THE WEST RAND AMATEUR RADIO CLUB

May 2004
Volume 4, Issue 10

ANODE

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Editor's Comments

May 2004

Well its been a hard day, I have been 'Defragmenting the garage'. So I only got to the computer late in the afternoon. A quick check on the amateur radio newsgroups produces information overload. So I don't have time to hack all this data, so you will just have to read it yourselves.

I got quite a nice surprise the other Saturday at Princess Crossing. John (ZS6WL) and I have mourned the passing of Vidikits and the only shop supplying components and electronic kits on the West Rand. So the stumbling across this Electronic kit supplier was an eye opener to say the least. I even bought a pic programmer kit for R53!

Taken from one of the newsgroups :-

Radiomen
by Bob 'Dex' Armstrong "KØHB"

In the old gravel-gut boat service, your only link with the civilized world was via the radio shack. A cubby hole on Requin aft of the scope wells in the control room... It was the home of the spark shufflers.

If you were in tight with a radioman, you could get ball scores. Sewer pipe sailors lost touch with the teams they followed... A hazard common to submarine sailors and people who take a moon walk and miss the ride home.

Actually, we lost touch

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Sampling FM monitor

THE UNIT TO BE DESCRIBED is designed to enable an amateur with some constructional experience to build a simple fm monitor, capable of monitoring fm transmissions from his station from hf to uhf. The use of a sampling mixer allows a very wide frequency coverage with a simple low frequency local oscillator.

Principle of operation

The sampling mixer essentially consists of a switch which is opened and closed by short pulses derived from the local oscillator signal (see Fig 1). When the switch is closed, the input signal is fed to the hold capacitor so that, when it opens again, the capacitor holds a charge proportional to the value of the input signal during the sampling interval. Operation is shown in somewhat idealized form in Fig 2. The low frequency (If) signal which appears on the hold capacitor is filtered and forms the intermediate frequency (i.f.).

There are several assumptions implicit in Fig 2:

1. The sampling pulse is short compared with the period of the input signal.
2. The switch resistance

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Editors Comments

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with just about everything. In the war movies when they come across some guy who claims to be an American, they ask him questions only an American could answer. If they had picked me up and asked me anything but (A) The names of Roy's and Gene's horses (B) Who won World War II and (C) Blaze Starr's bust size, I would have been one 'up the creek' sonuvabitch. Hell, we didn't know Jack Kennedy was the president until we snorkelled a day later.

Only a complete idiot would make a bet with a radioman. Chances were, the radioman had the final score before you tossed your wampum on the mess table.

I remember one great night brought to us by the spark pushers in the radio shack.

We had finished whatever nonsense they sent us out to do and were making turns for home. The Old Man opened the showers... Guys were bumming razor blades and rooting around in side lockers for something that would pass for a towel.

Next thing you know, the foo-foo juice came out. Now there's a myth that all smoke boat sailors eventually bought into, sooner or later...

Aqua Velva was never meant to disguise poor personal hygiene. No matter how much of the stuff you poured on a dungaree shirt you had been inside of for two weeks, you were still one disgustingly foul smelling sonuvabitch.

You could spray French perfume on an engineman with a fire hose and buzzards would still circle around the bastard when he went topside. But I digress...

A group of us were sitting around in the crew's mess drinking coffee and ragging guys heading fore and aft. A radioman came in and told us we were in for one helluva good laugh. He monkeyed around with the RBO and patched it into something in the radio shack.

For those of you who never had the pleasure of riding diesel boats or other seagoing steel-hulled garbage scows, I must explain something here.

You could make phone calls from a ship at sea. Here is how it worked. The radioman would raise someone ashore called a 'marine operator'. Then the radioman would give the marine operator the name and phone number of whoever the bluejacket aboard ship wanted to call.

The marine operator would then place a collect call and when the party answered and accepted the charges, the marine operator would form a radio link with the ship and 'Bill the Bluejacket' could talk to his sweetie.

