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 8 January 2003

Previous issues – http://www.netspace.net.au/~rpreston/index.htm

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CONTESTS

Contest Results VHF Field Day December 7th and 8th 2002 (via Wellington VHF Group)

Station	Location		Score
6m (52 MHz)			
ZL1BQ	Maunganui Bluff	RF64SG	82*
ZL2TMA	Wanganui	RF70KF	75
2m (144 MHz)			
ZL2ALW	Mt Ranganui	RF71RP	642*
ZL1BQ	Maunganui Bluff	RF64SG	600
ZL1BK	Stratford Plateau	RF70BQ	529
ZL2WA	Quartz Hill	RE78IR	463
ZL1TPH	Moirs Hill	RF73HM	428
ZL2VKD	Wanganui	RF70LF	186
ZL2TGQ	Newlands	RE78JS	133
70cm (432 MHz)			
ZL1BK	Stratford Plateau	RF70BQ	864*
ZL1TPH	Moirs Hill	RF73HM	703
ZL2WA	Quartz Hill	RE78IR	691
ZL1BQ	Maunganui Bluff	RF64SG	354
ZL2ALW	Mt Ranganui	RF71RP	306
ZL2VKD	Wanganui	RF70LF	30
ZL2TGQ	Newlands	RE78JS	9
32cm (925 MHz)			
ZL1BQ	Maunganui Bluff	RF64SG	504*

23cm (1.2 GHz)

ZL1BK	Stratford Plateau	RF70BQ	903*
ZL1TPH	Moirs Hill	RF73HM	444
ZL2ALW	Mt Ranganui	RF71RP	351
ZL1BQ	Maunganui Bluff	RF64SG	264
ZL2WA	Quartz Hill	RE78IR	225
ZL2TGQ	Newlands	RE78JS	16

12cm (2.4 GHz)

ZL1BQ	Maunganui Bluff	RF64SG	1216*
ZL1TPH	Moirs Hill	RF73HM	869

9cm (3.3 GHz)

ZL1TPH	Moirs Hill	RF73HM	48*

5cm (5.6 GHz)

ZL1TPH	Moirs Hill	RF73HM	129*

3cm (10 GHz)

ZL1BQ	Maunganui Bluff	RF64SG	1051*

Aggregate Score

ZL1BQ	**Maunganui Bluff**	**RF64SG**	**4071***
ZL1TPH	Moirs Hill	RF73HM	2623
ZL1BK	Stratford Plateau	RF70BQ	2296
ZL2WA	Quartz Hill	RE78IR	1379
ZL2ALW	Mt Ranganui	RF71RP	1299
ZL2VKD	Wanganui	RF70LF	216
ZL2TGQ	Newlands	RE78JS	162
ZL2TMA	Wanganui	RF70KF	75

Great DX!

6m Local	ZL1BQ	ZL4LV	1159 km
6m International	ZL2TMA	VK2UBF	2160 km
2m Local	ZL1TPH	ZL2WA	532 km
2m International	ZL1BQ	VK3EK	2320 km
70cm	ZL1TPH	ZL2WA	532 km
32cm	ZL1BQ	ZL1AVZ	146 km
23cm	ZL1BK	ZL1TPH	310 km
12cm	ZL1TPH	ZL1BQ	120 km
9cm	ZL1TPH	ZL1TBG	9 km
5cm	ZL1TPH	ZL1AVZ	45 km
3cm	ZL1BQ	ZL1AVZ	146 km

Check Logs
ZL2TAR, VK2ZAB

47 Stations Active:
ZL1: AAN, AVZ, BK, BOE, BQ, DK, GSM, IU, KA, SWW, TBG, TBT, THG, TPH, UJG, UJJ, UST, UTG, UYJ, WPK, WTT,
ZL2: ACJ, ALW, CIA, HD, TAL, TAR, TE, TGQ, TJT, TMA, TMB, TNG, UGD, VAL, VKD, WA, WAO, WSP
ZL3NE
VK: 2TG, 2UBF, 2ZAB, 3BWT, 3BWT, 3EK

Comments from logs.
Looked for ZL3MH on Banks Peninsula, but didn't hear a squeak from the South Island. - ZL2WA
Outstanding signal from the (Wellington) 1296.275 Beacon, Harry, ZL1BK Mt Taranaki.

