FREQUENCIES VHF, UHF, SHF NEWSLETTER NZ

This newsletter is compiled by Kevin Murphy ZL1UJG to promote operational and construction activity on the VHF, UHF and SHF Amateur Radio allocations in New Zealand (and overseas).

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ISSUE 10, FEBRUARY 2003 Previous issues – http://www.netspace.net.au/~rpreston/index.htm

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NZART TECHNOLOGY CONVENTION

This Easter on April 19th & 20th 2003, the Hamilton Amateur Radio Club is hosting the NZART Technology Convention. They will be using the premises of the Hamilton Astronomical Society, located in Brymer Road, Hamilton, which is adjacent to the Hamilton Zoo which has plenty of parking.
I have a form if you wish to attend. Numbers will be held to 100 maximum.
It is highly probable that I will have a test equipment setup loaned from work * to check transceivers, transverters and oscillators (RF power up to 10368 MHz, Spectrum Analysis to 5760 MHz)
*(Repair Group Limited)

1296 MHZ BEACON

Kevin ZL1UJG

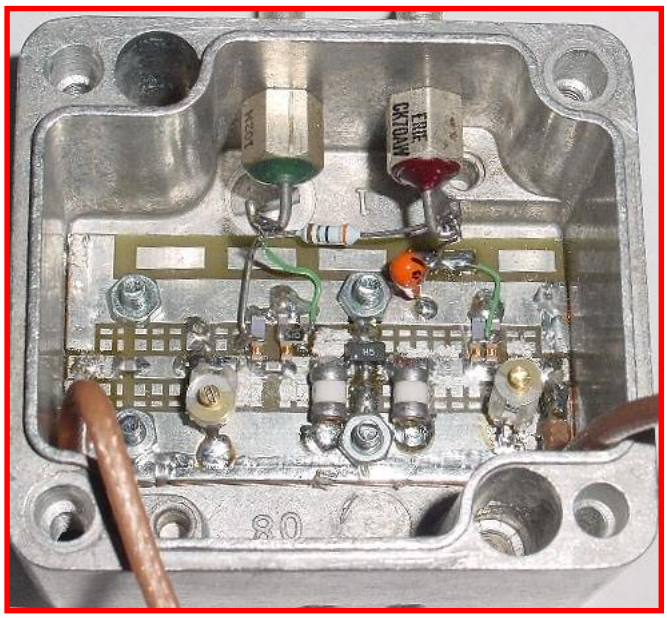
Multipliers for 1296 MHz Beacon

Some further work was attempted with the multipliers to achieve higher output power on the 648 to 1296 MHz (x2) multiplier. (+7 dBm in for + 8 dBm out) No further power was gained by adding extra capacitance to the transistor collector. Further inductance could be added in series with the transistor o/p (up to a few turns) without significantly altering power.
As mentioned in the previous newsletter I had found that the G4DDK004 final multiplier (using a 2SC2367) gave +14 dBm with +12 dBm drive. I drove the 648 to 1296 Beacon multiplier with ~ +13 dBm and ~ +13 dBm was obtained, indicating in this case that the harmonic output level was drive related at the higher frequencies and also that the transistor impedances were lower. At the lower frequencies transistor gain and matching gave higher multiplier gains.
I am leaving the 648/1296 MHz multiplier as designed in the previous newsletter, with output at +8 dBm since it is more than needed. The output will be attenuated to drive either a PIN diode switch or a MMIC amplifier stage directly.