From sweetie to the marine operator was private and confidential... From the marine operator to Barnacle Bill, it was up for grabs... Great evening entertainment.

"Poopsie, is that you?"

"Yes ducky doo, it's me."

"You miss me, peach blossom?"

"Oh yes... YES, darling!"

"Miss me a lot?"

"Oh, I miss you soooo much I can't wait to hold you and..."

"Okay darling... Are you going to meet the ship?"

"No sweetheart, I parked the car in the pier head lot... Keys are under the mat."

"Why aren't you meeting the boat, sweetheart?"

"Oh, it was supposed to be a surprise... If you must know, the kids are spending the night with the Webbers. I bought a new nightie and I figured we'd break it in tonight."

The animals would cheer,

"LET'S HEAR IT FOR MAMMA AND HER NEW NIGHTIE!!"

And so it went. Bluejackets phoning in after six months in the Med...

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An Introduction To Amateur Satellite Ground

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Great entertainment.

"Darlin' can't wait... Just you and me and a can of Crisco!"

We heard it all... It was great... Laugh after laugh. A very memorable evening... Best and cheapest fun we ever had on Requin.

There were times... Moments that we took for granted and that passed with little notice. It's funny how they come back late in life when you have the time to reshuffle your memories... The collected moments that constitute your life.

Radiomen linked us with the world. Another thing we just took for granted and that was so damned important looking back. Never thanked them...

Should have.

Great guys, all of them.

—{}—

Calendar

MAY
1 *Workers Day* - IPA CW Contest
1 - 2 10-10 International Spring CW Contest - MARAC County Hunters CW Contest - ARI Int DX Contest
2 IPA SSB Contest
8 FISTS Spring Sprint
9 *Mother's Day*
20 **Radio Amateur Exam** www.sarl.org
15 - 16 His Maj. King of Spain CW Contest
20 *Ascension Day*
25 Marconi Day
29 – 30 CQ WW WPX CW Contest www.cq-amatear-radio.com
30 **SARL President's net**
31 **Deadline Radio ZS articles**

JUNE
5 *World Environmental Day*
5 – 6 IARU Region 1 CW Field Day
11 – 13 **PEARS Mid-Year Digital Contest**
13 *Father's Day*
16 *Youth Day – Comrades Marathon*
Kids Day www.sarl.org.za/public/contests
19 - 20 All Asian DX CW Contest - SMIRK Contest - www.jarl.or.jp/English/4_Library/
25 *Schools close – inland provinces*
26 – 27 ARRL Field Day - His Maj. King of Spain SSB Contest - Marconi Memorial HF Contest - www.arrl.org/contests
27 **SARL President's net**
30 *Schools close – coastal provinces*

Sampling FM monitor

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is small so as to allow the input signal to charge C to the correct value during the short period when the switch is closed. Finite resistance in the switch means that the 'hold capacitor is not charged to the peak of the input signal, and manifests itself as loss in the mixer which increases as the intermediate frequency is raised.

3. The leakage resistance must be sufficiently large that capacitor voltage does not fall appreciably in between samples, causing mixer loss.

The sampling mixer can also be considered in the frequency domain (see Fig 3). The local oscillator (Lo) pulse, if infinitely short in duration, would have a spectrum extending out to infinity, a so-called harmonic "comb", with a "tooth" spacing equal to the lo frequency. Practical pulses of finite duration have a comb which is not flat but falls at high frequencies. The wider the pulse, the lower the roll-off frequency.

Also depicted in Fig 3 is the fact that each lo harmonic can produce an i.f. with any signal spaced an i.f. away on either side. The sampling mixer thus has a multitude of responses, and is not therefore recommended as a receiver front-end! For transmitter monitoring, there will (it is hoped) be only a single frequency present, and this is then of no concern. The sampling mixer described below enables transmitter monitoring to frequencies beyond the 432MHz band.