VHF Contest Calendar 2003
Hibernation Contest April 5, 6
Brass Monkey Contest July 5, 6

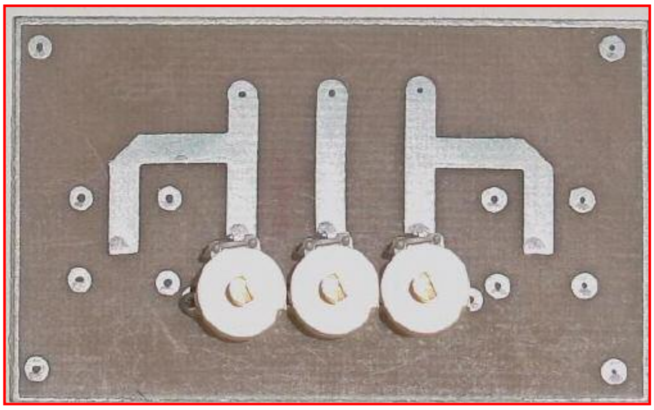
The rules were published in September/October 2000 Break-In, and can also be found at the Wellington VHF Group Website: www.vhf.d2g.com

Please send contest logs within two weeks to:
Contest Manager,Wellington VHF Group,
P.O. Box 12-259,
Thorndon, WELLINGTON

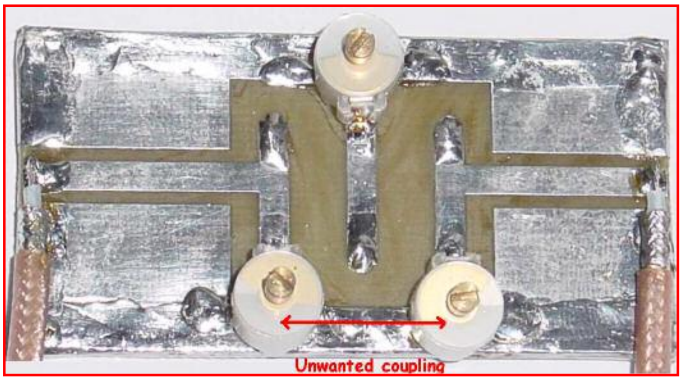
Cliff Betson Contest (11/12 January 2003)
Report from Kevin, ZL1UJG (Home Station) ,
The signal conditions in Hamilton were strange (and it was'nt just me, Tom ZL1THG indicated the same thing)
The Auckland 2M Beacon was a consistent S3/4 (normal) while ZL1BK, ZL1UKG and many others were incredibly weak. Steve ZL1TPH was S9+ going to noise level twice every minute.(Some sort of multipath)The signal variation was the same whether he was operating from home (Saturday) or from Moirs Hill (Sunday)
On 70 cm the Auckland Beacon which normally resides at S2-3 (10-15 dB S/N) was in the noise and I struggled to hear ZL1BK for a single contact (I was running 30W to a 19 element.) I was so sure my RX had failed I checked the sensitivity, but it was as expected. On the previous contest I was working Steve on 70cm and hearing ZL1BQ no problem.
Steve,ZL1TPH indicated that signals were good from the Wellington 2 M Beacon, during the contest.
Tom has also mentioned that even contacts from the Bombay Hills to Hamilton have dropped right out on previous occasions. I dont know the reason for the drop in levels.(most likely the signals disappearing into the Waikato Swamp)
I heard about 6 SSB signals on 1296 MHz probably from ZL1BK, ZL1AVZ and ZL1UKG and possibly one other. The system is only temporary but the signals appear to be there so with some improvements should be able to work up to Auckland OK.(Tom worked 1296 MHz to Auckland). When the Auckland based stations beam towards Hamilton on 1296 MHz we appear to hear them OK.
The bad conditions were not just limited to Hamilton as they report from Ray in New Plymouth shows.
Report from Ray ZL2TAL (Home Station)
RF conditions were flat as a pancake ......returns from repeaters up north were non existent. However I had a good contact on 23cm with Harry ZL1BK towards the end of the last period on Sunday.........Peaking at 50dB over S9, on FM with little QSB, with a bounce off Egmont to boot. **Well done Ray and Harry**

Filter PCB's (See also issue 2)

