter you are building for 432.

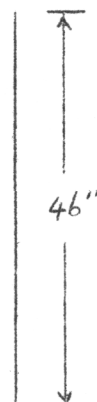
7AK.

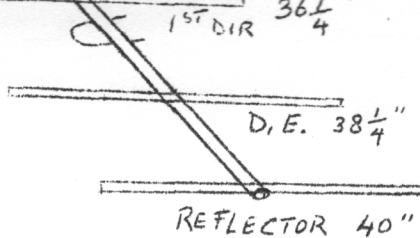
2 METRE LIGHT WEIGHT BEAM.

This 4 element beam was whipped up in half a morning and is currently serving duty for local contacts. If you need a second beam or a cheap lightweight collapsable beam, then this should be of interest to you. The boom is $\frac{3}{4}$ " plastic conduit and the elements are fitted by drilling a hole two sizes too small for the elements and then forcing them through. With care it is possible to pull them out again and again without loosening them. The elements are slightly offset to allow the gamma match to be fitted to the centre of the driven element. They need not be offset if the beam is not required to collapse. Elements in the original were made from stiff No. 10 copper wire although $\frac{1}{8}$ " aluminium tubing will also work. The prototype was not weather proofed and a permanent installation would require more attention in this respect.

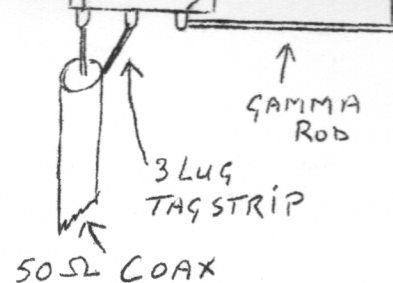
VK7ZMS

2M. MOBILE WHIP

 $\frac{5}{8} \lambda$ LONG



ELEMENTS SPACED
AT 16" CENTRES

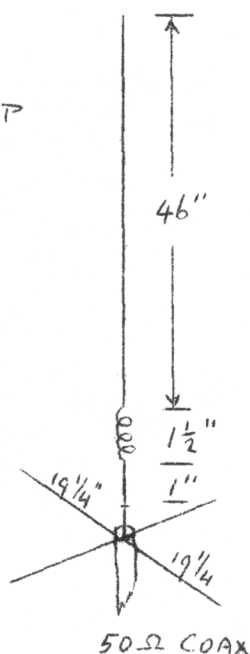


This 4 element beam was whipped up in half a morning and is currently serving duty for local contacts. If you need a second beam or a cheap lightweight collapsable beam, then this should be of interest to you. The beam is $3/4$ " plastic conduit and the elements are fitted by drilling a hole two sizes too small for the elements and then forcing them through. With care it is possible to pull them out again and again without loosening them. The elements are slightly offset to allow the gamma match to be fitted to the centre of the driven element. They need not be offset if the beam is not required to collapse. Elements in the original were made from stiff No. 10 copper wire although $1/8$ " aluminium tubing will also work. The prototype was not weather proofed and a permanent installation would require more attention in this respect.

VK7ZMS

2M. MOBILE WHIP

$5/8 \lambda$ LONG



$L = 11$ TURNS 14 GAUGE

TURNS OPENED OR CLOSED FOR TUNING
WHEN TUNED COVER WITH ARALDITE