March 2011
Volume 11, Issue 9

ANODE

Inside this issue:

Anode Editor's Comments

Volume 11, Issue 9
March 2011

Can You believe the Club?
Take a look at the pictures on Page 11. Wow what a difference!

Researchers crack the mystery of the spotless sun
http://www.defenceweb.co.za/index.php?option=com_content&view=article&id=13981:researchers-crack-the-mystery-of-the-spotless-sun&catid=35:Aerospace&Itemid=107

Shields Up: Why Last Week's Solar Storm Was a Dud
http://www.wired.com/wiredscience/2011/02/weak-solar-storm/

A Super Solar Flare
http://science.nasa.gov/science-news/science-at-nasa/2008/06may_carringtonflare/

(continued on page 11)

Equipment - Used and Abused

Batteries – a change for the better!

Over several years spent activating SOTA summits I have carried fairly large and heavy batteries up summits to power the equipment that I use. I don't mean that I repeated the follies of my youth when I carried a 34AH car battery up Kinder Scout G/SP-001, The Long Mynd G/WB-005 and other places like Ruabon Mountain (SJ231463) along with 10 GHz wideband FM gear, but something altogether more modest.

From the start in SOTA, I was determined to do much more than a handheld smash and grab type activation. Having a firm interest in 2m SSB, I pressed my semi-retired FT-290R and 25 watt linear into service. To power this set up, I initially purchased a 12AH sealed lead acid battery from Maplins for £25 which weighed 4.2 kg. This powered my station for around 18 months.

After a year or so, through a regular exchange of ideas with Richard G4ERP, the weight I was carrying up summits was is question. Having upgraded to a shiny new FT-817 in late 2006, my financial resources were still somewhat limited, so I decided to purchase 4 Ultramax SLABs, each of 3.3AH capacity which cost me £8 each including postage from Battery Masters. I soon found that these had limited capacity when running around 20 watts output and I was having to take two up each summit to carry out an activation. The 12AH battery was retained for use on the less arduous summits.

With the increasing availability of Lithium Polymer batteries, the subject of power and weight was discussed in a number of threads on the SOTA Reflector during 2008. To purchase the

(Continued on page 2)

Special points of interest:

- Contact details on back page (corrected & updated July 2010)
- Ham-Comp Latest on web site.

[I promise to have this updated ASAP. JB]

Equipment - Used and Abused

(continued from page 1)

equivalent of my 3.3AH SLABs would then have cost around £80 just for a single 11.1V 3 cell LiPo battery. To purchase 3 or 4 of these to replace the SLABs was therefore out of the question, so the idea was put to the back of my mind.

In January this year, I exchanged emails with John G4YSS on the subject of using LiPo batteries. He had started using LiPos to power his station and I was keen to get his view on how successful this had been. John provided some extremely useful information and between us we were able to shift through a lot of the rubbish that is written about LiPo technology. The batteries seemed to be famed more for their potential to act as fire bombs than as very useful power sources. Scores of videos on YouTube bore testimony to this. John suggested RCM Direct as a retailer of reasonably priced LiPos serving the model control hobby. At the time, their 4400 mAH 3 cell 10C LiPo cost £44 – prices had come down, but this was still quite a financial commitment as I needed more than one. Top rated batteries cost considerably more.

Just a word or two of explanation here. LiPo batteries are rated in milliamp hours and by cell count and discharge rate. Since most amateur radio equipment is designed to run at between 12 and 13.8 volts, the most useful batteries are 3 and 4 cell types, typically rated at 11.1 volts and 14.8 volts respectively. These are actually the voltages when the battery is fully discharged, or at least the voltage that they should be discharged down to. They are supplied with this voltage at their terminals. The discharge rate is given by a C capacity rating - a 10C battery will provide an output of 10 times the amp-hour rating of the battery, so a 4000 mAH battery will provide 40 amps. A 35C rated battery will provide 35 times the capacity – a massive 140 amps! While this type of output may be required for something like a model helicopter, it would be a heavy piece of amateur radio equipment that would require such power. This level of power delivery is, of course, only required for a relatively short period sufficient to fly model helicopters. Activations generally take considerably longer.

So what of the fully charged voltage? Well, typically a 3 cell LiPo will give around 12.6 volts initially and a 4 cell LiPo around 16.8 volts. The choice of cell-count really depends on the voltage tolerance of the equipment in use. Transceivers such as the FT-817 work well on the 3 cell LiPo as even at the minimum 11.1 volts the transceiver still provides near full power on most bands. Linear amplifiers and other equipment not specifically designed for portable use may be less tolerant. Nigel G6SFP successfully uses 4 cells LiPos with a diode voltage dropper arrangement that has a moveable short so that he can manually adjust the output to provide the optimum voltage for his equipment.

