ANODE

Inside this issue:

Editor's Comments

Volume 11, Issue 1

Elektor unveils DSP radio
Publication date: 1 July 2010

The Summer Circuits issue of Elektor features a construction project for a world radio receiver using a digital signal processor (DSP). The DSP radio has a USB interface for connection to a PC, which enables the radio to be configured and controlled from the PC if desired and use the PC speakers for audio output, as well as drawing power from the USB port. The unit can receive and demodulate FM signals in the FM broadcast band and AM signals over a frequency range of 153 kHz to 21.85 MHz.

Many radio amateurs use two receivers in practice: one portable and the other fixed, with PC control capability. The Elektor DSP radio can operate in either capacity. To support stand-alone portable operation with power provided by a 6 V battery, the circuit also includes an audio amplifier for mono or stereo output. A backlit 2 x 16 LCD module provides the user interface.

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Operating 'ZS10' during the World Cup

One possible advantage of England's demise in the World Cup is that Steve Richards, working for the BBC out in Johannesburg, has found a bit more time than predicted to air the special call-sign ZS10/G4HPE.

An Introduction to Software Defined Radio

by Hannes Coetzee, ZS6BZP

Software Defined Radio is currently one of the buzzwords in Amateur Radio and is definitely going to play a major role in the future. Who knows, maybe it is the magic wand to expose "computer mad" kids (big and small) to home brewing and communications.

Introduction

Software Defined Radio (SDR) is probably like many other technical terms, a bit of a misnomer, especially in Ham Radio applications.

Military and "professional" definitions for SDR differ quite a bit from the excellent SDR freeware that you can download from the Internet.

To many people SDR implies that the functionality of the radio can be enhanced, expanded or kept up-to-date simply by downloading new firmware on the radio. In the days before Digital Signal Processing (DSP), it was common practice to buy additional IF filters for your HF transceiver. Options included very narrow filters (typically 250 or 500 Hz) for CW or wider filters for data communications. In a modern

Special points of interest:

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

Editor's Comments

(continued from page 1)

The South African Radio League worked with the licensing authority ICASA to make the special prefix available for radio amateurs visiting South Africa during the tournament.

Steve has a special QSL card for the event and is looking for 2 metre and 70 centimetre contacts in the Johannesburg area, as well as further afield via Echolink.

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Technology in Amateur Radio - where are our innovators?

The South African Amateur Radio Development Trust has thus far received <u>one entry</u> in the Innovation in Amateur Radio Competition from an Amateur in the UK. Where are the South African innovators?

Radio amateurs and technologists are invited to submit projects that will innovate amateur radio whether it is software, amateur radio and the Internet, the development of compact HF antennas for flat and complex dwellers or innovation in Emergency Communications.

Out-of-the box ideas are required to solve some of the problems and challenges faced by the 21st century radio amateurs. The innovation project is in the form of a competition to stimulate the creative side of amateurs to develop those solutions that will make the hobby more enjoyable to amateurs all over the world. Even old ideas improved with modern design techniques and modern components can generate a "wow" factor. Solutions will be judged by their uniqueness, e.g. not having been previously published.

Entry of paper designs are invited by 30 September 2010. The designs must be innovative but also practically implementable. Three entries will be chosen to go to the final stage of the competition which requires the entrant to develop and build a prototype. The three winners of the first

stage will be announced at on 31 October 2010.

Visit www.amateurradio.org.za for details and an entry form.

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DAB 'Flop' and Internet Radio

An article on The Register says BBC Trust Chairman Michael Lyons has called for a review of its radio strategy - acknowledging the failure of DAB and the Corporation's neglect of Internet radio.

It appears that Internet radio is a great untold BBC success story with iPlayer users listening to radio for 163 minutes per month, and spending just 64 minutes watching TV. Although traditionally people have listened to Internet radio using their PC's these days increasing numbers are listening to Internet broadcasters via their cell-phone.

