



NERG NEWS

North East Radio Group Inc
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Incorporated 1985 Victoria Reg No A0006776V
Affiliated with the WIA
Editor - Greg VK3VT

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NERG Net

The NERG NET will be on non-meeting Thursday evenings on the VK3RMH 70cm repeater. That is 433.325MHz repeater input with 91.5Hz CTCSS. Set your receive frequency to 438.325MHz. 8:30pm. You can also use the 9700 remote to take part.

November 2024

WHAT'S ON THIS MONTH?

Monthly meeting

Thursday 14th November - 8PM

NERG White Elephant Sale – Bring along that gear that you would like to move on and buy something a bit different, NERG Members Table free (members make a donation commensurate with takings on the night to a max of \$20), non-member \$20. **MUST REMOVE ALL YOUR ITEMS AT THE END OF THE NIGHT!** Email vk3cne at gmail.com for any assistance.

Every Thursday afternoon – Radio Café

At the hall – Commencing at 2:00pm

Come along and play with the radios, have a chat and a cuppa, bring your favourite nibbles.

Forth Tuesday of the month –

Gainfully Unemployed Group

Please let Jim know if you are coming to the next one on Tuesday 26th November 2024

If you would like to be a member of the mailing list for this group please request membership on groups.io the group name is nerg-gug.

Kit Building and Testing plus Foundation Training and General Assessment Day

Saturday 23th November 2024 Training commences at 9am, if you would like to attend or undertake an assessment for any licence class please let us know at vk3cne@gmail.com or training@nerg.asn.au

Kit day starts around 10am lunch will be available.

A Modular 6cm Transverter

Part 3 Mixer and Switch

By Paul McMahon VK3DIP

This time I concentrate on the Mixer, and the following switch.

Which Mixer to use?

After actually working for 5.7GHz the most important criterion for the mixer I had was that it be available in one offs and at a reasonable price. I initially identified three possibilities. The first was one that I happened to already have to hand, was the Mini-Circuits MBA-591. The MBA-591 is a passive +7dBm mixer with the RF and LO ports rated at 2.8 to 5.9MHz. I actually got to the point of doing a PCB layout for this mixer (see Figure 1 MBA-591 PCB) but then discovered I couldn't find a good source for it now. I had got my original sample from W1GHZ because at that time it was what he used in one of his rover transverters.

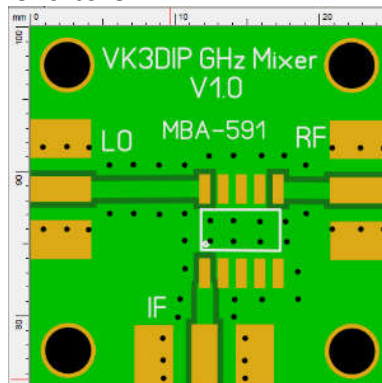


Figure 1 MBA-591 PCB

Moving on from the MBA-591 I next found the ADL5801 which is available as a prebuilt module for about \$18 from several AliExpress stores. A typical example I purchased with the metal can removed is shown in Figure 2 - ADL5801 Active Mixer Module.. As can be seen the ADL5801 is an active device requiring a power supply, but as a result of this it actually requires only 0dBm LO drive and actually has some 1.8dB conversion gain rather than loss. The IF can handle up to 600MHz and RF and LO 10MHz to 6 GHz. It also has differential LO and RF ports and provides a DC level detector output. Basically it more than fits the bill but I was worried that it was a bit too complicated plus I would have to pad my LO drive down quite a bit.

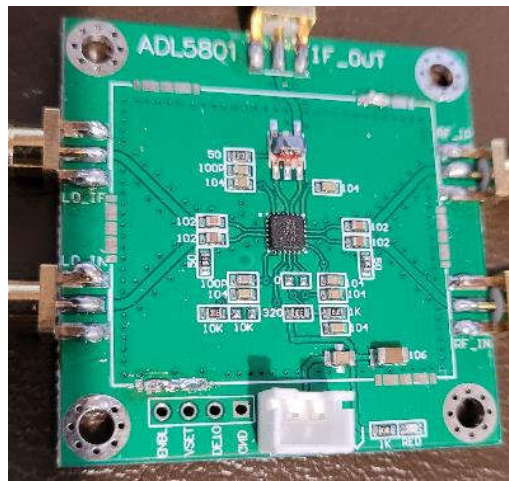


Figure 2 - ADL5801 Active Mixer Module.