Back in January I was on the verge of taking on LiPo technology, so what eventually made me jump? The answer is eBay – I discovered that by April, the cost of 15C technology had come down to an affordable level. The modelers were now typically using 35 Celsius rated batteries in their hunger for more power and longer flights, so the cost of the "old" technology had come right down. By purchasing directly from a dealer in Hong Kong, I was able to obtain two (yes two) 4000 mAH 15C 3 cell LiPos for £28 including postage. I chose a dealer that split the total cost almost 50/50 between the value of the goods and the postage charge. This way, import taxes were not levied as the package "flew under the radar" as far as Customs were concerned.

I now had my batteries, but how to charge them? It was back to RCM Direct who market a very inexpensive charger-balancer which charges at a rate of 800 mAH costing around £12 including postage. For a 4000 mAH battery, the charge time from the 11.1 volt level takes around 5 hours and is at 0.2C rate. LiPOs should be charged at a maximum rate of 1C which for a 4000 mAH battery is obviously 4 amps, but there is evidence to suggest that

(Continued on page 3)

Equipment - Used and Abused

(Continued from page 2)

charging at a lower rate may extend the life of the battery. The charger-balancer unit connects to the LiPo's charging port, which is a small 4 pin plug arrangement on a flying lead out of the battery and requires 11.5 to 13.5 volts input. I charge from an old car battery with a protective 3 amp fuse in the supply lead as this allows me to charge the LiPos outside of the house in a protected position on the patio with little risk of a problem if we have a sudden shower. It is recommended that LiPos are charged outside of buildings. This is just a precaution – the fire bomb scenarios which you can see on YouTube are all set up by idiots. By taking care both when charging and in use, the technology should be completely safe. Voltage checkers and warning alarms are available at little cost off eBay to ease the mind!

The first outing for my new batteries was on the International SOTA Weekend when Paul G4MD and I activated Maesglase GW/NW-029. I took with me two 3.3AH SLABs and the two 4AH LiPos. We were intending spending up to 4 hours on the summit if the weather was suitable. Typically, on 2m SSB running the FT-817 and Microset VUR30 dual band linear, I get just 20 minutes out of a single 3.3AH SLAB, so I was expecting 30 minutes out of one LiPo. I actually decided to change batteries after 2 hours! The battery was down to 11.1V and was still enabling the linear to provide 15 watts output. This was excellent performance given that I get 22 watts when the LiPo is fully charged. The second two hour slot included a session by Paul using the 817 running barefoot on 6m, so the second LiPo was not fully discharged. The SLABs were only useful as weights to hold down the plastic sheet that I sat on.

The first outing was so much of a success that I ordered two more 4000 mAH LiPos on the Monday after the activation. With the supply leads and 4 mm sockets added to the batteries, each one weighs just 281g. Their dimensions are approximately 140 mm x 48 mm x 17 mm. This is far lighter and smaller than the 3.3AH SLABs which weigh 1125g without leads and are 134 mm x 67 mm x 61 mm.

So what else can I say about LiPos? Well, they have no memory so can be recharged regardless of their charge state. The charger-balancer automatically switches off when a full charge is reached. They hold their charge well and when they have eventually completed their life cycle they can be safely disposed of after fully discharging to zero volts and placing in a bucket of salty water for 24 hours. The life cycle for amateur radio use is unknown, though since this is a lightweight duty, expectations are that the batteries will considerably exceed 100 charge cycles.

Gerald G4OIG

Amateur Communications Receiver

Advanced design covering the 80, 40, 20, 15 and 10 metre bands

1: Design considerations

by D. R. Bowman, A-11.1nst. E., G3LUB

For many years the author's amateur radio station has included a complex home-built dual conversion valve receiver. Throughout this time a number of solid-state receivers have been constructed, though it must be admitted that none has approached the overall performance of the valve unit. The recent appearance of a number of new semiconductor devices coupled with the ever widening range of i.f. filters has prompted the author to re-appraise selected frequency band communication receiver design. A number of fundamental design requirements have been generally agreed for many years, but, in the final analysis, every receiver design is a compromise.

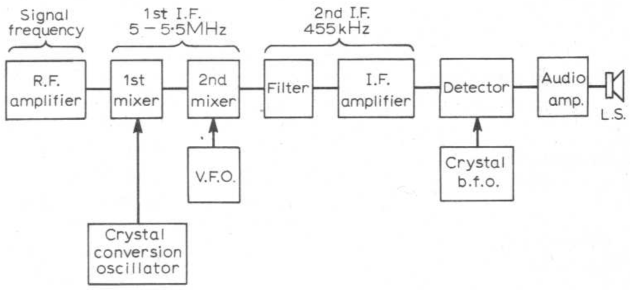

Fig. 1. The block diagram of a typical dual conversion receiver.