Read the full Register article 'BBC chief acknowledges DAB flop & internet radio' at http://www.theregister.co.uk/2010/07/06/bbc_radio_review/

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September launch for ham radio satellite SRMSat

An Amateur Radio satellite being built by students of SRM University in Chennai may be launched by the Indian Space Research Organisation (ISRO) in September.

A description of the SRMSAT ground station indicates it may use the bands 145.8 MHz for the uplink and 434.5 MHz for the downlink.

A SRM University press release describes SRMSAT as a 15 watt satellite weighing between 10 and 15 kg and measuring one meter cube. The project is estimated at Rs 2 crore and the construction of the satellite is done

Editor's Comments

within the university's premises.

This project is aimed at increasing the technical expertise of our staff and students and giving them the rare opportunity of constructing a satellite first-hand with ISRO scientists guiding them. We want to prove that our students are worthy of this feat. We hope to launch a satellite once in every two years, of course, with different scientific objectives,? says P Satyanarayana, vice-chancellor, SRM University.

Read the NDTV story 'ISRO may launch nano satellite in September' at
http://publication.samachar.com/pub_article.php?id=9450692&nextids=9447831|9449069|9449922|
9410540|9450692&nextIndex=0

SRMSAT Information
http://www.prlog.org/10719954-future-perfect-of-srm-university.html

SRMSAT Ground Station
http://srmuniv.academia.edu/ssn/Papers

SRMSAT Yahoo Group
http://tech.groups.yahoo.com/group/srmsat/

Chennai Hams VHF/UHF/HF Enthusiasts Forum
http://chennaihams.blogspot.com/2010/03/asol-exam-conducted-at-srm-university.html

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NEW ZEALAND REGULATOR VOICES CONCERNS OVER INTERNET CONNECT HAM RADIO

New Zealand is the latest nation to look at Internet linked ham radio operation and question its legality. Jim Meachen, ZL2BHF, is in Auckland with more:

New Zealand's Ministry of Economic Development -- the MED -- which acts as the nations telecommunications regulator has raised some concerns with the New Zealand Amateur Radio Transmitters or NZART. This, over Internet connected ham radio operations such as IRLP, D-Star, Echolink, APRS and all similar unattended transmitter supervision. This is because they do not appear to fit within the nations current ham radio license conditions.

Among the concerns raised by the MED, is the use of unattended transmitters and unlicensed digipeaters for APRS. They are also concerned over the possibility of overseas radio amateurs operating a New Zealand based amateur station without specific MED sanction to do so.

The NZART Administration Liaison Officer is Don Wallace, ZL2TLL. He is currently putting together a paper on this topic and would appreciate input from all interested New Zealand amateurs.

The concern voiced by New Zealand's Ministry of Economic Development comes closely on the heels of France banning ham radio use of D-Star and possibly other digital voice modes because they use codecs based on proprietary software and algorithms. As reported here on Amateur Radio Newsline last week, France's telecommunications regulator ARCEP says that this is a violation of that nations open standard policy. The ARCEP also cites alleged concerns regarding cryptography and national security. (ARNewsline, Southgate)

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NEW SA CUBESAT TO INVESTIGATE HF INTERFERENCE

The world of amateur radio may soon have greater insight into sources of interference on the High Frequency bands. This with word that an important mission of the upcoming South Africa AMSAT CubeSat will be to measure the

Editor's Comments

High Frequency noise levels over South Africa and report this information back to Earth for analysis and action to reduce these unwanted signals.

S-A Amsat's Hans van de Groenendaal, ZS6AKV, will be giving a presentation on South Africa's first CubeSat at the AMSAT-UK Colloquium in Guildford, England, that runs from July 31st through August 1st. According to ZS6AKV the information from the tiny satellite will identify the areas where the H-F frequency polluters are situated and will help in reducing or eliminating the source. It is also hoped to include a 30 kHz linear transponder and an Automatic Packet Reporting System in the CubeSat.