The last mixer I came across (last just because it was what I ended up using, and there are probably many other possibilities out there) is the ex-Hittite (Now Analog Devices) HMC220 +13dBm passive mixer. This device has a lot going for it in this application, available on AliExpress for some \$7 each for just the chip, this device is specified for an IF of 0 to 4GHz, and RF and LO ports from 5GHz to well in excess of 10GHz. You may recall from the LO section I had an output of some 12.9dBm available which should fit the bill for the 13dBm LO drive. The only question then is do I do another PCB layout for this chip or do I try something else? The thing that got me looking at something else was the 10GHz spec. of the mixer. FR4 the most commonly available (cost effective) PCB material does not work very well at 10GHz, even at 5.7GHz the losses in FR4 are quite considerable so I have only used it where I have readily available gain to counteract it. Anyway, with the HMC220 I wanted to try air line (posh talk for flying leads) construction. I found a supplier on AliExpress that was selling nice little (about 1 inch square) milled anodised aluminium boxes for about \$8 each in 5 off and got one lot.

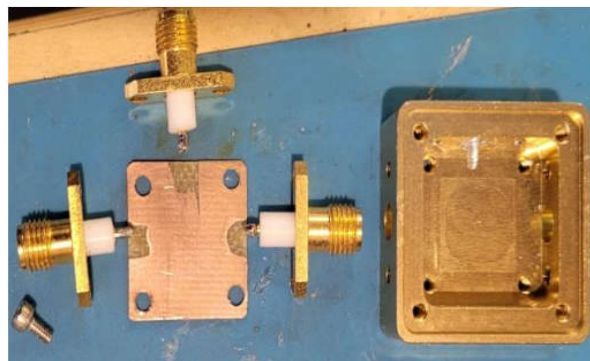


Figure 3 - Enclosure and blank PCB.

The box used two hole bolt on SMA connectors with extended dielectric that I had some of available from a previous AliExpress order, and it was a reasonably simple matter to drill and tap holes in the box for a third connector (the box only came with holes for connectors on two sides).

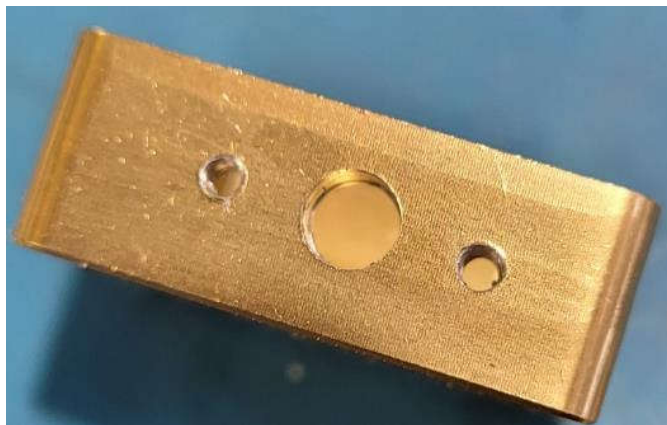


Figure 4 – Box with extra holes.

The central hole was 4mm and the two mounting holes were drilled at 1.5mm and tapped to M2. The PCB was a small piece of thin FR4 PCB, but as I am not intending to actually use it as anything other than a ground plane the losses should be irrelevant.

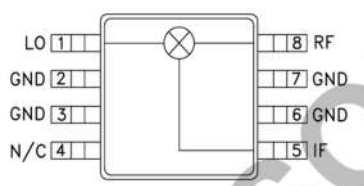


Figure 5 - HMC220 pinout.