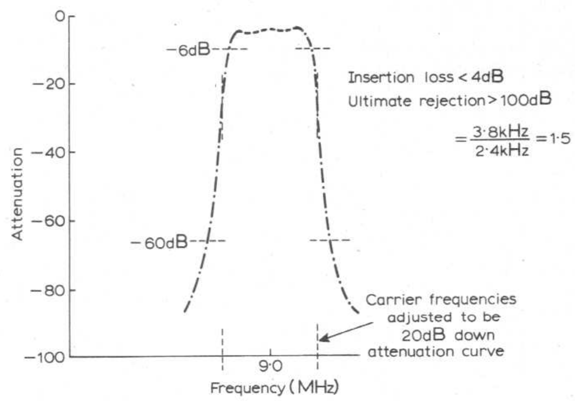

Fig. 2. Attenuation curve for the 9 MHz KVG XF-9B i.f. filter.

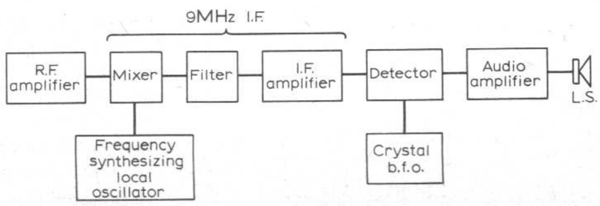

Fig. 3. The block diagram of a single conversion receiver.

One of the biggest troubles is cross-modulation which can be experienced using almost all types of receiver. All one needs to do is to tune to say 7 MHz at night, listen, and then insert a 20 dB attenuator in series with the receiving aerial. The effect is most enlightening as low-power signals re-appear from under the high power broadcast stations.

To reduce cross-modulation to the lowest level possible the selectivity must be as near to the front of the receiver as possible so as to reject the unwanted powerful signals before they can be amplified and cross-modulated in the mixer and to a lesser extent in the r.f. stages. Until recently first-rate i.f. selectivity has been unattainable above about 1 MHz and commercial filters were almost exclusively limited to frequencies in the region of 400 to 500 kHz. This limitation has forced designers either to accept poor image rejection or poor noise figures. Image rejection is a function of the r.f. circuit Q and the number of r.f. coils.

It will be shown that obtaining very high front-end selectivity and a good noise figure are conflicting requirements. It was this problem that led designers to introduce the dual conversion concept (Fig. 1). This system consists basically of a single conversion tunable receiver using a frequency band chosen to produce good image rejection, which in turn is fed from a range of h.f. converters each translating the required receiver band to the frequency of the tunable receiver. This use of a tunable i.f. also has the advantage of allowing the same basic tuning rate and dial calibration to be used on all received frequencies. The stability problems of tunable oscillators is also reduced as only one v.f.o. is required and it operates on a relatively low frequency, usually about 5 MHz. The first oscillator is invariably crystal controlled.

(continued on page 5)

Amateur Communications Receiver

(Continued from page 4)

There are some problems in this type of system. The already mentioned need for selectivity at the front-end is not met, but by restricting the pre-i.f. gain to the minimum consistent with good noise performance and the use of low noise mixer circuits, this problem can be minimized. A good a.g.c. (automatic gain control) system controlling the r.f. gain is also essential. The other main problem, namely internally generated spurious frequencies, can be more or less overcome by the careful choice of conversion frequencies coupled with good physical screening. This said, it must be admitted that the dual conversion system is rather complex.

Recently a number of high-frequency crystal filters have become available. Although they are expensive, when it is realized that the KVG XF9B 9 MHz filter (specified in the design) consists of a double lattice using eight crystals in addition to the two carrier crystals, the author considers that it is very good value for money. The ability to achieve good selectivity (see Fig. 2) at a high intermediate frequency lends itself to the use of a single conversion system (Fig. 3). The extremely narrow bandwidth of the 9 MHz filter led to the decision to design essentially for the single sideband reception for which the filter was intended. The performance of the completed receiver on e.w. is also very good and a.m. transmissions can be resolved using the exalted carrier method, i.e. the reception of only one sideband by zero beating the a.m. signal's carrier.

The choice of a high i.f. means that the image response to the required signal ratio is very high; remembering that the image is displaced by twice the i.f. in frequency from the required signal; in this case 18 MHz.