More on this interference detection experiment from space is on-line at www.uk.amsat.org/colloquium We will have more ham radio space related news later on ion this weeks Amateur Radio Newsline report. (ANS, AMSAT-SA)

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DELAWARE EXEMPTS HAMS FROM MO-BILE CELLPHONE BAN

A big win for mobile ham radio operations in Delaware. This with word that in a unanimous vote, both houses of that states legislature passed an amendment to a Delaware house bill that outlaws mobile use of "two-way communication" devices, but now specifically allows amateur radio use.

As reported last week, the original wording of the states cell phone law would have also banned all sorts of two-way radio operations as well. But State Representatives Ruth Briggs King and Dave Wilson recognized the deficiencies in the wording and introduced an amendment to correct them. It then became the work of the Delaware ham community to assure its passage.

According to a public posting by Dennis Karol,

KB3MJ, on the QRZed.com website, some 15 Delaware amateurs not only wrote, called and emailed to their state Representatives and Senators, but actually spent endless hours at Legislative Hall in Dover on Tuesday and Wednesday nights. They spent that time educating legislators about radio communications in general and amateur radio in particular. In the end, the amendment passed with yes votes from 100% of the Representatives and Senators who were present in both Houses. (KB3MJ via QRZ.com)

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ESA COLUMBUS AIS SYSYEM ANTENNA BUILT BY HAM

SpaceDaily.com reports that the European Space Agency's Columbus module maritime Automatic Identification System or AIS aboard the International Space Station was switched on. The A-I-S antenna, mounted externally on the Columbus module, was fabricated by AMSAT and ARISS member Lou McFadin, W5DID and the United States ARISS team. The group has also constructed a nearly identical amateur band antenna for ARISS operations that will be used when the Ericsson amateur radio gear is activated in early 2011.

And how well does the new antenna work? The European Space Agency reports receiving more than 90,000 Class A AIS messages during a 14 hour test between 1900 GMT on June 2nd and 0900 GMT on June 3rd. This generated a global view of maritime traffic as the ISS orbit crosses all major shipping lanes. (ANS)

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"STUDENTS TO BUILD PAYLOAD FOR SUTH AFRICAN HABEX BALLOON"

[What did you hear??? Were they listening to the SABC?]

Students assisted by area hams will be building the payload for the South African High Altitude Balloon Experiment or HABEX project. This for

Editor's Comments

(Continued from page 4)

the ZS6SCI SciBono Discovery Centre in association with the Gauteng Department of Education.

The objective is to involve schools in Gauteng in the entire process of developing and building a payload that will be launched using an unmanned meteorological balloon.

SciBono approved a budget for the building of HABEX. A team of radio amateurs who are engineers and designers are assisting the schools in developing the payload. Approval has been obtained from authorities for the launch of HABEX which is currently slated now for July 24th from nearby Klerksdorp Airfield. At airtime its not known what type of ham radio gear will be on board at liftoff.

HABEX was inspired by the United States BACAR or Balloon Carrying Amateur Radio project. (SARL)

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FRENCH TELECOMMUNICATIONS REGULATOR RULES D-STAR ILLEGAL FOR FRENCH HAMS

D-Star and possibly other digital voice protocols are not legal for hams to use in France. At least not as far as that nations telecommunications regulator is concerned.

A report on France's digital ham radio website DR@F says that the nations telecommunications agency, the ARCEP, has said the D-STAR digital audio protocol specifications could allow ham radio operators to connect their stations to Internet. As far as that regulatory agency is concerned, that is a prohibited practice.

The ARCEP also cites alleged concerns regarding cryptography and national security. It also says that digital voice modes that use proprietary codecs such as the AMBE vocoder in D-Star, uses patents, licenses and proprietary undisclosed specifications that are against France's open standard policy.

It should be noted that France has always exercised strong control on use of cryptographic methods in all electronic communications. In this case, it seems to be that the ARCEP views a codec using proprietary standards such as AMBE as a way of encrypting or disguising the content of ham radio communication.

But the French ham community counters by saying that the ARCEP is not respecting the terms the agency's Directive 2009/140/CE art. 1 - paragraph b. French hams claim this to be about the fundamental right to access to the Internet by and from final users regardless of the way that access is made.