As can be seen in the pinout in Figure 5 - HMC220 pinout. while the chip has 8 pins most of them just go to ground (or NC). The idea then was to just slightly bend up pins 1, 5, and 8 and air wire them to the relevant coax sockets. This turned out to be a fairly fiddly task as the chip is very small, but I ended up with the result shown in Figure 6 - Wired Mixer chip, and Figure 7 - Closeup of Wiring. The individual pieces of wire over the ground plane in air will have some random impedance (actually for interest AppCad suggests given the dimensions used the impedance should be about 100 Ohms) but as they are only about a tenth of a wavelength long hopefully any mismatch will not be a problem, and the air dielectric should mean low losses. The only issue I may have is some undesired coupling from the LO to RF ports so if I was using this at 10GHz I would probably put a bit of shielding around the LO and RF wires to cut this coupling back a bit. This would also lower the air line impedance a bit which would possibly improve matching also.

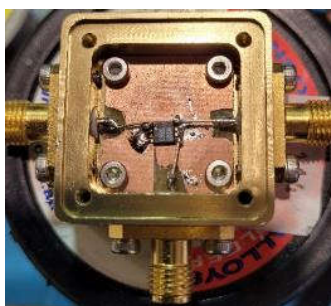


Figure 6 - Wired Mixer chip



Figure 7 - Closeup of Wiring

You will note I removed a section of copper under each coax centre pin to prevent shorts, and it is bare wire so as noted before the idea is to have an air dielectric with the wire parallel to the ground.

The finished mixer with its lid on is shown in Figure 8 - Finished Mixer..



Figure 8 - Finished Mixer.

To test the mixer I fed the LO port direct from the LO chain from the previous part and simulated the expected transmit and receive flows using a signal generator and Spectrum Analyser. The LO level was a shade low but the HMC220 specs suggested that LO drive down to 10dBm would still work fine.

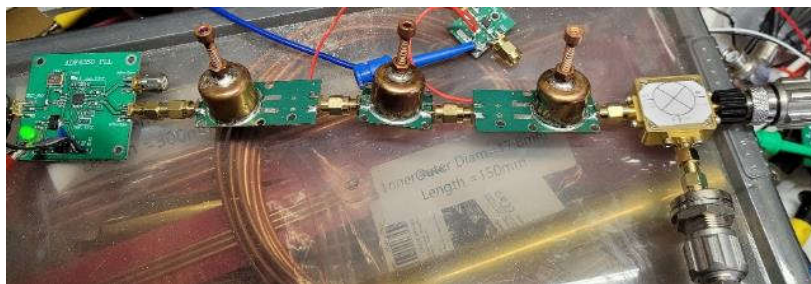


Figure 9 - Mixer Tests

In the first test emulating the TX path I fed a 0dBm level CW signal at 432 MHz from the signal generator into the IF port with the Spec.An on the RF port. The result is shown in Figure 10 - 0dBm 432MHz into IF.

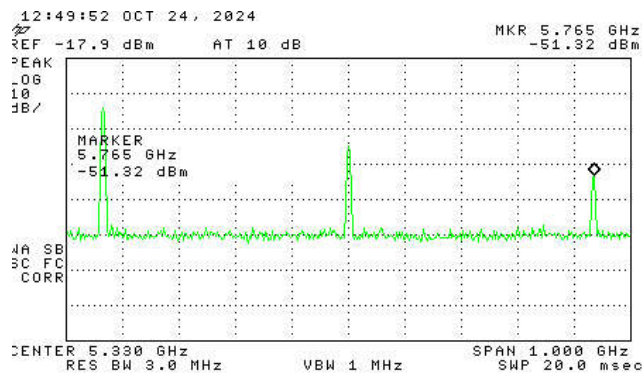


Figure 10 - 0dBm 432MHz into IF

Note, I did have a 30dB attenuator in the Spec.An input line just in case. With the datasheet suggesting of the order of a 10dB conversion loss with about 10dBm of LO drive, best case we should be seeing about 0dBm out. We can see that the desired signal at 5.76GHz is weaker than both the LO and image signal but is still perfectly usable. Allowing for the extra attenuator the image level is pretty much exactly where the datasheet would suggest with the required signal some dBs below that. This sort of performance is not unusual as losses will increase as frequency increases and you will often see the higher frequency (sum) product be at lower level than the lower (frequency) (difference) product. This gives a good indication what sort of filtering will be required in the TX path as well as gain, with the filters narrow enough to reject both 5.3GHz and 4.9GHz and sufficient gain to come up from this level to whatever output is required.