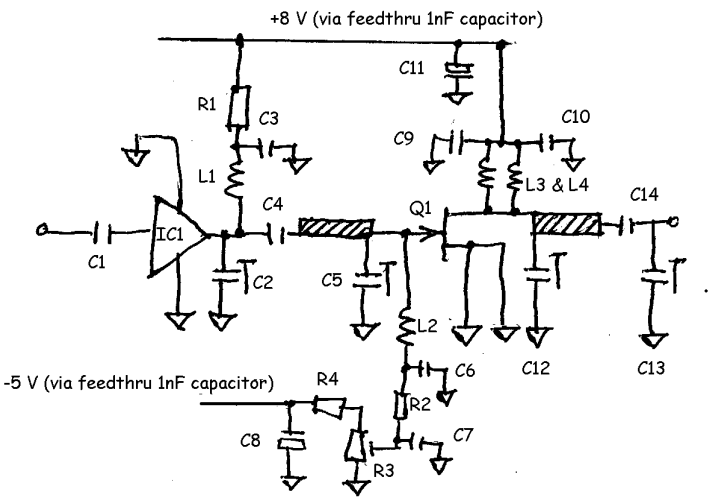
Driver and Power Amplifier stages

The driver/PA is built in a separate compartment (small diecast box $_1$) so that radiation at the higher levels is not fed back into low level stages. This improves stability and also means that RF filtering is more effective because radiation doesn't bypass the output filter. The DC supplies are fed in via feedthrough capacitors.
The driver amplifier is a NGA-586 (Sirenza Microdevices), a monolithic microwave integrated circuit (MMIC) specified for use in 50 Ω systems. On paper it has ~18 dB gain at its -1 dB gain compression point and output

power at –1 dB compression is +18 to +19 dBm. (~ 60 - 80 mW) The rated current through the device is 80mA at ~ 4.9 volts. A +8 volt supply feeds the device via a 39 Ω resistor and 100nH SMD inductor.



The Power amplifier (PA) is a SHF-0589 (Sirenza Microdevices), an Heterostructure FET (HFET) capable of ~ 2 watts (+33 dBm) at –1 dB compression (typical figures). Maximum operating specifications such as $V_{DS\ max}$ and $I_{ds\ max}$ have recently being reduced by Sirenza to reduce over dissipation. The device will be operating at 8 volts and standing drain current (no drive) set for 300 mA. The + 8 volt supply is fed via two 100nH inductors so that the maximum current through a single inductor is not exceeded. The gate is fed via a 50Ω resistor and 100nH inductor. The 50 Ω resistor/100nH inductor is decoupled with a 100 pF, so that the bias circuit as seen by the HFET tends towards 50Ω at low frequencies helping preserve stability of the circuit.
The +8 Volt supply is fed via a P channel FET that is interlocked with the –5 Volt supply (-5 Volts present before +8 volt supply is switched to PA/driver MMIC).
The 47 pF 0805 SMD capacitors in series with the signal are roughly series resonant so that their losses are minimised. There are better quality capacitors such as the American Technical Ceramic (ATC) ranges but these were not thought necessary at this frequency and power.
Multiple capacitors are used in bypass positions so that bypassing is effective over wide frequency ranges. This improves the stability of the circuit.
Notes 1 DSE H2231 Diecast box. This box is just the right size for the Filter or Amp PCB's from the Waikato VHF Group, as they fit with just a few wipes of a file.
The image above shows the almost completed Driver and PA during testing (bias pot not fitted). I was able to achieve in excess of +32 dBm (1.6 watts) with ~ + 2.0 dBm RF input power. The current for the FET was ~ 400 mA @ 8V (with drive) so the final stage efficiency is ~ 50%. Gain at –1 dB gain compression point is + 30 dB.
The PCB is screwed down with 3mm countersunk hardware. There are 5 veropins close to the devices (2 for driver and 3 for FET amplifier). There are additional veropins close to decoupling capacitors. The 3 veropins and 2 screws close to the FET help by providing a low thermal path to the case for heat generated by the FET,as well as providing a low impedance RF path. NOTE there is a small amount of Gate current of ~ 1 mA.
The 2 outer trimmers are similar to those from Farnell/RS/Wn and Ak VHF Groups. The 2 inner trimmers are also low cost trimmers from Voltronics in USA http://www.voltronicscorp.com/A4_Series/A4Series_8.html



Schematic Diagram of 1296 MHz Driver and +32 dBm Power Amplifier

PARTS LIST
R1 39Ω 0.6 watt metal film
R2 51Ω SMD 1206
R3 470Ω 0.6 watt metal film
R4 470Ω miniature preset
Adjust R4 so that Q1 has 300mA standing current (no RF drive)
C1, C4, C6, C10, C14 47 pF SMD 0805
C3, C9 470 pF - 1nF SMD 1206
C7 470pF – 1nF SMD 0805
C8, C11 1uF 35v Tantalum
C2, C13 (1.5 -5.5pF Philips or similar type)
C5, C12 Voltronics
2 x 1nF feedthrough capacitors
L1, L2, L3, L4 100 nH SMD 0805
IC1 NGA-586 (Sirenza)
Q1 SHF-0589 (Sirenza)

Tuning was done initially with the trimmer capacitors and further optimisation was done with conductive silver paint. The box is barely warm since a total of ~ 2 watts (under drive) or ~3 watts (no drive) is dissipated.

