Frequencies VHF, UHF, and 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).

Articles for this Newsletter can be sent via email to rfman@xtra.co.nz

Post to K Murphy, 8 Tamar Place, Hamilton, New Zealand. Ph 07 8470041

Issue 6 October 2002

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

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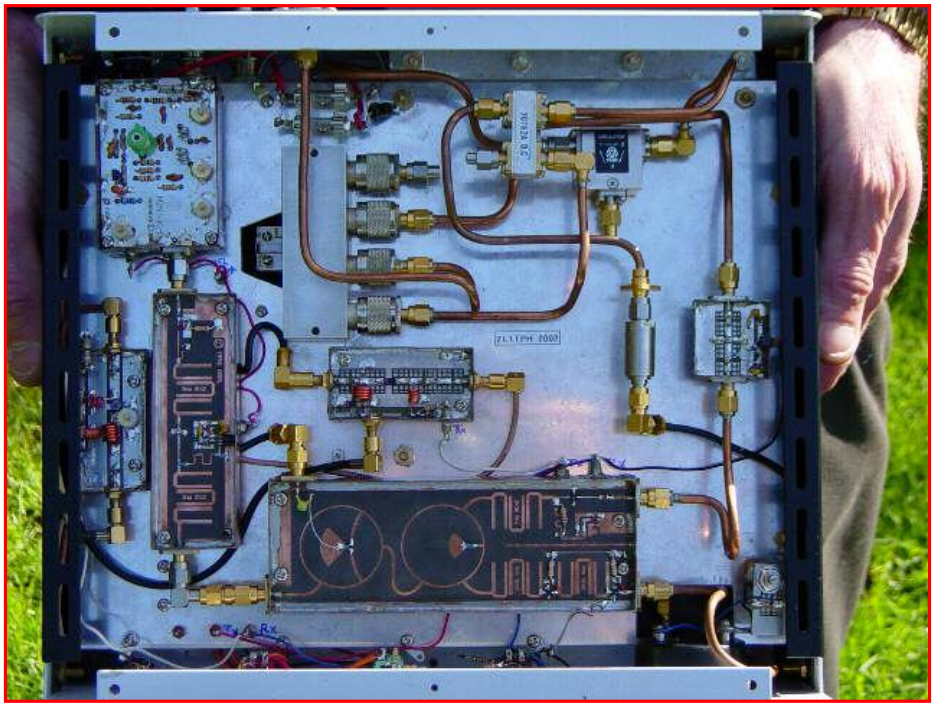
Newsletter on Internet

Earlier issues of the newsletter are on the Internet at http://www.netspace.net.au/~rpreston/index.htm

WSJT Rex VK7MO

Bob ZL3TY completed an EME contact on 6 meters with ON4ANT using WSJT's JT44 mode.

Bob ZL3TY and Rex VK7MO, portable VK3, extended the VK-ZL two meter digital record to 2143 kms using WSJT's meteor scatter mode FSK441. The QSO took 70 minutes to complete. Rex was using a small 2.7 meter boom yagi on his car and 200 watts PEP. This opens up the possibility of VK-ZL 2 meter contacts during field days from good locations from most of ZL to the East Coast of Australia.



9 cm Transverter Project

Stephen Hayman ZL1TPH

The basic kit for the 3.4 GHz (3400 MHz) transverter comprises of a EME65 540 - 600 MHz local oscillator module (top left) a local oscillator multiplier for injection at 3256 MHz (below oscillator) and the main transverter board (at bottom center of image).

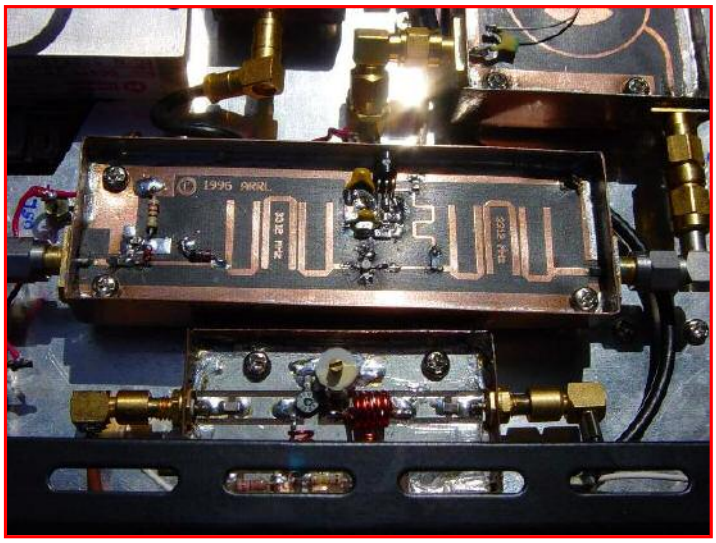
The transverter PCB and LO multiplier PCB was originally designed by Zack Lau, W1VT at ARRL for the 3456 MHz band.