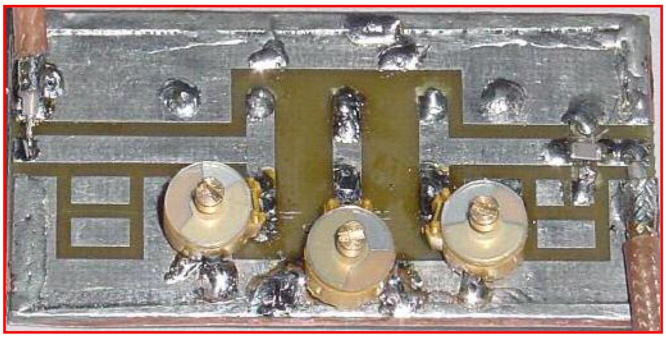
Kevin ZL1UJG



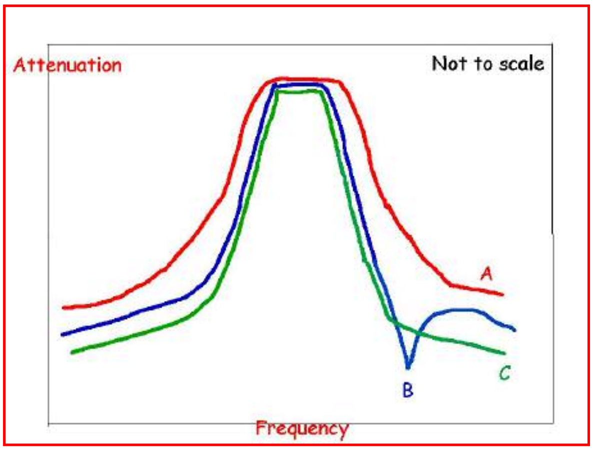
The Filter PCB layout has evolved over time. The original design was produced many years ago (see picture right). The signal is coupled across the adjacent striplines, however there is considerable unwanted coupling across the closely spaced plastic trimmers leading to lower rejections away from the centre frequency. See A on graph.
With the production of the new Filter PCB's a few years ago the coupling was minimized by placing the centre trimmer at the opposite end (like an interdigital filter) see photo below. This improved the rejection but the loss was slightly greater. This filter appeared to have a notch on the high side of the centre frequency. This was due to unwanted coupling across the outside trimmers See B on graph.



While spending some time working with the recent generation Filter PCB's I changed the position of the trimmers. All the trimmers were fitted on one side and the outer trimmers were swung outwards by ~ 90 °.
The position of the trimmers has reduced the losses slightly (2.8 dB loss including 0.5 dB 300mm cable loss @1300 MHz). The rejection is also better by ~ 2dB overall at frequencies from 600 – 1300 MHz.



The new position of the trimmers has removed the high side notch which was apparent on most frequencies the filter was tuned to. (see photo right) See C on graph.
The yellow trimmers, ~ 2-10 pF resonated at 1300 MHz with close to minimum capacitance! (available from Wellington and Auckland VHF Groups, Farnell, RS,etc). These trimmers are commonly used in filters/tuned circuits due to their availability.

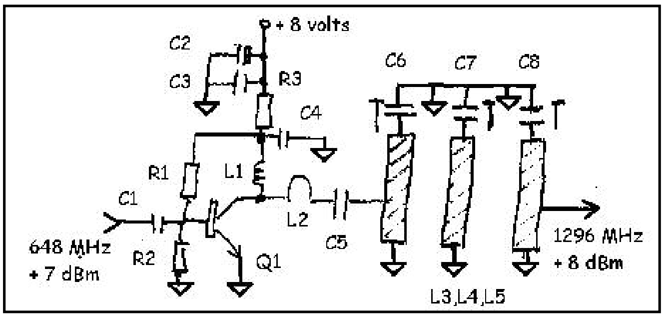


The filter I am building is to be used in a 1296 MHz beacon. This particular filter was to be tuned to 648 MHz before building the multiplier section on board. The filter has 2.1 db loss, (including cable loss) rejection @ 324 MHz –55 dB, 216 MHz –60 dB, 108 MHz –70 dB.

The 1296 MHz Beacon osc/multipliers are tuned to 108 (x3) to 324, (x2) to 648 and then (x2) to 1296 MHz avoiding amateur bands. This is done to minimize interference to co- sited 2M and 70CM amateur band equipment.
I haven't tried the centre trimmer on the opposite end . This may improve filter rejection even further.