As a result the website is calling on all European amateur radio societies to help them in what they call a battle to allow all digital voice modes,. Also to permit Internet access, no restrictions on experimentation, and their first step is a big one. They have begun a region wide petition drive to the European Parliament of the European Union. One that asks that august body to direct the French government and its telecommunications regulator to respect the fundamental rights of that nations ham community to communicate using digital technology and Internet linking.
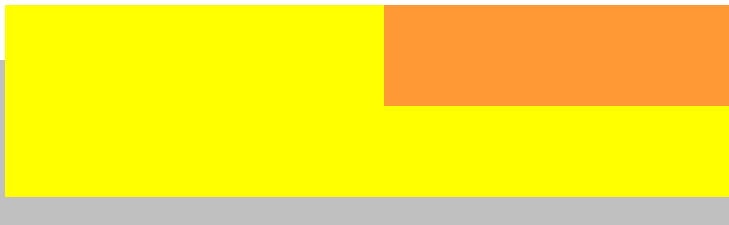
Where this all might lead is anyone's guess. We will keep you posted as we learn more.

For the Amateur Radio Newsline I'm bill Pasternak, WA6ITF, in the newsroom in the City of Angels.

More on this situation in electronically translated English can be found at draf.asso.fr (Southgate, DR@F)

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JB 2010-07-11

An Introduction to Software Defined Radio

(Continued from page 1)
SDR application, the new filters would be implemented in DSP and not hardware anymore. To upgrade your transceiver, or to keep it current, the latest features (e.g. new IF filter bandwidths) are installed on your radio simply by downloading the latest or the applicable firmware.

If the above definition is taken to the limit, it is possible to even classify a cellular telephone as a Software Defined Radio as it is acceptable practice to update your cell phone with the latest firmware from the Internet. In Ham Radio applications SDR normally refers to something quite different (and very exciting):

Basic Ham Software Defined Radio Application

In a typical Ham application the more accurate term is probably Software Defined Demodulator and not Software Defined Radio.
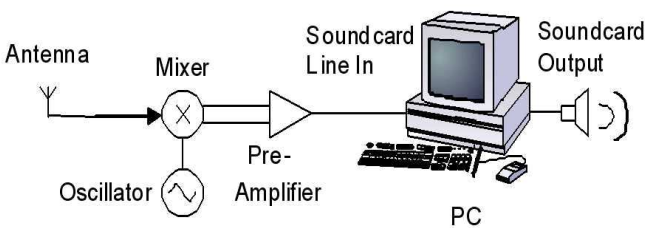
Direct Conversion Front-end

Figure 1 . Basic Ham Radio SDR Application

The band of interest is linearly down converted to base-band (e.g. 0 – 20 kHz) with a single mixing stage. The linear mixing process implies that all the information of the signals is retained and that only the frequency of operation is changed.

The computer sound card is used as an Analogue-to-Digital Converter. It is possible to apply many different DSP processes and techniques on the digitized information. The ability to "see" all the signals in the down converted

band is very powerful. This is achieved by performing a Fast Fourier Transform (FFT) on the data. The result is a graph of frequency versus amplitude for the down converted frequency band. This is also referred to as the signal spectrum.

It is also common to display the calculated FFT's over time in what is commonly known as a waterfall or a sonogram. A history of the signal activity is then available and this history can be used to glean a lot of information regarding signal activity. It is also possible to read Morse Code (CW) signals and some other digital signals (e.g. Hellscreiber) directly on the screen.
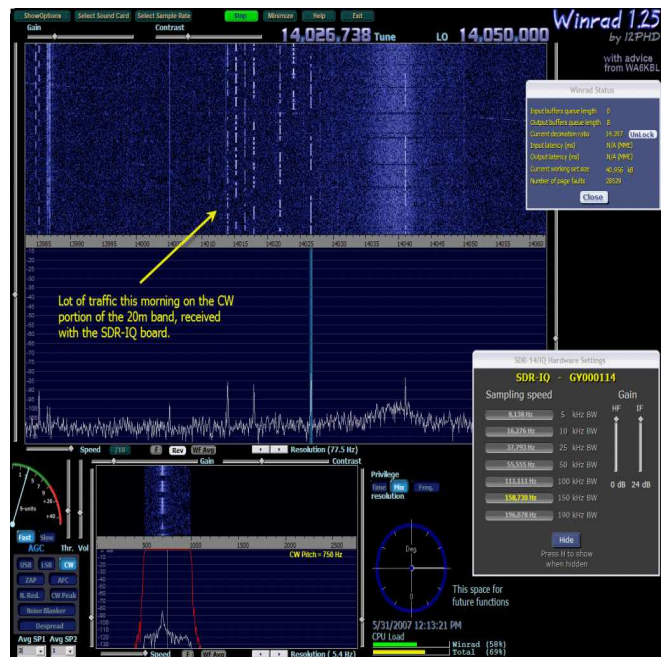