Modulation Modes

The Beacon is designed to have either FSK or CW keying. Both have their advantages/disadvantages. CW keying saves more power, reduced dissipation in Power devices, and is easier to resolve (initially).
FSK provides constant carrier for antenna alignment and easier design, however frequency stability may be degraded and power consumption is higher. (Voice modulation could be added)
CW keying Option (A1A). If the beacon is to be CW keyed then the + 8 volt supply can be switched via the P channel FET thus decreasing the level of the backwave (key up). The gate of the FET has a RC network to slow down the supply rise and decay times to ~ 5mS. This will reduce keyclicks. This, together with a PIN diode switch on the output of the 648/1296 MHz PCB will provide adequate carrier suppression. The Hamilton 13 cm Beacon on 2424.256 MHz has a –55 dB backwave with the PA and driver switched alone.
The PIN diode switch operates in a series shunt configuration. A 3-5 dB attenuator is fitted between the multiplier and the PIN switch so that the multiplier sees a relatively constant load when PIN diodes are activated. This enhances stability, sets the optimum drive level for the MMIC amplifier and reduces the reflected power going back into earlier multiplier stages. If a PIN diode switch is not fitted then the attenuation is increased to ~ 6 dB due to removal of losses associated with the PIN switch.
FSK keying Option. (F1A) A varicap diode is ONLY lightly coupled to the crystal oscillator circuit (in an effort to maintain the frequency stability). A DC voltage is fed to the varicap (to centre its operating range) and the keying line is used to provide a negative offset of 850 Hz when in the mark (data = 1). That is with no modulation the Beacon TX sits at its allocated frequency. Similar waveshaping is used reduce keyclicks.

BEACON NEWS

ZL1VHW 2424.256 MHz Beacon. Due to the addition of a FET PA, the beacon has increased power to ~ 2 watts output before feeder losses. Previously the beacon was running 400-500 mW before feeder losses. The 6-7 dB increase in power should extend the range significantly.
The 144.256, 432.256 and 1296.256 MHz ZL1VHW Beacons are based in Central Hamilton at the Telephone Exchange. The output powers are in the 5-10 watt range and are fed to cloverleaf antennas. On 1296 MHz there are 2 cloverleaf antennas stacked providing extra gain. The 144 MHz Beacon has frequently been heard in Australia and verbal reports of the 1296 MHz Beacon being heard come from Auckland and further north.

Beacon news from From Auckland. A new Beacon transmitter in the Auckland area for 32cm is set up and running on test from a Howick QTH on 925.240 MHz. The transmitter is a Tait T881-15 transmitter set to 5W output, using narrowband FM (peak deviation 1.5 kHz, total bandwidth 10 kHz, 10K0F3E) and will feature a digital voice synthesizer with a pre-recorded voice ID by Jim, ZL2BHF.
The antenna is currently a mobile phone base antenna panel (cellsite), vertically polarised from a Howick QTH. The intention is to co-site it at Whitford, with the 50.0433 MHz beacon & 1248 MHz FM TV repeater.
(Thanks Tim ZL3VTV/1)

Beacon Monitoring is a tool for checking propagation along DX paths. Repeater monitoring can substitute on the lower bands, however UHF and SHF beacons are sorely missed when they are off the air for repair or due to other circumstances.
Conditions may be quite variable between VHF and the SHF bands. One may struggle with a contact on 144 or 432 MHz whereas signals may be much higher on 1296 MHz and above. The importance of monitoring beacons both in the short-term for instance during contest/DX activity and in the long-term over months (looking at seasonal variations such as rain scatter) cannot be emphasised enough. Additionally the beacons can be used for checking sites or your equipment for deterioration (such as with water in coax), or improvement (for instance, due to improvements in preamps or antennas).
Coverage of Beacons is important both nationally and internationally. SUPPORT BEACONS!