Although a number of first quality receivers have been designed using no r.f. amplifier preceding the mixer the author decided to include an a.g.c. controlled amplifier, The 40-dB attenuation of signals that can be achieved ahead of the mixer does reduce the quantity of blocking and cross-modulation produced in the mixer stage of the receiver. The use of an r. f. amplifier also allows adequate pre-mixer selectivity to be used.

Table I

range		local osc.	h.f.osc. crystal
metres	MHz	MHz	MHz
80	3·5– 4·0	5·5– 5·0*†	none
40	7·0– 7·5	16·0–16·5	11
20	14·0–14·5	5·0–5·5†	none
15	21·0–21·5	30·0–30·5	25·0
10	28·0–28·5	37·0–37·5	32·0 (3rd overtone)
	28·5–29·0	37·5–38·0	32·5
	29·0–29·5	38·0–38·5	33·0

* tuning direction reversed † sideband selection reversed

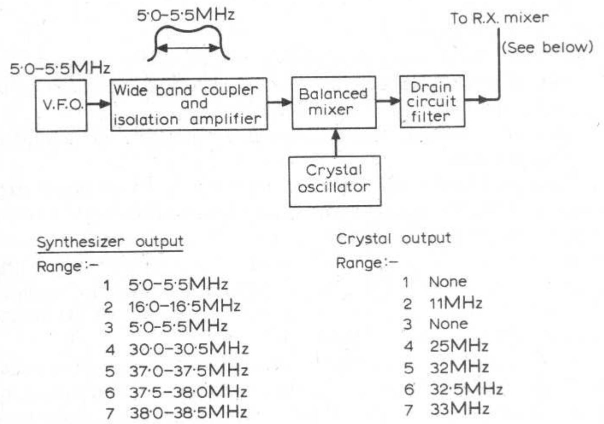

Fig. 4. The local oscillator synthesizer.

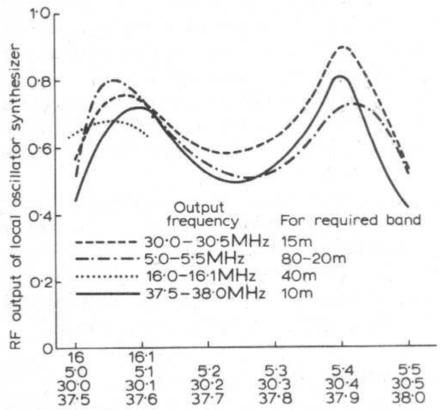

Fig. 5. Output voltage for the oscillator of Fig. 4.

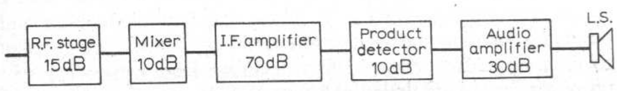

Fig. 6. Gain distribution throughout the receiver.

(Continued on page 6)

Amateur Communications Receiver

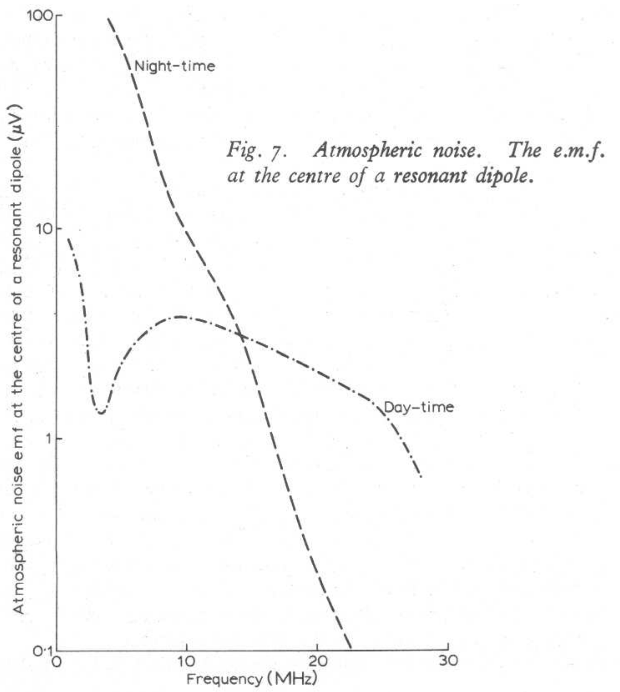

Fig. 7. Atmospheric noise. The e.m.f. at the centre of a resonant dipole.

(Continued from page 5)

So far the proposed system appears too good to be true however there is a disadvantage. To tune the high-frequency amateur bands, say 10 metres, the local oscillator would have to tune either: (28 to 28,5) + 9 MHz - 37 to 37.5 MHz or (28 to 28.5) - 9 MHz - 19 to 19.5 MHz.