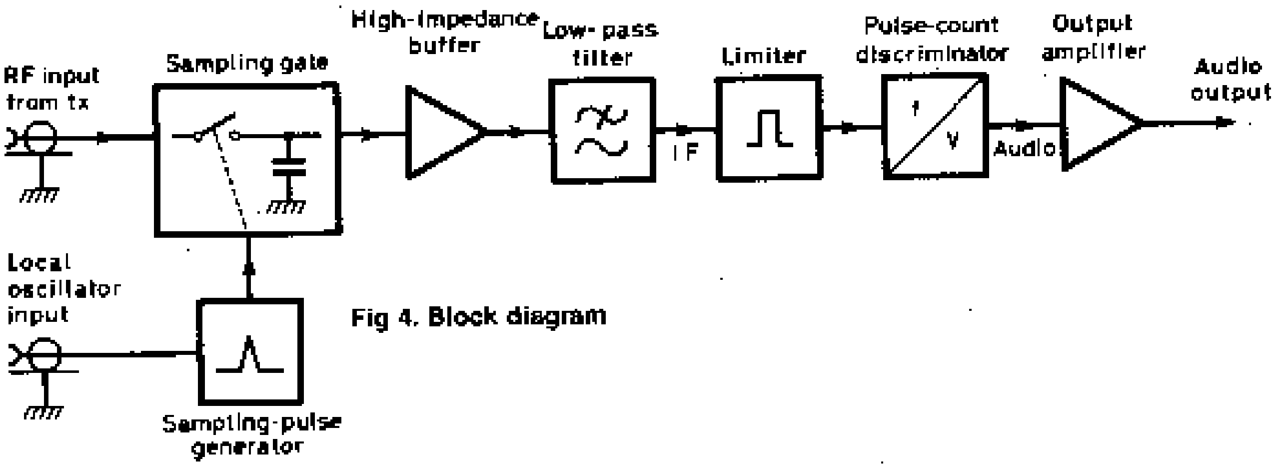


Fig 4. Block diagram

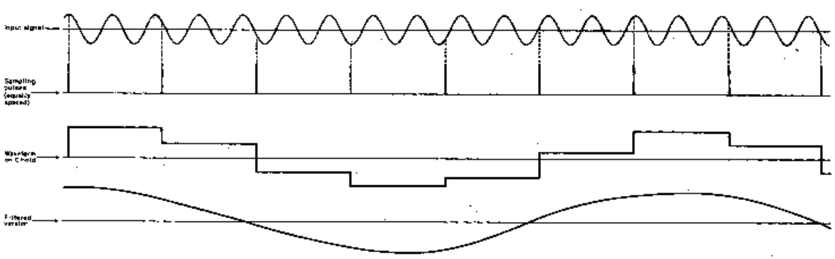
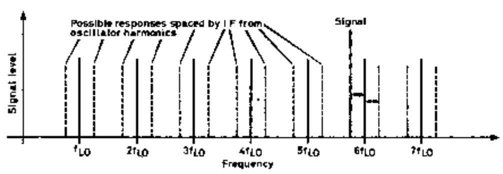


Fig 2. Idealized sampling action

Fig 3. Spectrum of sampling gate showing multiple responses



Monitor block diagram (Fig 4)

The sampling mixer, consisting of a diode gate fed by an lo pulse generator is followed by a high impedance fet buffer amplifier. The i.f. signal is selected by a lowpass filter and amplitude limited. The fm signal is rendered intelligible by a pulse-counting

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Sampling FM monitor

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discriminator. This form of discriminator is used because it is wideband, and removes the need for excessively tight tolerance on the lo frequency. For example, an lo operating in the region of 4MHz will produce an i.f. with a 432MHz signal on around its hundredth harmonic. A narrow-tuned discriminator would require very careful setting of the lo.