A quick survey on Beacons

Please reply to the editor whether you monitor beacons regularly and which Beacons you monitor. Any other information relating to the beacon activity in your area gratefully received.
Is your area in need of a Beacon TX?
If you are involved with beacon TX in your area please send me details.

TECH NOTES

Sirenza Microwave Devices

I notice that Sirenza Microdevices (previously Stanford Microdevices) are replacing some of their range. The NGA-586 and NGA-386 MMIC's are affected. The replacement devices appear to have better thermal characteristics. Go at http://www.sirenza.com/

Interesting Websites

At the Website of Stefan Heck LAØBY http://www.qsl.net/la0by/ there are some SSB phase noise measurements of the Icom IC202, Yaesu FT-225RD and Icom 821. The graphs show that the elderly IC202 with its VXO has superior close in phase noise (just what is required for contest applications). The composite noise floor is bettered out to 1 MHz by the other transceivers, however.
There is also considerable information at this site about phase noise in Amateur VHF transceivers http://ham.te.hik.se/homepage/sm5bsz/. There is also a lot of other information that would be of interest.
A good Australian website is http://www.vhfdx.oz-hams.org/

Relays

While looking at the recently updated Milcom test equipment site http://www.milcom.co.nz/ I came across a miscellaneous panel with 6 HP 8761A relays (probably latching and rated at 10 watts to 18 GHz) for $120 + GST per panel. http://www.milcom.co.nz/photos.html Look under misc There are about 10 panels in total. First come first served.

FET Amplifiers

To turn a FET amplifier off, remove the drain volts. Turning the FET off by making the gate volts more negative, will increase the drain volts. (less current). This will probably exceed the Vds_{max} and possibly Vgs_{max} with most low power FETS and some higher power FETS. HEMT devices are more susceptible. I have seen drain current I_{DS} increase and FET's develop gate current if these maximums are exceeded! (This was seen to occur with MGF1302/MGF 1402 {Vds_{max} = + 6 volts & Vgs_{max} = - 6 Volts}) Also operating these devices near the VDS_{max} is not recommended as an avalanche breakdown appears to occur and the noise floor can increase substantially. (This was noticed in my G3WDG001 2.5 GHz – 10 GHz Multiplier and the decision to operate the unit on 5 to 6 volts {instead of 8 volts} was made. This resulted in similar output power and the multiplier/amplifier was felt to be more stable. (Devices used in the multiplier were Plessey black spot devices but a similar breakdown would be expected with MGF1302/MGF1402)
G3WDG units are available from http://www.g3wdg.free-online.co.uk/

Amateur Statistics (@ 3rd February 2003)

From the Ministry of Economic Development: via HQ-Info-Line (NZART)

Beacons 42	Repeaters 212	Digipeaters 29
Fixed 2	General 3281	Limited 1603
Novice 16	TV Repeaters 19	Total 5204

RECENT VK/ZL ACTIVITY

via VK-VHF reflector

During the 26th and 27th of January, 2003, enhanced propagation across the Tasman allowed some DX contacts between VK and ZL: - Below are notes from some of the operators

Doug VK4OE (Brisbane): - Interesting catching the tail end from VK4 of the recent big trans-Tasman opening that mostly favoured VK2. This morning, after setting up my portable system on the side of Mt Coot-tha in Brisbane (elevation 158m where I was), I worked Nick ZL1IU briefly at low signal strength on 144.1MHz, followed by Stephen ZL1TPH/1 at his elevated portable location North of Auckland on 144.12MHz. Signals to Stephen started weak, came good then faded away completely over about 30 minutes. During that time we tried 1296MHz but no contact ensued... My assessment is that the opening on 144MHz needs to be pretty strong (as it is sometimes) before 1296MHz can propagate. And definitely, the elevated location at each end assisted us! Real good fun!! Also, Nick ZL1IU reported independently that during the VK wee small hours of the morning, he was copying the VK4RTT beacon in the Bunya Mountains at good strength for several hours...there's a message there...