Either band is rather high in frequency for good stability using a free running oscillator and especially when it is realised that various switched ranges are required. It would be impossible to adjust the various tuning ranges so that the dual conversion systems advantage of a constant tuning rate and dial calibration on all ranges is achieved.

Various ideas were considered, the most promising being the heterodyne V.f.o. dating back to soon after the last war. It consists of a single range low-frequency v.f.o. fed to a mixer together with the output of an h.f. crystal oscillator; the output of the mixer circuit being tuned to the appropriate product (Figs. 4 and 5). This system was originally introduced as a means of avoiding the use of frequency multiplication with its associated output of unwanted frequencies. For receiver local oscillator use it is essential that the various frequencies are chosen carefully and that the unwanted components present in the output of the mixer circuit are not passed on to the main receiver mixer.

To avoid spurious signals within the bands the best v.f.o, frequency range is found to be 7.6 to 8. 1 MHz, but this does mean that each amateur band covered requires a separate crystal (table I), If an odd one or two spurious whistles can be tolerated then, with a v.f.o. range of 5 to 5.5 MHz, two of the bands can be covered using no h.f. crystal oscillator.

required band v.f.o. i.f.
(3.5 to 4 MHz) + (5 to 5.5 MHz) ~ 9 MHz (14 to 14.5 MHz) - (5 to 5.5 MHz) ~ 9 MHz

One more slight disadvantage is that the receiver tuning direction will be reversed on one of the ranges. However, on 20 and 80 metres the receiver's performance is likely to surpass even the most advanced commercial unit.

It will be noted that one harmonic of the v.f.o. falls within the 15-metre band. The amplitude of this spurious signal can be reduced to a very low level by careful v.f.o. circuit design in conjunction with extra filtering and good mixer design. This method of local oscillator frequency generation does lend itself to a constant tuning rate and dial calibration on all ranges.

The next basic decision that a receiver designer has to make is the gain distribution throughout the receiver (Fig. 6). At first sight it would seem that the best receiver would embrace the maximum signal gain.

The random motion of free electrons in wires and resistors generates small currents, even though the average over a finite time of these currents is zero. At any one time this contributes a small noise current to the circuit. From these small currents are derived voltages which are named " white noise " because they spread

(continued on page 7)

Amateur Communications Receiver

(Continued from page 6)

more or less evenly throughout the frequency spectrum.

e ~ 4 K.T.B.R. Volts
K ~ Boltzman's constant
1.3 x 10-2' joule per ~K (absolute)
T ~ temperature of conductor in degrees Kelvin
B ~ bandwidth of the complete system in hertz.
R ~ resistance of conductor in ohms.

For 25~ C:
aerial noise voltage e = 1.55 x 10-10 x BR volts
system bandwidth of 2 x 102 Hz
aerial resonant impedance 75~l: e = 1.55 x 10-11 x 2 x 101 X 75 - 0.023 ~X

As far as external noise is concerned it is generally accepted that over the frequency range 1 to 14 MHz the minimum external noise level will be at least 30 dB above the ideal figure quoted above (Fig. 7). Even from 14 to 30 MHz the level can be expected to be only about 10 dB better. This external noise is made up from various sources. Electrical storms in widely separated parts of the world contribute noise in addition to cosmic sources originating from the milky way. It is generally accepted that a signal must exceed the noise level by at least 10 dB to be readable.

This sets the minimum noise level at 30 dB above 0.023 mV or 0.7 gV, over the range 1 to 14 MHz, and 20 dB above 0.023 l~V, or 0.23 liV above 14 MHz.

For a 10 dB signal ratio the minimum detectable signal levels will therefore be 2.1 IV from 1 to 14 MHz and 1 ~,V above 14 MHz.

Although these noise figures vary considerably from area to area they can be taken as a starting point.

In a well designed unit the vast majority of the

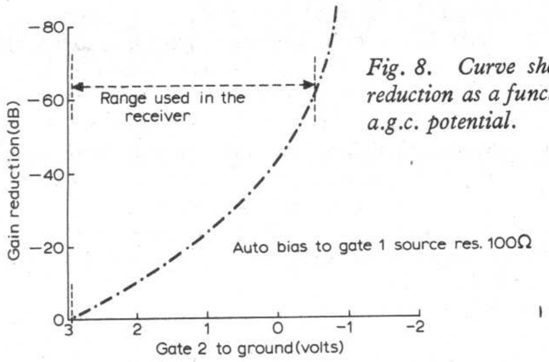

Fig. 8. Curve showing gain reduction as a function of gate a.g.c. potential.