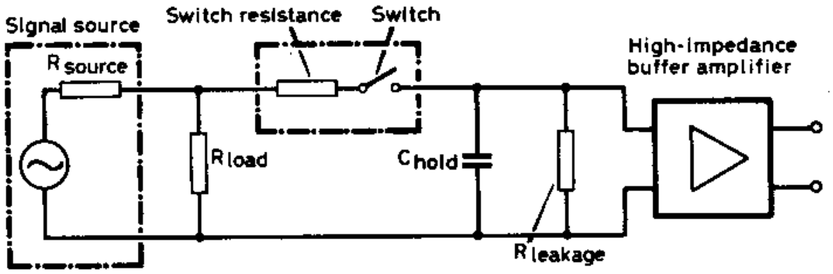
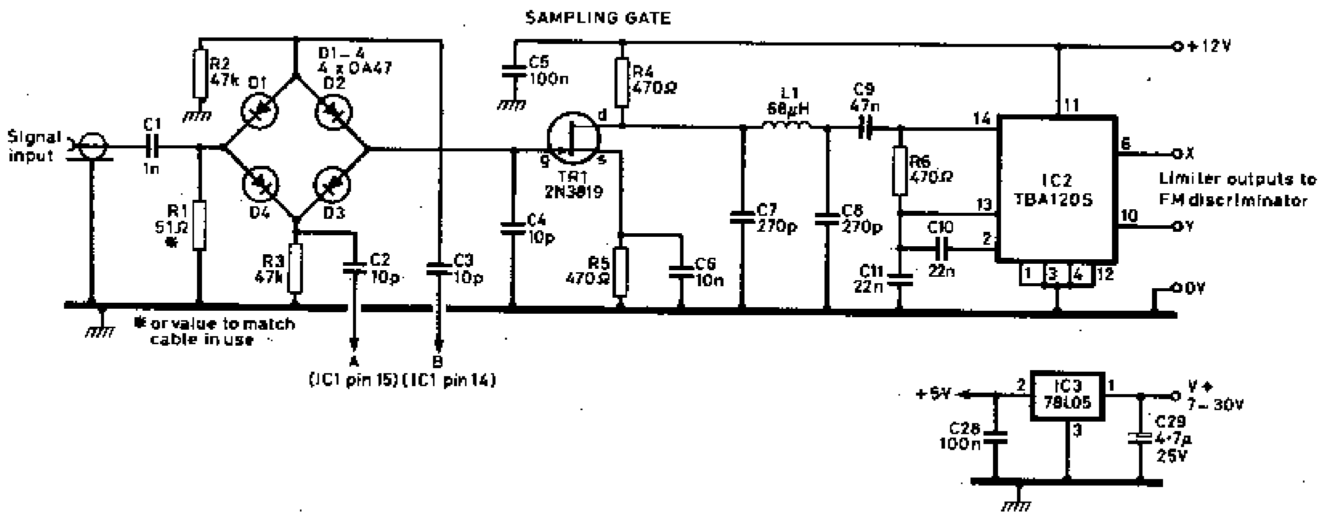


Fig 1. Simple model of a sampling gate

Circuit description

Economy was a major design consideration, and the unit uses relatively cheap components throughout. A diode gate (D I to D4) acts as the switch, with C4 the hold capacitor. Germanium diodes are specified on cost grounds, although Schottky diodes give good performance



if available. A fet amplifier, TRI, buffers the sampling gate. ICI, an ecl triple-line receiver, forms a somewhat unorthodox pulse generator. The first two sections square up the*

oscillator signal. The square waves then feed the third section with a delay to one input caused by the insertion of a short length of coaxial cable (12in being suitable). The square wave edge at pin 7 causes the output at pin 14 to go "high". After the very short cable delay, the delayed edge returns pin 14 to the low state, giving a very narrow pulse. An antiphase signal is available at pin 15. The two outputs are very convenient for driving the sampling gate, and the symmetrical drive to some extent balances out the lo and reduces breakthrough into the i.f.