The second test emulated the RX path. Here a 5760MHz signal at about 0dBm is fed into the RF port and the Spec.An. is on the IF port. The output obtained is shown in Figure 11 - RX emulation 0dBm 5760MHz into RF.

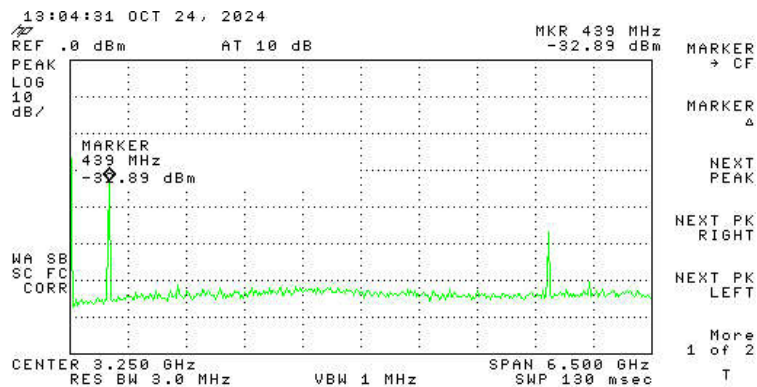


Figure 11 - RX emulation 0dBm 5760MHz into RF.

Here the frequency losses are working in our favour with the 70cm IF output being pretty much exactly at the expected level (allowing for the attenuator etc.) The frequency is a bit off because my 5.76 GHz signal generator is not frequency locked, it's actually a sweep generator turned down to zero sweep, so it would not have been exactly on 5760MHz. The test is still valid though, and again gives a good idea of the requirements for gain and filtering in the RX path.

Before we completely specify the gain required in each path we also need to take account of the TX/RX switch required on the Mixer RF port. In the above tests I just moved cables so my switch effectively had zero loss, but a real-life switch will not be able to achieve this.

Which Switch?

As mentioned in part one, the conventional transverter with a single mixer and single antenna requires two switches one at the RF port of the mixer, and one at the antenna port. Of the two the antenna port switch is the more critical as it must both handle the high TX power, and have a low loss so as to not to impact the RX noise figure. The Mixer switch on the other hand, while still at the final frequency (i.e. 5760MHz), needs to handle considerably lower power levels, and losses can be relatively easily made up with additional gain, without impacting noise figures. In fact, in the W1GHz rover transverter designs he often just uses a resistive splitter/pad instead of a switch in this position. Of course, this only works because he also switches the power to the respective RX and TX gain stages preventing the inevitable feedback loop of a connecting the output of a high gain tuned amplifier effectively to the input of another equivalent filter/amplifier. The assumption being that the unpowered amplifier will not be destroyed by the signal going through the powered strip. The 6dB loss of the splitter helps with this a bit but it is still quite a bit of gain to make up, and of course if something goes wrong with the RX and TX power rails sequencing then ##### will happen.

In my case I want to use an actual switch for the mixer, and given I can live with some “on” losses so long as the “off” isolation is reasonably high, an IC RF switch should do fine. So, its back to AliExpress again looking for an available switch with likely specs. at a reasonable price.

Once again, I found an ex-Hittite now Analog Devices part the HMC849, this time as a module on a small board with SMA connectors. See Figure 12 - HMC849 0-6GHz SPDT Switch.

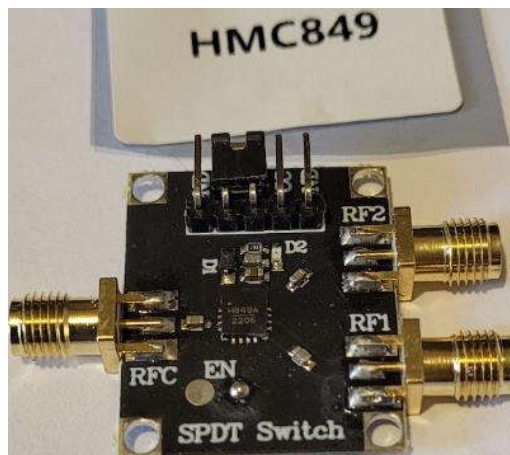


Figure 12 - HMC849 0-6GHz SPDT Switch

This little board could be purchased for around \$11 and the specs sounded ideal. Good to 6GHz, worst case 2.5dB “on” loss and 35dB “off” isolation at 6GHz, and runs off 3.3V or 5V with very simple switching connecting the control line to either VCC or GND to select the switch state. As the board came it had the enable (EN) line grounded (i.e. switch enabled) via a blob of solder to earth which you can just see in the picture. While it could theoretically handle a couple of watts the loss at 6GHz would probably be too high for antenna switching use.