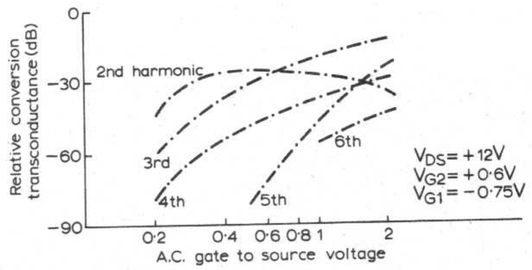

Fig. 9. Showing the relative conversion gain of several harmonics as a function of oscillator voltage (reproduced with the permission of R.C.A.).

receiver noise originates from the first r.f. stage; the succeeding mixer contributing only about 1 dB. To reduce cross-modulation to a low level it is essential to reduce the amplitude of strong off-channel signals before they reach the mixer.

To do this it would seem that a number of high-Q tuned circuits ahead of the r.f. stage could be used. It can be shown that in fact excessive pre-r.f. stage selectivity considerably worsens the overall noise figure. In general it can be said that the lowest noise figure coincides with minimum signal loss between aerial and the first r.f. amplifier device. Maximum power transfer occurs when the signal source is matched to the load. As noise performance is most important on the higher frequency ranges, 10 metres has been taken as the starting point.

Assuming stray capacitances to be of the order of 10 pF then the minimum value of C is taken as 15 pF which at 30 MHz resonates with 2 MIL

(Continued on page 8)

Amateur Communications Receiver

(Continued from page 7)

Assuming an unloaded Q of 100 then: Q = (.L) ~R therefore: R - (.L):Q
(2r, x 30 x 101 x 2 x 10-1)1100 - 3.8 12
the dynamic resistance of the parallel tuned circuit RD is:
RD L~(CR) = (2 x 10-1)/(15 x 10-11 x 3.8)
35.1 kL2

If maximum power transfer from the aerial to the tuned circuit occurs then the value of R, is transformed up to Z~ and the effective resistance in parallel with the tuned circuit becomes RD;12 = 17 ki2. The tuned circuit must of course also match the input impedance of the amplifying device. The device chosen has an input impedance that varies with frequency. At 3 MHz it is very high dropping to as low as 20 M2 at 30 MHz. It will be noted throughout this analysis that the reactive part of the devices input and output impedance is ignored. This can be justified as the reactive portion becomes part of a tuned circuit.

The total parallel resistance:

(17 k x 20 k)1(17 k - 20 k) ~ 9.2 k
Therefore the circuit loaded Q is: Q - Rp~(-Lp) - (9.2 x 101) (2,. x 30 x 101 x 2 x 10-1) - 24
Therefore it is shown that minimum noise figure does not occur with maximum selectivity in the r.f. stage. A compromise has to be made between noise figure and selectivity.

This does not mean that overall system selectivity has to suffer as this is determined by the i.f. filter. The hest compromise is to trade excess r. f. gain for increased selectivity by reducing the loading on the r.f. to mixer coupling circuit. This has the extra advantage of increasing the r.f. amplifier's stability factor. Care must be taken not to reduce the gain too much. The author decided to aim for a noise figure of 12 dB on the I.f. bands and better than 8 dB on 10 metres.

R.F. amplifier The requirements for the r.f. amplifier were as follows:
(1) Very good immunity to cross-modulation and blocking over the a.g.c. range.
(2) Low noise figure.
(3) A low reverse transfer admittance to avoid the necessity for circuit neutralization in association with high input-tooutput isolation reducing resonant circuit interaction.
(4) An a.g.c. voltage range compatible with the i.f. amplifier requirements.

Cross-modulation distortion occurs when a device has a particular transfer characteristic and is fed with two differing frequency signals. As long as the transfer characteristic is linear or follows a square law then the gain applied to signal two is independent of the second signal's amplitude. If the transfer characteristic deviates from a linear or a square law the gain on signal one will be modulated by the amplitude of signal two.

An investigation into various semiconductor devices shows that only the field effect transistor has a transfer characteristic of approximately square law. Bipolar devices are particularly poor in this respect. During some earlier work the author found that even f.e.t. cross-modulation performance is determined in part by the choice of drain current operating point. Very poor performance is likely if reverse a.g.c. is applied to a single gate device. This disadvantage can be overcome by using two f.e.t's in a cascode circuit applying a.g.c. to the common base stage (Fig. 8).

R.C.A. have recently marketed an integral cascode device which has the advantage of a somewhat lower h.t. requirement than separate devices, as well as a very low reverse transfer admittance value.

These devices are marketed under an assortment of code numbers and vary in price from about 7s to 14s. The author tested the following types and at up to 30 MHz could find very little difference between them:-3N140, 3N141, TA7149 and 40500. (Since writing the MEM 564C has become available and is to be recommended since gate protection is incorporated).