Frequency Multiplier using Filter Board

Kevin ZL1UJG



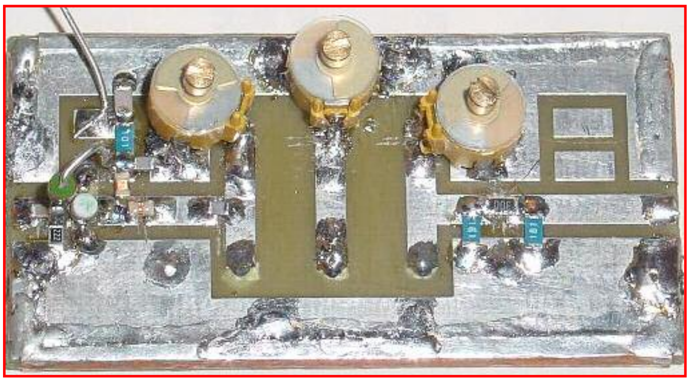
648 MHz to 1296 MHz (x2) multiplier.
see adjacent schematic/picture
The circuit will also multiply to
432 to 1296 MHz (x3)*
576 to 1152 MHz (x2)
384 to 1152 MHz (x3)*
*The output is ~ +4 -> +5 dBm when used as a tripler.
With the grey trimmers (1.5 to 5 pf) the output filter will tune 622 to 1300 MHz. At lower frequencies L1 and L2 may need to be increased in value to optimise performance.

Parts list (CH = CHIP)
C1,C5 100pF CH **C2** 100nF TANT **C3 ,C4** 470pF CH
C6,C7,C8 1.5 to 5.5 pF trimmers
R1 22 kΩ **R2** 2k2Ω CH **R3** 100Ω CH
L1 100 nH CH
L2 0.5 turn ~4mm high, wire wrap wire or resistor leg
L3,L4,L5 Striplines printed on PCB grounded at one end
Q1 2SC2367 8 GHz device. Alternatively an SMD device may also be fitted.

The board requires ground vias at 9 places as well as having the top and bottom earthplanes wrapped at the edges. **The collector voltage measured at R3/C4 junction will be close to 8 V without drive (~ 0 mA collector current). With ~ +7 dBm drive the voltage will reduce to ~ +5.6 V (~ 24 mA collector current). The output trimmers should be tuned into a RF detector. At 1300 MHz the trimmers are engaged ~10%. The +8 V supply must be regulated so that the operating point of the transistor doesn't change due to supply variations (eg battery)
As a doubler f^{in} was ~55 dB below the output level and other products were at a similar level.

324 to 648 MHz (x2) multiplier.
The circuit is very similar to the 648 to 1296 MHz multiplier except that the trimmers **C6,C7,C8** are 2 to 10 pf.
L1 and **L2** are 100nH and 33 nH SMD 0805 inductors respectively.
The board will resonate at 576 to 648 MHz.
Output as a doubler(X2) 324 to 648 MHz or 288 to 576 MHz is +12 dBm (+ 7 dBm with attenuator fitted)
Output as a tripler (X3) 216 to 648 MHz or 192 to 576 MHz is + 8 -10 dBm (+3 - 5 dBm with attenuator fitted)

As a doubler, rejection of f^{in} & $3f^{in}$ 65 -70 dB
As a tripler, rejection of f^{in}, $2f^{in}$ & $4f^{in}$ 62-65 dB,
DC current (no drive)~ 0 mA. (Vce = 8 V) (with drive) ~ 18 mA (Vce = 6.2V) See also **



This PCB (left) is used to drive the 648 to 1296 MHz Multiplier, and is fitted with an additional 5 dB attenuator to drop the + 12 dBm output to + 7 dBm. It also gives a broadband termination to the following multiplier enhancing stability.
PI Attenuator is 2 x 180 Ω SMD 1206 to gnd and series R is 30 Ω.
The rejection of the unwanted signals was certainly more than expected (hopefully due to new location of outside trimmer capacitors)
(PCB = same one on Page 4 but populated)

RF POWER AMPLIFIERS Kevin ZL1UJG

LINEAR AMPLIFIERS MUST NOT BE OVERDRIVEN

LINEAR AMPLIFIERS should not be driven past the point where the gain drops by 1 dB. (called the –1 dB gain compression point.)

*For example an amplifier with 10 dB gain and capability of ~ 100W. Drive the amplifier with low power (1W) and measure output power (10 W) Gain is 10 dB (10 log P^{out}/P^{in} = 10 log 10). If the drive is increased to 10 watts and the power output is 80 watts then the gain is 9 dB (10 log P^{out}/P^{in} = 10 log 80/10). In this case the amplifier is at the –1dB gain compression point.

If the power output at this point is less than 80 watts then the 1 dB gain compression point has been exceeded and the drive from the transmitter must be reduced so that -1 dB gain compression point is not exceeded.