Connecting the switch up to 5V and the VNA gave S21 results as shown in Figure 13 - S21 Common to RF1 switch on. and Figure 14 S21 Common to RF1 switch off..

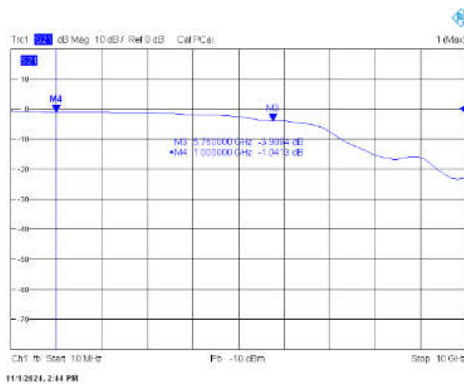


Figure 13 - S21 Common to RF1 switch on.

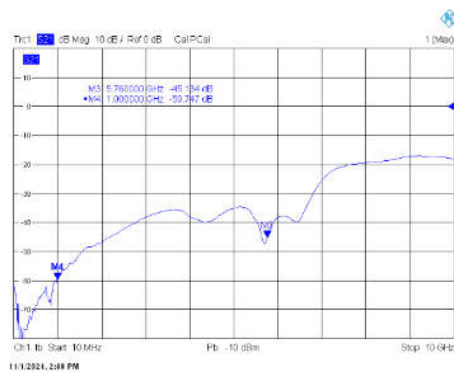


Figure 14 S21 Common to RF1 switch off.

In summary about 3.9dB through loss at 5.7GHz (which is a dB or so worse than the data sheet worst case) and about 45dB off isolation (which is some 10 dB better than the data sheet worst case). While the on loss is a bit higher than I would like (possibly due to the use of FR4 PCB and no name SMA connectors) it is still perfectly suitable for the mixer switch role here.

If I was doing this transverter as a commercial product then I would probably end up with both of these HMC parts on a single low loss substrate such as Alumina or Teflon. It is possible however that these parts are currently available and relatively cheap because of the transfer from Hittite to Analog Devices and they may be being discounted to run out stocks.

Next Time.

Next time I will look at the TX chain. I have found a supply of pipe caps (via Amazon) at the right price but I have had to buy them 50 at a time. They are also slightly larger, so I have had to redo my proto PCB, but that is back from JLCPCB now, so I am all set for the next steps.

73 Paul VK3DIP.

NERG Social event Report – Saturday 26th October.

A small but vibrant group of NERGs gathered at 'Walk the Wok' for a Chinese meal after kit & training day on Oct' 26.

On hand were: Steve Mann, Phil Vis, David Aston, Peter and Sue Crawford, Colin Donnison, John Costa and Anthony Plumb.

The food was nice and the wine three of us bought even better! They were very fair with us, dropping one corkage (per bottle) which I thought was very fair of them.

We try to hold quarterly dinners at various restaurants around the Eltham / Greensborough area. If you have an idea for a NERG dinner, please contact Anthony Plumb on: 0434 247 282.

The next Social event is the NERG Christmas Dinner – at the hall, on December 12th.

NERG Monthly lunch at Greensborough RSL October report.

On the 4th Tuesday of each month, the retired NERG's (The Gainfully Unemployed Group) meet for lunch at the Greensborough RSL.

These lunches are arranged by Jim Baxter and we appreciate his consistency over many years organising these get-togethers.

Present and pictured: Ewan and Janelle, Jim, Anthony, Colin, Ed, Marie and Bill, and Peter.

The food was good – the menu has certainly improved there since I last dined, and the company – being a NERG event – was superb. 73 Anthony VK3YH



If you can make a 4th Tuesday lunch, let Jim Baxter know: 0438 671 253. All are welcome.