Figure 2 . WinRad Spectrum and Waterfall Display

Next step is to click on the signal of interest, select the applicable demodulator, filter bandwidths, AGC settings, noise reduction functionality, etc.(In DSP the possibilities are endless!) The demodulated audio is played via the sound card over the PC's loudspeakers. The result is a very powerful receiver using the minimum of

An Introduction to Software Defined Radio

external components.

SDR RF Front Ends

The most basic front end simply consists of a local oscillator and a mixer. This functionality is available in a single IC. Typical examples include the evergreen NE602 family as well as the TDA7000 family. If you are interested in the signal range of 7.060 to 7.100 MHz, a 7.080 MHz local oscillator (LO) is used. A signal at 7.070 MHz mixed with the 7.080 MHz LO produces two output signals. One signal is the sum at 14.150 MHz which is filtered out. The other signal is the one of interest at 10 kHz. This frequency is acceptable to the soundcard and the digital demodulation process as described above is then performed. A signal at 7.090 MHz would also result in a 10 kHz output. This is referred to as Double Side Band (DSB) receiver. If this type of front end or down converter is used, either Upper Side Band (USB) or Lower Side Band (LSB) demodulation is required although the original 40m SSB transmissions were only LSB. In effect at least 40 kHz bandwidth (Z 20 kHz depending on the soundcard used) are displayed due to the "fold-over" or signal image (DSB). This is not a problem as there are typically quite a few different demodulators implemented in a typical SDR application.

A more complex (and higher performance) front end makes use of two mixers and two L.O.'s on the same frequency but with a 90° phase difference. The two, base band outputs are thus also 90° out of phase. This is known as a complex or an I-Q (In phase - Quadrature) mixer.

The two mixer outputs are fed to the left and the right stereo inputs of the soundcard. A complex FFT can now be performed and more information can now be extracted. It is now possible to display a spectrum with a band-width of 40 kHz although the soundcard is only capable of 20 kHz inputs. The displayed signals can now also demodulated in their original modulation formats e.g. LSB for the 40 m band.

High performance front end kits are available at very reasonable prices. One of the most popular ranges is the "Soft Rock" series [1].
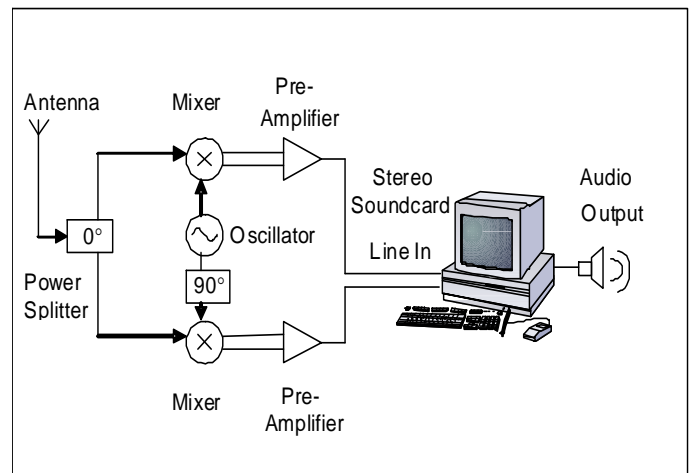

Figure 3. Basic I-Q SDR

Some SDR applications available on the Internet

There are quite a few excellent SDR programs available on the Internet [2, 3, 4 and 5]. Although they perform to there fullest with I-Q (0-90Z) inputs, lots of fun can still be had using only a single, DSB input.