Bob ZL3TY (Greymouth): - Good opening on Sunday to VK2,3. Nil here on 27th January. Stations worked: VK2AWD, VK3BWT, VK2FZ, VK2KU, VK2XKE, VK2DVZ, VK2ZAB, VK2FLR, VK2BHO, VK2FHN, VK2APG, VK2EM, VK2ARA, also heard VK2BZE but could not get a report. Heard VK2ZXC wkg ZL1IU. First contact was VK2AWD at 1930z (830am local) during a WSJT sked, and went QRT after 1020z (1120pm), the band was still open. Australian TV Ch 5a 143.75 Sound Channel also heard.

Steve ZL1TPH/p (Brynderwyn ranges, north of Auckland): - Contacts, this weekend on 2M to VK2ZAB, VK2FZ, VK2KU, VK2DVZ, VK2YO, VK2APG, VK4LC, VK4AFL, VK4QV and VK4OE. The 144.440 Beacon was 5/9+++ and so was Bill VK4LC into ZL. No sign of the 144.420 and the 144.425 Beacons. Ross VK2DVZ heard Steve's 1296.3MHz carrier a couple of times on Sunday evening about the time that 2m dropped out between them.

Gordon VK2ZAB A Duct to ZL enabled contacts between VK and ZL all day Sunday. First to the south Sunday morning and then to the north and south Sunday afternoon/ evening. Stations worked in chronological order: ZL3TY at Greymouth on 2M SSB. Tried 70cm - indications but too weak for contact. ZL1TPH at Orewa 2M SSB only. ZL1IU at Okaihau 2M and 70cm SSB. ZL2WSP at New Plymouth 2M and 70cm SSB, ZL2TAL at New Plymouth 2M and 70cm SSB.

CONGRATULATIONS TO THOSE STATIONS. A WELL DESERVED RESULT FOR YOUR EFFORTS.

To subscribe to the VHF-VHF reflector go to http://www.hermes.net.au/vk2ku/reflect.html. At the same website is a link to Guy VK2KU's homepage which links some interesting soundfiles of DX contacts.

WANTED

Icom IC202, ~~IC402~~, IC211, IC251, IC271, IC451, Any condition
Wellington VHF Group 100 watt 2M Linear, Any condition
TO REPLACE STOLEN Icom IC-211 Transceiver S/N 6805955 (power cord permanently wired-NO AC SKT)
Also wanted :- The Lowlife who stole Leon's transceiver, Any condition
Phone Leon ZL2AOC Ph 04 – 3828064, email leon@surveylab.co.nz.
Keep both eyes open for Leon's stolen transceiver.
Contact editor if you wish to have your stolen equipment listed

CONTESTS

Hibernation Contest

All Bands 50 MHz and up. Saturday 5th and Sunday 6th April, 2003
Operating periods are 1600 to 2200 on Saturday, and 0800 to 1400 on Sunday, NZT or NZDT, as applicable.
See http://www.nzart.org.nz/nzart/Update/Contests/vhfcontestrules.html