Another DX award Pic

At the AGM a number of DX awards were presented, Luke VK3HJ was not there to receive his but was at the October meeting and so Anthony presented him with his First Place Extra Class award.



NERG meets with Banyule City Council

Prior to the October NERG RSL lunch Peter VK3PPC and Anthony VK3BNR met with our liaison person, Nicole at the Council offices above Watermarc in Greensborough. We had a very fruitful meeting and covered the last year so from a club point of view, as well as the view ahead for us at the hall.

The council are happy with the club in all areas. Over the next 3-5 years, there are preliminary plans for a kitchen and bathroom facelift at Briar Hill Community Hall. Peter and I then joined the other NERG's for coffee and lunch at the RSL 😊.

November 2024 PLANNED DXPEDITIONS

Some good DX coming up. The solar cycle is near its peak so get on the air and get your country count up. Remember the NERG is trying to improve on our 13th place in the world club ranking in the DX marathon, we need your score to help us.

Start	End	Entity	Callsign
Nov 02	Nov 22	St Helena	ZD7
Nov 02	Nov 09	Maldives	8Q7TR
Nov 03	Nov 09	Honduras	HR9
Nov 03	Nov 12	Turks & Caicos	VP5
Nov 05	Nov 12	Cayman Is	ZF2KM
Nov 05	Nov 14	Belize	V31TL
Nov 06	Nov 13	Guam	KH2
Nov 06	Nov 16	St Kitts & Nevis	V47JA
Nov 07	Nov 18	Reunion	FR
Nov 07	Nov 24	South Cook Is	E51SGC
Nov 08	Dec 12	Fiji	3D2TP
Nov 10	Nov 13	Guam	WR7B
Nov 11	Nov 16	French Polynesia	FO
Nov 11	Nov 20	Sao Tome & Principe	S9Z
Nov 14	Nov 20	Palau	T8
Nov 15	Nov 23	French Guiana	FY
Nov 15	Nov 25	Falkland Is	VP8G
Nov 15	Dec 04	Rotuma	3D2Y
Nov 16	Nov 29	Wallis & Futuna	FW7AA
Nov 19	Nov 26	Chatham Is	ZL7YL
Nov 19	Nov 28	Galapagos	HD8CW
Nov 19	Nov 29	St Martin	FS
Nov 25	Nov 29	Gambia	C5T
Nov 25	Dec 06	Tonga	A35GC
Nov 27	Dec 08	Sierra Leone	9L5A
Nov 30	Dec 02	Fiji	3D2NB
Nov 30	Dec 13	St Martin	TO9W
DECEMBER			
Dec 02	Dec 07	India	AU2K
Dec 08	Dec 18	Br Virgin Is	VP2VMM

Thanks to <http://www.ng3k.com/misc/adxo.html>

November 2024 CONTESTS

For RTTY contestors this weekend sees the **WAE DX RTTY** on the 9th & 10th. - read the rules on this one and have some fun sending Q???. The last weekend in November sees the biggest CW contest of the year in the **CQ WW CW** on the 23rd and 24th this is a great contest to snag a few rare countries as a lot of operators visit exotic places. N1MM+ is the logger for all of these.

Contest	Times & Dates
WAE DX Contest, RTTY	0000Z, Nov 9 to 2359Z, Nov 10
10-10 Int. Fall Contest, Digital	0001Z, Nov 9 to 2359Z, Nov 10
JIDX Phone Contest	0700Z, Nov 9 to 1300Z, Nov 10
OK/OM DX Contest, CW	1200Z, Nov 9 to 1200Z, Nov 10
South American Integration Contest CW	1800Z, Nov 16 to 2100Z, Nov 17
ARRL Sweepstakes Contest, SSB	2100Z, Nov 16 to 0300Z, Nov 18
CQ Worldwide DX Contest, CW	0000Z, Nov 23 to 2400Z, Nov 24
Ham Spirit Contest	0800Z, Nov 30 to 0759Z, Dec 1
December 2024	
ARRL 160-Meter Contest	2200Z, Dec 6 to 1600Z, Dec 8
Kalbar Contest	0000Z, Dec 7 to 2359Z, Dec 8
PRO CW Contest	1200Z, Dec 7 to 1159Z, Dec 8
INORC Contest	1400Z, Dec 7 to 1359Z, Dec 8
FT Roundup	1800Z, Dec 7 to 2359Z, Dec 8