Fig 1. Simple model of a sampling gate

The lo is not shown. Frequencies from 4 to 100MHz have been used, with levels above about 20mV being suitable. Hence, the lo may be based on a large number of designs appropriate to the frequency chosen. A crystal source is to be recommended.

The i.f. at TR1 is lowpass filtered to remove any lo signal, and applied to a limiter IC2. The limited i.f. signal is then fed to a pulse-counting discriminator, based on the

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design by GMGO [1, 2].

The value of C20 shown on the circuit allows operation with an i.f. up to 500kHz. The sampling gate, however, is capable of operating with an i.f. of more than I MHz. If this extended range is required, the capacitor value should be reduced in proportion to the maximum i.f .; e.g. if 1MHz maximum i.f. is used, C20 should be reduced to 90pF.

The penalty paid for this is that the discriminator then produces a smaller output for a given deviation, and more audio gain must be used to restore the level. IC5 provides audio gain with the gain set at 48. This is given by (R30+R31)/ R30 and should be adjusted if C20 is changed. With component values as in the circuit, the audio output will be approximately 1 V peak for 1 kHz peak deviation. A. signal with ± 2.5kHz deviation will therefore give an audio output of 5V peak-to-peak. The op-amp will clip outputs some way under 12V peak-to-peak which (fortunately) limits the amount of noise when the input signal is disconnected.

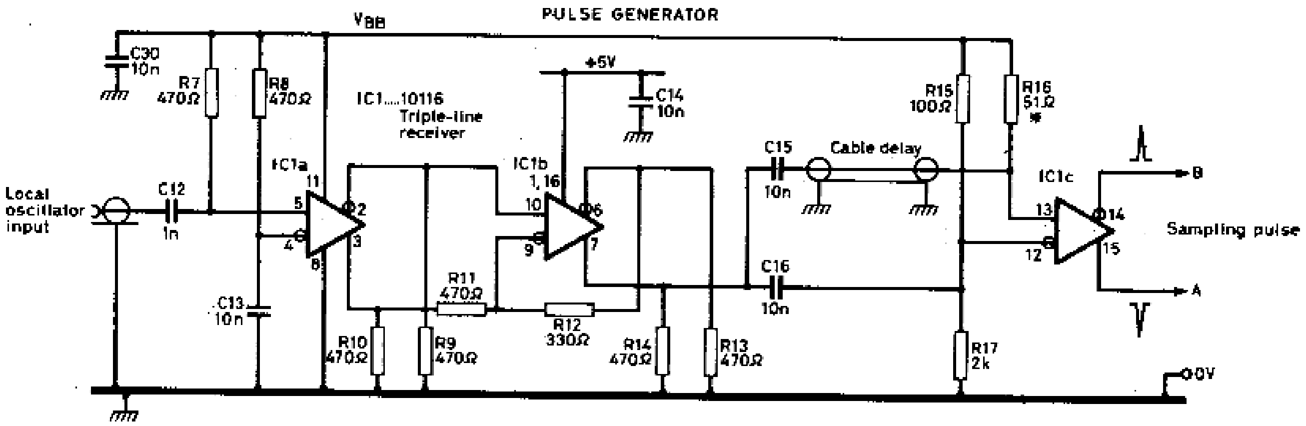

Fig 5. Circuits of sampling gate and pulse generator

Construction

Several prototypes have been built. The quickest, surest method -of construction of the high frequency circuitry of the sampling gate and pulse generator is to build them on an earth plane of plain copper-clad glass-fibre board, with components soldered together using minimum lead lengths, and decoupling capacitors and. other earthed Imrts soldered directly to the board. IC1 should be mounted upside down and connections made direct to the pins. The result is an. ugly working circuit. The braid at each end *of the delay cable should be soldered direct to the copper (see Fig 7). The input and lo leads can be soldered similarly. If 752 cable is used, R16 should strictly be increased to -752 or a close value to provide. a match. This is not critical, however no advantage is gained by shortening the cable. Fig 8 shows the original prototype and illustrates this form of construction.