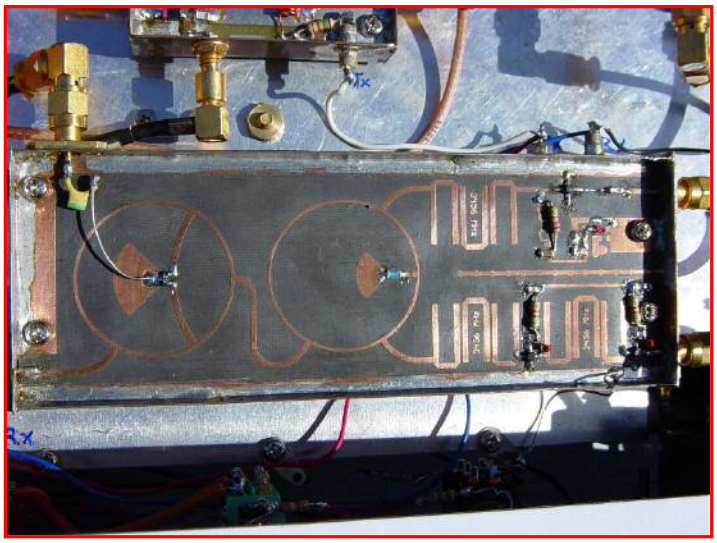
These components are available in kitset form from Mini-Kits Australia http://www.minikits.com.au/ and are reasonable priced should one wish to construct and become operational on 3.4 GHz.

Waikato VHF Group boards are used for the Pin diode 144 MHz I F switching and the HP MGA 86576 Gas As MMIC preamp, and this is mounted external to the main board and is suspended with Ut141. An Era 3 is also used and is mounted on the main board and is before the first Rx filter. A 144 MHz IF amplifier was also used and can be seen on the far left.

A Toshiba 20 Watt output linear class A is mounted internally and is below the center mounted aluminum chassis and use of surplus isolators and couplers are used to monitor output power and stability whilst in the field. Current on Tx is 10 Amps, hence voltage regulators are use on all stages.

Below
Image left showing IF preamp & 3312 MHz frequency multiplier.
Image right showing LO splitter, mixer, RX filter, 2nd stage RX amp and 2 stages of TX amplification and filtering





The relay shown in the first image will be replaced with a more suitable Dow Key shortly. Rx sensitivity and stability are excellent and this unit with a dedicated 60 cm 23 dB gain dish should be capable of an easy 300 odd Km with a little bit of altitude and that will be the next project.

Excellent job Steve

Note the transverter and Multiplier PCB's are also available from Downeast Microwave. The EME65 Oscillator is available from Mini-kits. An equivalent Oscillator is available from Downeast Microwave

Trying to work 300 km's on 2424 MHz Kevin ZL1UJG and Steve ZL1TPH

During the weekend of 20th and 21st of July, Mary (my wife) and I went to Whakatane. I phoned Steve Hayman, ZL1TPH before we left and asked if he was interested in trying a contact on 2424 MHz on Sunday Morning at 11 am. No problem was the reply. He contacted Ralph Sanson ZL1TBG via email to be part of their team and they were going to Cape Rodney (near Leigh).

The radio path between Whakatane and Cape Rodney has very good horizons at both ends with the aerials pointing out over the sea, however there is a big midpath obstruction of the Coromandel Ranges peaking at 952m with Mount Te Aroha.

The most favorable site for us was at a lookout point above Whakatane, which involved about 100m walk up a steep track from a nearby carpark. (Only a few minutes from the town centre)

At about 11pm we assembled our station and called Steve on the cellphone to alert him that we were active. They had previously arrived at their site about 30 minutes earlier at were operational out the back of Steve's vehicle.