Conclusion

A simple solution to enable the next generation of hams to experience the satisfaction of operating homebrew equipment was described. The intention is to combine powerful, freely available software with a simple RF front-end. The result is a low cost, powerful, multi-mode receiver featuring spectrum display, variable demodula-
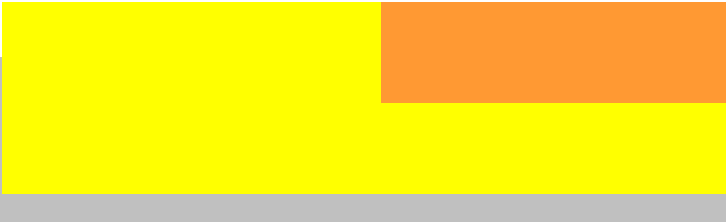
An Introduction to Software Defined Radio

tion bandwidths, noise reduction and other advanced Digital Signal Processing techniques.

References

1. http://groups.yahoo.com/group/softrock40/

2. M0KGK SDR Decoder by Duncan Munro, M0KGK. www.m0kgk.co.uk

3. Rocky by VE3NEA. http://www.dxatlas.com/Rocky/

4. WinRad by Alberto di Bene, I2PHD. www.sdradio.eu

5. Multidem by Patrick Lindecker, F6CTE. http://f6cte.free.fr

by Hannes Coetzee, ZS6BZP

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Ok, So the article has "whetted" your appetite …
Below is a 'typical' digital front-end from QEX. It