The other photograph shows a later version of the complete unit which was built on a breadboard with an earth. plane on one side and holes with pads on the other side, connections being made using short lengths of wire between pads. Performance of this unit, was entirely satisfactory. and indicates that. if good rf layout is followed, there should be no difficulty in producing printed boards for those thus inclined.

Following the fet buffer stage, construction becomes non-critical, and any of the large range of constructional techniques available may be used.

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Sampling FM monitor

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Choosing the local oscillator frequency

Using a single Lo frequency, the availability of a range of several hundred kilohertz of i.f. to SU20 (433.375 to 433.500MHz) can be covered with an i.f. of 176.2 to 301.2kHz, and discriminator values shown would be suitable. The 12th harmonic of the sa%e# oscillator frequency is As the i.f. is lowered below 100kHz, more i.f. signal appears in the audio output, and the application. determines whether this is tolerable.

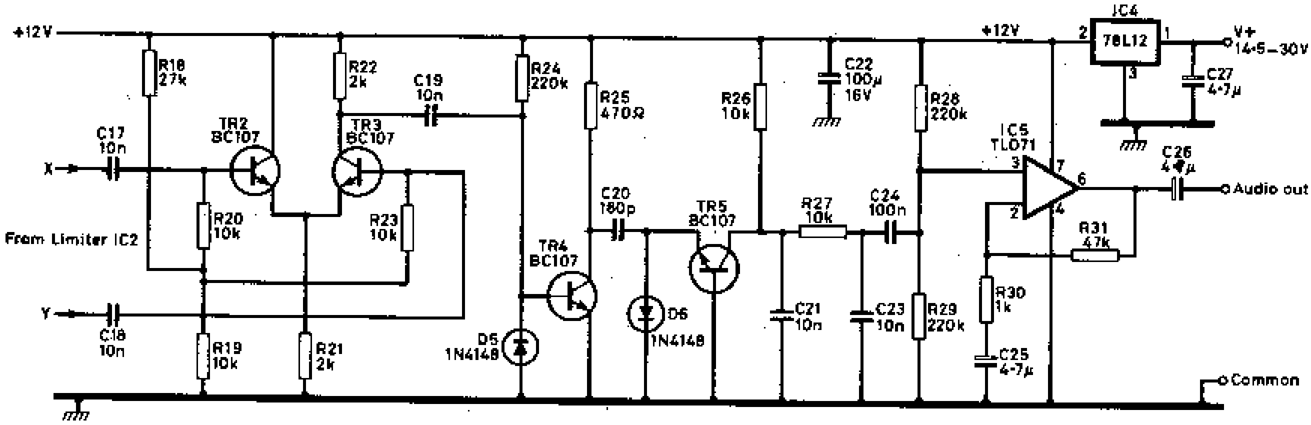

Fig 6. Pulse-count discriminator circuit

allows a similar range of frequencies within an amateur band to be used. For example, suppose that the discriminator capacitor is set for a maximum i.f. of 500kHz. We should attempt to find an local oscillator frequency which gives an i.f. from about 100 to 500kHz, and thus a 400kHz band coverage. Of course the image response will give, another 400kHz on the other side of the local oscillator harmonic if this is useful. The relation between the various frequencies is:

Input frequency = N.f(lo) ± f(i. f.) where N is the harmonic number in use.

Let us take a realistic case:
f (1o) = 12.0333MHz (crystal)
36f (1o) = 433.1988MHz