Many thanks to

<http://www.contestcalendar.com/contestcal.html>

Discounts from Suppliers

Club members can get discounts from two suppliers:

Altronics. (Australia Wide), Mention you are from the North East Radio Group or give our customer no - 64429. Discount will be minus 10% up to 45% off depending on the item. (Actual discounts depend on the product type and quantity purchased). There is No Minimum Spend in store to receive the discount. For on-line or phone Sales there **IS** a Minimum spend of \$25.00 inc GST but **NOT** including Freight. In the comments section put "64429" to receive the discount.

We have discovered that David VK3UQ gets an email, that you may not get, detailing delivery of your order. So pop him an email when you order and he will be able to track which email belongs to you. We hope to have a method of dealing with this soon. President at nerg.asn.au

Jaycar Electronics stores by mentioning you are from the "NERG" no spaces quotes or dots etc, Account code is 44700493. You need to spend a min \$25.00 to receive a 10% discount. <http://www.jaycar.com.au/>

VK3CNE REMOTE STATION



Can be used for receive on all HF bands. Provides transmit on 160 metres using a dipole, 80 and 40 metres using a trapped dipole and a Spiderbeam for 20 through 10 metres.

This is available to members, you will need:

- An Amateur Radio Licence – any grade – Remember you can only use the bands and power you are licenced to use.
- A windows computer with sound card connected to a speaker and a microphone. A PC headset is ideal.
- OR an android tablet or phone and are prepared to pay for the app (less than \$20)
- Download the client from RemoteHams.com install it on your machine and register with RemoteHams.com using your **callsign**. The

android app is called RCForb and is available on google play.

- The NERG station is "VK3CNE" Connect to it and request "club" membership and TX capability. Then wait until your membership is approved and away you go!
- Usage privileges are only available to financial NERG members with VK callsigns.

VHF / UHF Remote



The VHF/UHF remote operates exactly the same as the HF version, the Station is "VK3CNE – 9700"

About the NERG

The NERG Inc. Reg No A0006776V <http://nerg.asn.au> The North East Radio Group, Inc. is an amateur radio club devoted to encouraging members and others to enjoy the hobby of amateur radio. It tries not to hang on ceremony and endless reporting but rather participate in the fun aspects of this fascinating hobby.

MEMBERSHIP FEES

Due in August: Full: \$35 Family: \$50 Remote Member: \$50 Concession: \$25 You will get a renewal notice please wait for this before you pay.

COMMITTEE

President	Anthony VK3YH/BNR
Vice President	Greg VK3VT
Secretary	Peter VK3PCC
Treasurer	Mick VK3PRR

Committee Members

Mark VK3BYY	Ash VK3HAG
Phil VK3RP/BOY	Chris VK3IK/AWG

NERG NEWS ARTICLES

The NERG is always happy to receive news, articles, and member's wanted or for sale advertisements for inclusion in the newsletter. Please contact the editor at news@nerg.asn.au

NETS

*NERG NETS run on the club's 70cm repeater VK3RMH TX 438.325MHz and RX 433.325MHz both C4FM and analogue. **That means you RX on 438.325MHz and TX on 433.325MHz.** You will need a 91.5Hz CTCSS tone on your analogue FM TX and if you don't want to be bothered with listening to the C4FM digital signals on the output then set your radio to 91.5Hz CTCSS tone on RX as well.*

(8.30 – 9.30 pm Non-meeting Thursdays). Feel free to join the discussions.

146.575MHz is used as a general Net frequency by a number of NERG Members and is often used by the DX chasers in the club while hunting DX. Foxhunters use this channel for liaison as well on the third Friday of the month.

Club Sponsor



Margherita Pizza ph 9434 4980

89 Main Road, Lower Plenty, Vic 3093

web www.margherita.com.au

Margherita's Still Sponsor the NERG and provide the excellent suppers that we have come to enjoy. Order your next Pizza dinner from them and tell them you appreciate their support of the club.

Facebook

The NERG is on Facebook – A group has been established and can be found at

<https://www.facebook.com/groups/nergamateur/>

Members are encouraged to join this group