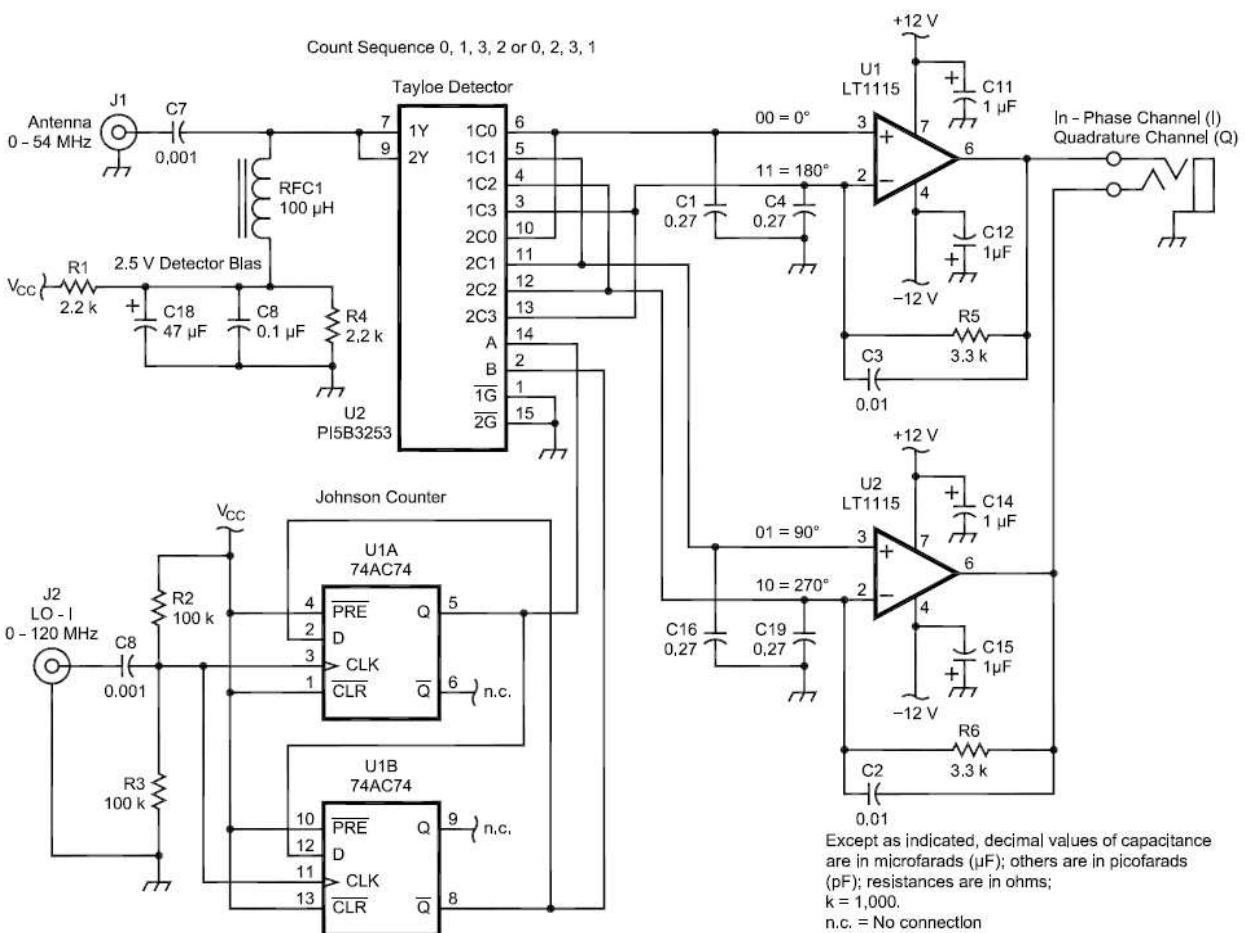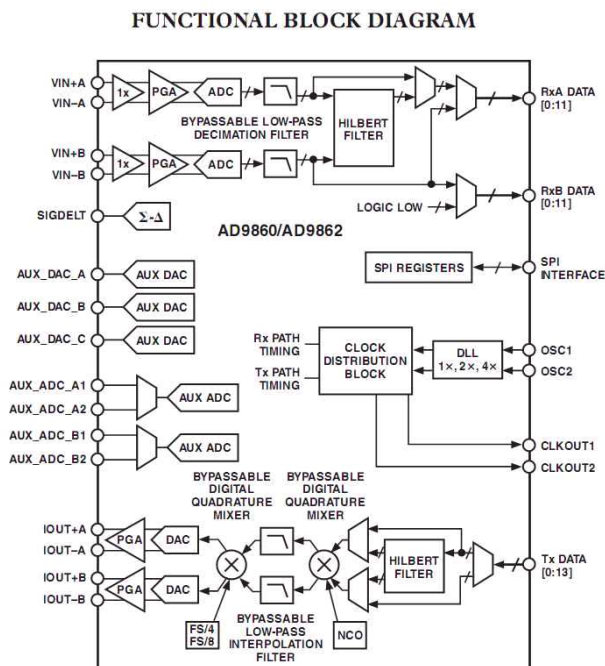

Fig 12—Singly balanced Tayloe detector.

uses a switching mixer being driven by 0 and 90

An Introduction to Software Defined Radio

degree local oscillator signals. Whilst the 7474 type i.c. may be easily found here in SA, the P15B3253 is not.

Then again you could try this chip...

FUNCTIONAL BLOCK DIAGRAM

But I think this is "overkill" and certainly not for unsophisticated constructors.

So maybe we (the Club) should talk about making some experimental "front ends"?

What do you think?

Come to the next Ham-Comp and let us know.
JB

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1715

Phone: **082 342 3280** (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)
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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 2005. This will be re-issued for the 10th year anniversary. Check with the chairman for details.
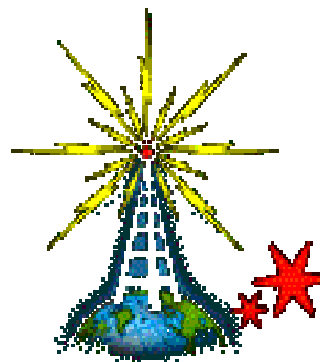
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