(continued on page 9)

Amateur Communications Receiver

(Continued from page 8)

The mixer and i.f. amplifier

If two signals differing in frequency are fed to a device with a square law characteristic, it is found that intermodulation win occur, i.e. addition and subtraction of the two input frequencies to produce other frequencies. Any deviation from square law will introduce cross-modulation and therefore the dual gate f.e.t. is as equally applicable to mixers as amplifiers. It has the added advantage that the two signals can be fed to separate gate electrodes to provide considerable isolation between the local oscillator and the signal voltages. The characteristics of this mixer are such that the overload performance is improved with a limited reduction in oscillator drive voltage. The mixer gain is of course also reduced and spurious signal generation suffers a very much greater reduction. The optimum value of oscillator injection for the authors' application was 0.3 V, Lower voltages than this impaired the noise performance and, above 0.5 V, the unwanted harmonic generation becomes excessive (Fig. 9).

One of the many advantages of using the 3N140, which is really intended for v.h.f. use, is the constant value of the output impedance over a range of 1 to 30 MHz, The i.f. amplifier was designed with the following factors in mind:
(1) Maximum gain of 70 dll centred on 9 MHz.
(2) At least 80 dB of automatic gain control.
(3) Wide bandwidth, say 300 kHz, as one method of avoiding frequency shift with a.g.c. action. Note the selectivity is determined by an 8-pole, 9 MHz, crystal filter.
(4) A.G.C. voltage sense and range compatible with the amplifier. Many circuit configurations were considered for use in the i.f. amplifier. The use of common emitter transformer coupled stages was avoided due to the high value of reverse admittance, making either circuit neutralization or low gain per-stage essential to ensure an adequate stability factor.

The cascode arrangement of bipolar devices was investigated. It was decided that there was little advantage in using field effect transistors in the i.f. amplifier as the cross-modulation problem is minimal after the very narrow bandwidth filter. The cascode arrangement was found to exhibit high-gain with a very low reverse admittance. The circuit also lends itself to a.g.c. control rather in the same manner as the r.f. amplifier. The control voltage is applied to the common base connected stage. This in turn means that the r.f. and i.f. controlled sections can easily be coupled together. It was found that the cascode arrangement induced very much less detuning of the i.f. transformers and by using low Q single tuned circuits very little change in the overall i.f. response occurs with a.g.c. action.

Although two high-gain sections could be designed to provide the required gain, the author's previous experience suggested that to be sure of maintaining stability three stages incorporating a total of six transistors -be used. The gain required is spread between the three stages. The possibility of using a capacitative potential divider across the i.f. coils to provide the consecutive base drive was investigated. It was found that the very long earth paths made a stable reproduceable design very difficult. The amplifier was very much easier to handle using low impedance coupling coils on the i.f. transformers.

During tests of the i.f. amplifier the a.g.c. gave the following performance: With a change of input signal of -50 dB below 200 mV the output dropped by -3 dB; and a change of input signal of -80 dB produced a drop of -10 dB at the output. The amplifier had a gain of 90 dB, and showed tendencies towards instability only when this figure was exceeded.

The stage from which the a.g.c. is derived is a

(Continued on page 10)

Amateur Communications Receiver

(Continued from page 9)

single transistor biased so that, with no signal, it is very nearly switched off. As the signal increases so the average collector current also increases and the collector voltage change is approximately proportional to the output of the i.f. amplifier.

For the reception of a single sideband transmission the normal fast attack, fast recovery, a.g.c. characteristic is useless. Because the transmission has no steady carrier wave the fast a.g.c. system tries to follow each syllable. One method of using a.g.c. with s.s.b. is to tailor the response to fast attack, slow delay. This has the effect of reducing the receiver's gain almost instantaneously, but delaying the release for the order of a second or so.

The detector frequency oscillator

The product detect or can be considered as a mixer in which the input i.f. signal is mixed with a beat frequency oscillator to produce an output whose frequency spectrum falls in the audio range. This system of detection is used to demodulate amplitude modulated signals which are treated as if they were single sideband transmissions. In a noiseless system there is a 3 dB signal loss relative to s.s.b. but under crowded amateur band conditions it is found that the ability to select either sideband reduces the chance of a heterodyne blotting out the a.m. signal.

Remembering that the i.f. bandwidth is only 2.4 kHz wide, it was decided not to incorporate a conventional a.m. detector due to the rather restricted audio response of 0 to 1.2 kHz that would result.