Steve's Equipment and comments The main setup Steve used was an early B version DEM 2424 MHz transverter which he picked up as unbuilt kit a few year's ago. The latest modifications were done as per the ARRL Microwave handbook (ERA 3 as multiplier etc). This transverter is similar layout to the above photos. There is a GaAs FET preamp installed, also a 2 watt pa which is from Mark VK5EME and is good and well recommended. http://www.minikits.com.au/

The Antenna was a 33 element Loop yagi, which Steve made himself with information from Harry ZL1BK and Peter ZL1UKG. Steve also took a 60cm dish. Steve makes dishes from a plaster of Paris mold of an original aluminium dish used for 10368 MHz. Coax was 6 metres of LMR600 Superflex coax to the Loop Yagi.

Steve also took a 1 watt DB6NT 2424 MHz transverter and 60 Cm dish as the DEM transverter was dead upon switch on Sunday morning (It was working in the Brass Monkey contest two weeks ago.) The fault was a cracked chip component in the Era3 Multiplier and was fixed that Sunday morning.

(Great work Steve)

Ralph ZL1TBG took his 2.4 GHz gear but tried out 23 Cm ATV portable later to Grant ZL1WTT and Ian ZL1VFO direct at about 70 Km with success.

Steve is interested in Ridge scatter/refraction, (knife edge..? Editor) with the contact Steve had with Harry ZL1BK recently at 313 Km, and Harry was using his DEM transverter, Steve seemed to have the advantage over Brian ZL1AVZ who was at 275 Km, where as Brian had a clear shot south and total water path into Taranaki, Steve had the 400 metre Waitakarie Ranges in the way.

Kevin's equipment and comments.

The equipment at Whakatane was a home brew 2424 MHz Transverter, FT290 MK1 IF rig and ½ a loop yagi borrowed from Tom ZL1THG (built by Ray ZL2TAL)

The picture left shows the equipment powered by 7A GEL cells and the picture on the next page shows my wife Mary assisting with the efforts.

I originally beamed along the hills north of Whakatane but heard no carrier while tuning around.

I then beamed out to sea towards Motiti Island (East of Tauranga) and this resulted in a weak carrier a few dB above the noise.

I changed the coax feed from a longer piece of low loss coax (3.5 dB loss) to a short length of RG58 (1.7 dB) After we peaked the aerials at both ends, Steve's signal was 5 to 6 dB above the noise at peaks. My 400mWtransverter, now only 270 mW at the aerial was put into TX. After much tuning, adjusting aerials and listening by Steve and Ralph we succeeded in hearing the ZL1UJG signals at Cape Rodney (very weakly). They were unfortunately around the noise floor so a full contact was not possible.

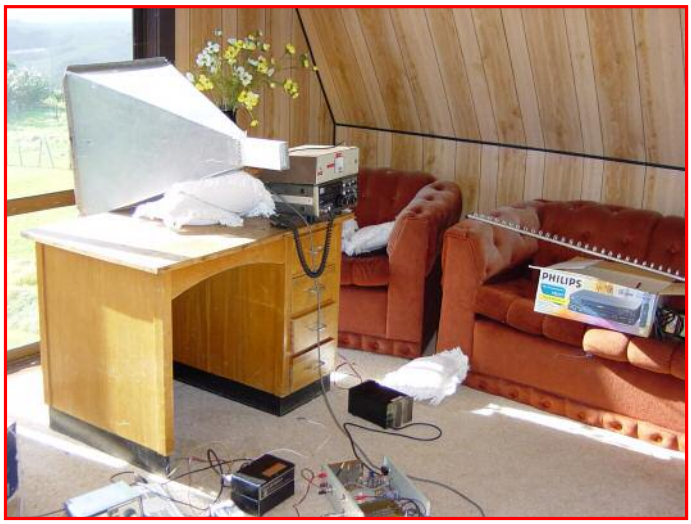
Final Comments by Steve ZL1TPH I think with an extra 10 db things we would have done a lot better but considering the short notice and the long distance (280 Km), and that big piece of Dirt in the way I think we did pretty well and I'm somewhat rapped myself.