Thus fm simplex channels SU15

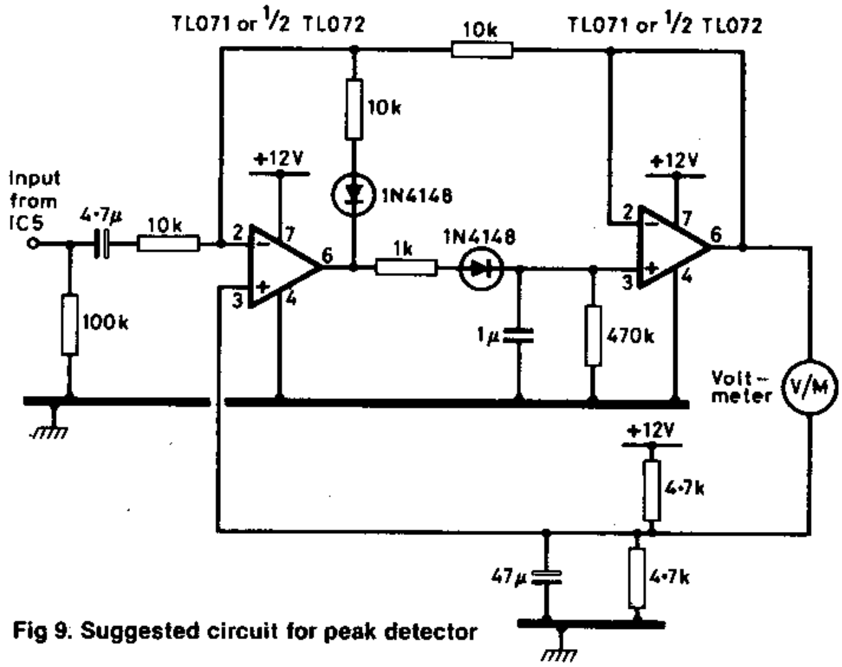

Fig 9. Suggested circuit for peak detector

144.3996MHz. An i.f. up to 1MHz would then give coverage up to 145.400MHz (S 16). An 8.0222MHz gives the same results with N = 54 and 18 respectively.

Operating the unit

Having chosen the lo frequency, apply this signal to the unit at a level exceeding 20mV emf. If a fast oscilloscope

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Sampling FM monitor

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is available, the pulses should just be seen at pins 14 and 15 of IC1. Arrange for a signal of 30mV to 300mV rms (potential difference) (- 13 to + dbm) from the transmitter. Excessive drive will cause conduction of the, gate diodes and degrade performance. The limiter should now produce square waves from the i.f., and audio should be available at the output. This audio can be used in a number of ways:

1. The audio can simply be used for listening to the modulation.
2. A scope can be used to check on the peak deviation.
3. A peak detector can be used (see suggested circuit in Fig 9) to give readings proportional to peak deviation. If the recommendations in the text are followed Y the IV/ kHz of peak deviation will be maintained.

Conclusion

It is hoped that the unit described will be taken as the basis for further experimentation, and used by amateurs to ensure that the quality of modulation and efficient spectrum use are kept to a high standard. The complete unit, shown in the photograph on page 878, contained an onboard calibrator, and the author hopes to describe this in due course.

Acknowledgement

The author wishes to acknowledge the use of the laboratory facilities of Marconi Instruments in testing the prototypes.

References
[1l "A pulse count discriminator unit", B. Priestley, G3JGO. Rad Com September 1971, p603.
[2] VHF-UHF Manual, 3rd edn pp451-2.

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

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

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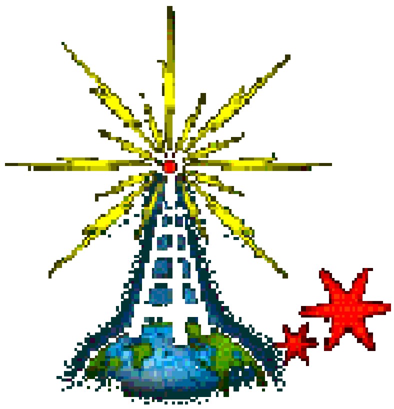
West Rand members - we need your input!

To make this the best ham radio magazine in South Africa we need your input. Please submit articles, comments, suggestions etc.

Please send plain text with no formatting to the email address below.

In July 2003, we re-published an Anode Compendium on CD. It has the issues from July 2000 until June this year. This included the new Adobe reader. It has been updated, check with the chairman for details.



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