A number of product detector circuits were investigated including one using an f.e.t. The author decided that the extra expense of an f.e.t. detector was not warranted. The circuit used is a balanced bipolar arrangement which requires a very low b.f.o. injection voltage of about 100 mV. This small oscillator voltage requirement helps the constructor to avoid stray b.f.o. signals getting into early stages of the i.f. amplifier. The use of a high i.f. amplifier does tend to increase this risk. The detector will operate at low distortion, with an i.f. signal no greater than 10 mV, and exhibits a gain of the order of 10 dB.

At an early stage in the design it was decided to use a crystal controlled b.f.o., whereas, when using an IS. system the crystal frequencies have to be specified accurately, it was found that at 9 MHz the frequencies can be easily adjusted over a few kHz. This final adjustment is carried out by connecting a small trim capacitance in parallel or series with the individual crystals. If the frequency is too high then parallel C is required and if too low, series C is required. The final frequencies being set 20 dB down either side of the filter characteristic. It will be noted later that the crystal is election uses germanium diodes which allow the control switch to be positioned remote from the actual circuit.

This completes the description of the basic system and the points that have either been dealt with fleetingly or not at all will be covered in the practical description which starts next month. The receiver will show up well in comparison even with very expensive commercial units, but, it is complex and only constructors with considerable previous experience are advised to tackle its construction. The use of a valve voltmeter together with a signal generator would be very helpful, but not essential.

(to be continued)

[and it was! August 1969 do you wish me to continue? JB]

Editor's Rants and Raves

(Continued from page 1)

Pictures taken in the club (last Monday)

The London Stock Exchange moves to Novell Linux
http://www.zdnet.com/blog/open-source/the-london-stock-exchange-moves-to-novell-linux/8285?alertspromo=&tag=nl.rSINGLE

"September 8th 2008 was one of the worst days ever for the London Stock Exchange (LSE), and high-end Windows server-based applications. That was the day that the LSE came to a crashing stop. What happened? While the LSE has never come clean on the whole story, my sources told me that the LSE's Windows-based .NET TradElec stock exchange had crashed. What we do know is that the CEO who had brought Windows and TradElec in was fired, TradElec was dumped, and a Novell SUSE Linux-based platform was brought in to replace it."

"Today, February 14th, the LSE's Linux-based Millennium Exchange took over and everything just worked. It did take longer to switch to Linux than expected, because of what the LSW first called "sabotage" but later put down to "human error" in late 2010. On its first day, out LSE ran like a charm."

"It's not the only stock exchange that's found that Linux worked better. The Johannesburg Stock Exchange in South Africa is moving to Millennium Exchange. The LSE's parent company is in the process of acquiring the Toronto stock exchange so it will soon be using Linux as well."

{for more info}
London Stock Exchange suffers .NET Crash
http://practical-tech.com/infrastructure/london-stock-exchange-suffers-net-crash/722/

The West Rand Amateur Radio Club
Established in 1938
KG33XU 26.14122 South - 27.91870 East

P.O. Box 5344
Weltevreden Park
1715

Phone: 083 267 3835 (Chairman)
Email: **zs6wr.club@gmail.com**
Web page: www.zs6wr.co.za

Bulletins (Sundays at …)
11h15 Start of call in of stations
11h30 Main bulletin start

Frequencies
439.000MHz 7.6MHz split
Input: 431.4MHz (West Rand Repeater)
145,625 MHz (West Rand Repeater)
10,135 MHz (HF Relay)

Radio Amateurs do it with more frequency!

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Vice Chairman	Geoff Levey	ZS6GRL	082 546 5546	glevey@gmail.com
Secretary	Rory Crouch	ZS6RBJ	082 448 4445	rorycrouch@mweb.co.za
Treasurer	Craig Woods	ZS6CRW	083 449-4886	zs6crw@gmail.com
Member	Romeo Nardini	ZS6ARQ	082 552 4440	roshelec@global.co.za
Member (Anode)	John Brock	'PieRat'	011 768 1626	brockjk@gmail.com
Member (technical)	Ron Eva	ZR6RON	082 902 8343	zr6ron@webmail.co.za
SARL Liaison	Willem Weideman	ZS6WWJ	082 890 6775	willem@zs6wwj.co.za

West Rand members - we need your input!

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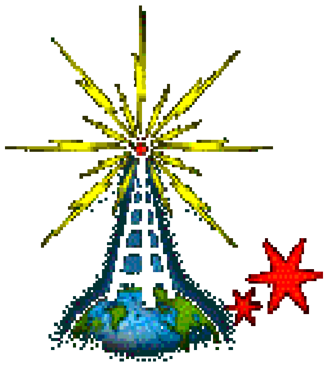

We need your input! Email us articles, comments and suggestions please. zs6wr.club@gmail.com