Final Comments by Kevin ZL1UJG I am working on upgrading my transverter. The RX side has benefited from changing the 2nd stage MMIC from a MAR8 to a NGA-386 (similar to a ERA-3) increasing the overall RX gain from 8 dB to 13.5 dB. This would have increased RX sensitivity by ~ 2dB. I am working on the G4DDK oscillator to upgrade as per issue 4 of the newsletter. Other work on the TX side will increase power significantly. Thank you Steve and Ralph for your efforts (and thank you Mary for helping me with the antics on top of the hill).

With modest powers, long distances can be achieved on the Microwave bands, even under flat band conditions and over obstructed paths. I hope this is an incentive to try contacts on the higher bands away from normal contest activity.

Images

The images below are of Brian's (ZL1AVZ) alternative location at Muriwai. There is a Microwave Module 1296/144 MHz transverter (left image) and also homebrew transverter. Note the use of Horn antennas.



Oscillators

G4DDK004 Oscillator Kevin Murphy ZL1UJG

I did some further measurements on one of the G4DDK004 Oscillators during modification. The PCB was modified as per previous issues of this newsletter. Output of unit is ~ +7 dBm. Some copper tape was added on TR5 base to improve the power from +4 to + 7dBm. The area covered is about the same size as the previous filter element.

(300 / 600 MHz multiplier) TR3 current ~ 20mA (device BFR91)
(600 / 1200 MHz multiplier) TR4 current ~25 mA (device MRF901)
(1200/2400 MHz multiplier) TR5 current ~14mA (device MRF901)

The output of the 1200 MHz multiplier was measured to be ~ +12 dBm so there was adequate drive to the 1200 / 2400 MHz multiplier. I suspected that MRF901's are flagging at this frequency. I had in my junk box a 2SC2367. This is an 8 GHz Ic max 50mA device. I fitted this smaller device in (with long leads due to the hole in the PCB). The TR5 current after tuning is 40mA. (Vce 4 V) and the power output is + 14 dBm. An increase of 7dB.

Oscillator Discussions.

I started a thread on WA1MBA's microwave reflector about a Butler 2 transistor oscillator using 2 FET's and during the discussions, Sam G4DDK posted an interesting reply to the group

As I understand it, the drawback of the single FET oscillator (and the KK7B bipolar) used by DB6NT and other German designers is that the amplification and amplitude limiting both occur in the same stage. This can lead to higher noise contributions. According to several well-respected articles including the famous 1979 VHF Comms articles by B Neubig, DK1AG, the limiting action is best separated from the amplification part of the circuit. The FET oscillator (which looks suspiciously like a single stage Butler – maybe someone can confirm this?) can provide lower noise when operated with a high power junction FET like the P8000. However, these have proven difficult to obtain (at least in the UK) and perhaps also in Germany, where the more readily available small signal J310/J309 device has become the device of choice. The higher power FET also drives the crystal harder, the resulting higher dissipation can lead to rapid aging of the crystal. Another point to watch and maybe another reason why the J310/J309 circuit became so popular?

As to whether the 1/f noise of the FET is worse than the bipolar oscillator is perhaps open to debate, especially where people like myself have inadvertently used relatively noisy integrated circuit voltage regulators to power the oscillator stage!

Can I also clear up any confusion about the 'RSGB Butler oscillator'. This was not, to my knowledge, developed by anyone in the RSGB microwave committee. However, it did appear in a well-known meteorological circuit design, from where the design was 'liberated' and modified, hence the original 384MHz source was known as a 'Balloon' board!

The clear advantage of the 2 stage Butler bipolar overtone crystal oscillator is that it is far less 'fussy' about it's operating conditions, compared with the junction FET, and with the addition of a simple series capacitor, can be brought onto frequency relatively easily compared with many other designs. Poor starting is usually due to trying to pull the crystal too far. Try shorting out the capacitor if the frequency is too high and needs to be pulled down a long way. Leaky FET's using the single FET design have been a constant source of problems in a number of commercial amateur designs.

Whilst I agree that it is important to design very low noise crystal oscillator sources, especially when these are to be multiplied into the nether regions of 10GHz plus, the level of phase noise in a well designed crystal oscillator/multiplier is still often better than that of the PLL local oscillator in low cost black box transceivers that we use for an IF rig. These are often the limiting factor, not the crystal oscillator. Ask anyone using an FT736 and living close to a crystal oscillator/multiplier based beacon!