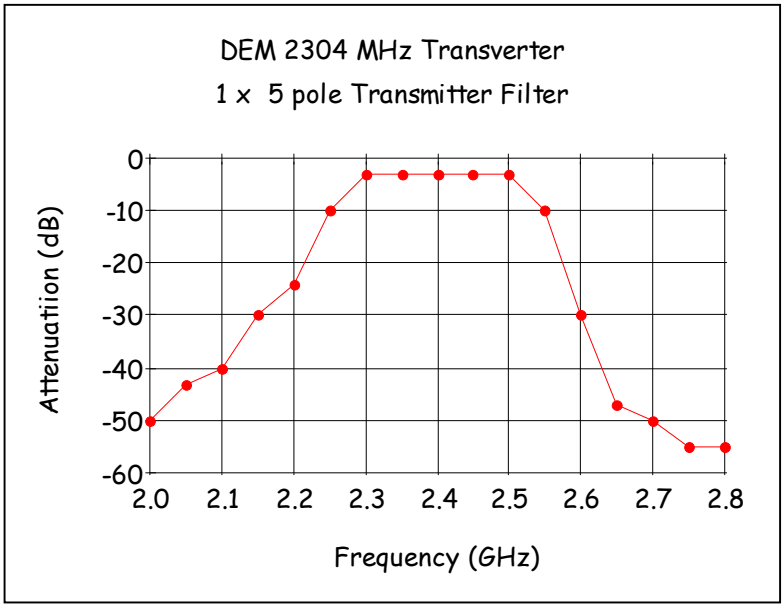
144MHZ & ABOVE DAILY NEWSLETTER

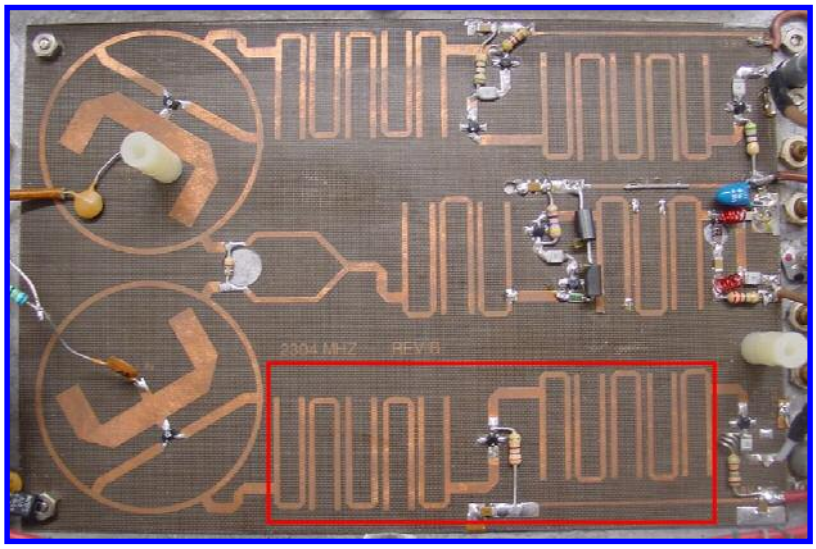
The above newsletter by Derek, G0NFA is now available as a PDF from http://www.144mhz.co.uk/.
The newsletter also now has 50 MHz (6 metre) content. Derek is looking for information & images of VHF amateur related activity for the newsletter.

DOWN EAST MICROWAVE 2304 MHZ TRANSVERTER

Kevin ZL1UJG

Tom ZL1THG and I are increasing the power of a DEM 2304 MHz transverter to about 1 watt. Additionally I am upgrading the unit, looking at ideas by DEM.
(see http://www.downeastmicrowave.com/)
This also gave me the chance to put a DEM 13cm transverter on a spectrum analyser. The spectrum was disappointing(!!) due to low rejections of Local Oscillator (LO) and other products. The unit had been crystalled for 2400 and 2424 MHz.
I looked at a section of the TX chain and looked at the filter response. NOTE. The transverter was tuned for 2304 MHz. Some units supplied via the Wellington VHF Group were trimmed to a higher frequency.





If this transverter is used at 2424 MHz the LO is at 2280 MHz and this 5 pole filter has only 5 dB loss at the LO frequency. There are two 5 pole filters in the TX chain (rejection of LO due to filtering is ~ 10 dB.)
Since the transverter is originally for 2304 MHz I think the filter's low end is set at 2.3 GHz. This would provide maximum rejection of the LO and image products. I am going to shift the filters up by 100 MHz (~4%) as previously done by members of the Wellington VHF Group. I will trim the TX filters only as the RX filters adequately reject any image signal.
There should be no power difference due to trimming of the filters, but rejection of the LO should improve possibly up to 40 dB (?) and the TX image by 20 dB.
The picture above shows the TX filters (highlighted in RED) where "pruning" will take place.
More about this ongoing project in the next newsletter
If anyone else has any ideas/feedback regarding these transverters or similar models. Drop me a line.

PLEASE send any news/activity/ideas/projects/articles/photos/etc… to
Kevin ZL1UJG, at my email or mail address at the top of the newsletter.
Thanks