It is quite common for solid state amplifiers to have gain exceeding their quoted figures. Example a 10/100 W amplifier may only require 3-5 watts for 100 watts output. By doing simple measurements at low drive levels and high drive levels then the -1 dB gain compression point can be found. Amplifiers should not be driven past the -1dB gain compression point as the amplifier quickly saturates and the signal widens significantly.(Your amateur and local neighbours will not like you)The saturated signal will probably create TVI and widen your presence on the band.(Not nice during contests)

The drive level from the transmitter may be dropped by a Power out control in your TX, or an ALC control. Other wise an attenuator may need to be fitted in series with the AMPLIFIER. Quite often the Amplifier may have a RX preamp so this is not quite as severe as it sounds as the RX gain can be reduced quite a few dB without the Signal quality degrading significantly. Alternatively an extra length of lossy coax may be used. Making up a 10 dB power attenuator is useful for checking amplifiers if your TX doesn't have a low /high power switch.

Amateur VHF Amplifiers specify a nominal output power and drive level. For example a Tokyo HI Power HL 37V 2 M SSB/FM amplifier specifies 3 watts in for 32 watts out. Bench tests revealed that 0.5 watts in gave 29 watts out, while 2 watts gave 38 watts out

Gain in dB at 0.5 watt drive = 10 log (29/0.5) = 17.6 dB

Gain in dB at 2.0 watt drive = 10 log (38/2.0) = 12.8 dB.

At 2 watts drive the amplifier's gain has dropped by 4.8 dB, as 2 watts has exceeded the –1 dB gain compression point significantly. In use the drive level should be 0.5 to 0.75 watts to maintain a clean signal on the band.

To look at it another way

For an input increase of.5 to 2 watts or 6 dB [10 log (2/.5)] the output has increased from 29 to 38 watts or only 1.1 dB…10 log (38/29)!!!

*In the previous example the input goes up by 10 dB while the output goes up by 9 dB (-1 dB gain compression).

When the –1 dB gain compression point is exceeded, the transmitted signal is distorted in the amplifier and the increase in power is mainly due to the increased level of these distortion products. (Intermodulation levels in the amplifier increase with excess drive). The difference in output power level between linear (-1 dB compression point) and saturated power can be quite small.

!!! PLEASE CHECK YOUR AMPLIFIERS !!!! **Avoid splattering your signal across the bands**

Perhaps your local club can have a night where VHF/ UHF Linear amplifiers can be checked for correct drive level using this technique.

During the time I lived in England, I was operating on 2 M SSB when an amateur came on operating SSB through a class C Amplifier. I found him more than 50 kHz away and a queue had already formed by the time I found the frequency. (Arrrgh!!)

The DC bias circuit in Linear Amplifiers must be stable at nominal output levels otherwise your signal widens.
At low drive levels or in manual TX mode on the Amplifier, measure the DC going to base of the RF transistor (On the cold side of the choke going to the base) (Bipolar transistor assumed) It Should be ~ 0.7 volts. The meter may need to be an analogue one due to RF interfering with DVM's. At high drive levels the variation should be less than 50 mV.
As I mentioned before the Trio/Kenwood TS700 dropped to 0 V due to series resistance between base and bias circuit. The FT221 is the same. Amplifiers/PA's in transverters are not immune to this and I have found negative volts on a MMT 432/XX transverter. I am sure there are many other rigs and amplifiers with bias deficiencies.

Brian ZL1AVZ in the News (NZ Herald Jan 10, 2003)
During the New Year Break, in the early hours of the 9th January, a pine tree demolished their caravan in Whitianga that Brian, Carole and family were sleeping in. It was a very close call for all concerned. I am sure we all wish them that the rest of the year will be an enjoyable one.

Waikato VHF Group
With my hat on as a member of the Waikato VHF Group, we are looking for new members so that Beacons and Repeaters continue operating in the future. All memberships/donations gratefully received. Please contact Gavin Petrie at gavinwp@ihug.co.nz for further details if you wish to join.
I am also the editor of their quarterly publication.

Input.
I wish to thank all those that have sent information for this newsletter. However I am always looking for further information, articles, images ,operating news, projects, etc to make it **YOUR NEWSLETTER.**
Also feedback please to help me develop the newsletter.
What do you like about the newsletter?
What do you want in the newsletter?

Best wishes to you all for a successful 2003

Kevin
ZL1UJG