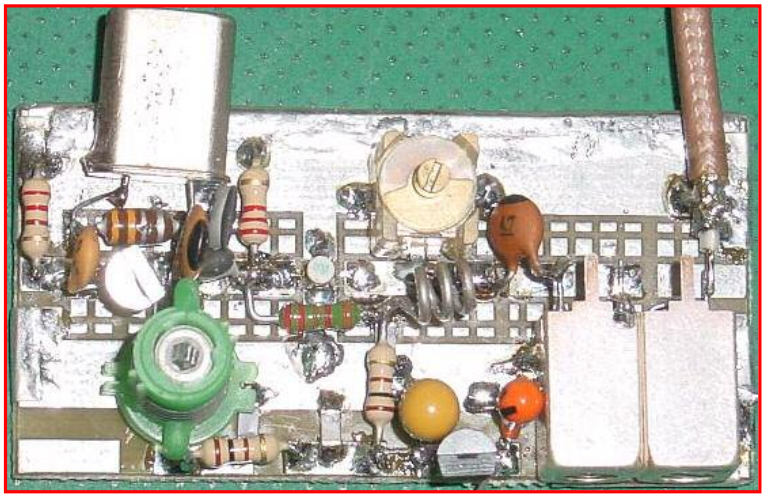
Current efforts by a number of microwave enthusiasts to develop new and lower noise crystal oscillator designs are to be applauded. For now the good old Butler oscillator, whether single or two stage, FET or bipolar, is still a good choice for modern amateur microwave design. Maybe, as has been advocated recently in the RSGB Microwave Newsletter, the Driscoll oscillator will lead us to pastures new?
Sam, G4DDK

Tom's 2424 MHz Transverter.

Tom Bevan ZL1THG

Tom Bevan ZL1THG is building a 2424 MHz transverter inside the battery compartment of an ICOM IC402. (IC302 in some countries). This is a photo of the partially completed unit.

Along the center of the photo (L-R) is the 2-stage preamp using an unknown GaAsfet and NGA386 MMIC (+32 dB gain) and the local oscillator chain. Above the preamp is a 2-section 2424 MHz filter using .141" semirigid coax and 2mm hardware. The two pieces of semirigid coax are lines used in the antiparallel mixer. Adjacent to the filter but missing is a small PIN switch. The middle top is DC switching and 7660 - 5 volt generator. A small TO5 can RF relay is near the BNC socket. 2 TX amplifier PCB's are not yet wired in



1152 MHz Oscillator

Kevin Murphy ZL1UJG

I have started to build up a replacement 1152 MHz Oscillator for a transverter that I am building. I had forwarded on my Mk1 Oscillator (1992 vintage) to someone building a 1296 MHz transverter. It was built on a single sided PCB with wires or component leads used to join components on the clear side.

I decided to use a Mk1 AMP PCB to construct the new oscillator/384 MHz multiplier. I wired it Manhattan style with good success.

The 96 MHz crystal oscillator uses a J310 FET in grounded gate (similar to DB6NT designs). A TOKO S18 type coil with an aluminium core tunes the oscillator. This then fed to a surplus 2SC2367 device used a x4 multiplier. The collector of the device is matched to 50 ohms with a tuned circuit (center of image) then fed to a 384 MHz helical filter. The 384 MHz output is +7 dBm. Both stages are run off a 78L08.

The 2SC2367 is running at 4 V on the collector with 40 mA Ic. This indicates ample RF drive. Note that nominal dissipation for most overtone crystals is ~ 1 mW. This design is estimated to have 2.5mW crystal dissipation I am increasing the J310 source resistor to 560Ω to reduce crystal current.

The coil and 384 MHz helical filter are available from BEC http://www.bec.co.uk/

The helical filter is a TOKO 7HW 37020A 380 MHz filter(BEC ref 084380).

Some further work on this unit is required and a circuit diagram will be in a later issue.

For Sale

Belcom Liner Four Thirty, VXO controlled SSB & CW only transceiver. Power output 10W.

In good condition and comes with instruction manual and circuit diagram. $100 ono + freight.

Contact Scott ZL1KB 09 828-5891

or packet ZL1KB@ZL1AB

Contests

VHF Field Day

All Bands 50 MHz and up

Saturday 7th December,2002 1600 to 2200 hrs NZST

Sunday 8th December, 2002 0800 to 1400 hrs NZST