September 2011
Volume 12, Issue 3

ANODE

Inside this issue:

Anode Editor's Comments

Volume 12, Issue 3
September 2011

From RSGB Bulletin—almost prophetic...
NEWS FOR WALES No news items have been received for Wales this week.

Antenna clothes help phone signal
http://www.bbc.co.uk/news/technology-14630656

Turning electrical goods into pure gold
http://www.bbc.co.uk/news/science-environment-14621075

Dummy Loads
http://www.dxzone.com/catalog/Technical_Reference/Dummy_Loads/

Interesting bits in South African licence.
From: Satans Rat <punkbiscuit@googlemail.com>(A noiseless patient Spider)
Date: Sunday 11 September 2011 15:57:13
Groups: uk.radio.amateur

Just been studying the **ZS licence**, and note a few interesting bits.

B2 USE OF AMATEUR RADIO STATIONS

(1) The licensee is permitted
(b) in the case of an emergency and where the safety of life or limb is at stake, to communicate with any other stations, using the amateur bands and other bands outside the

(continued on page 6)

What is a 'PICaSTAR' ?

Special points of interest:

- **Contact details on back page**
- **Ham-Comp Latest on web site.**

The PIC-a-STAR is an SDR radio designed by Peter Rhodes, G3XJP, which was serialised in RadCom. It also appears in the RSGB Radio Communication Handbook.

The transceiver is designed to operate between 160m and 10m on LSB, USB and CW only.

The radio compares extremely well with commercial high end Amateur Radio HF transceivers and in many cases, outperforms them.

The Pic-A-Star is a complex transceiver to build, however there are many in operation today and there are numerous Web Sites detailing construction techniques with tips and hints on building your own.

The unit can be widely customised to suit each individual's requirements or parts availability.

This is a sophisticated project and definitely **NOT FOR BEGINNERS**.

How does it work?

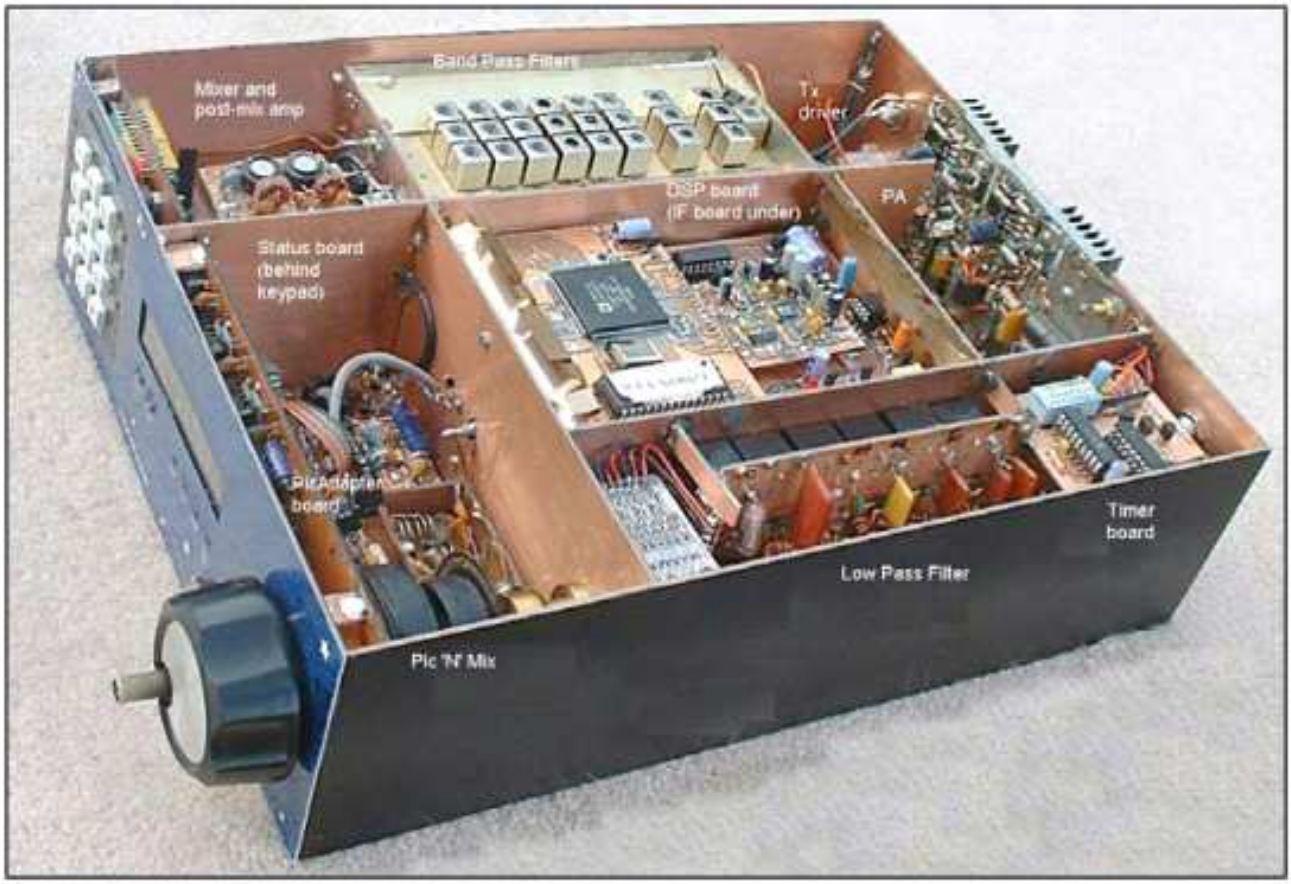
What Peter came out with was a DSP IF

(Continued on page 2)

What is a 'PICaSTAR' ?

(continued from page 1)

system that could be added to any single conversion transceiver design. He added a bilateral H mode mixer and first IF to (almost) complete the transceiver chain. The missing bit was a transmitter power chain. Most of the hams who built the Pic-a-Star transceiver settled on one (or both) of a pair of final amplifier designs also published in RadCom, being of 20 watts or 150 watts. The first using RF MOS F.e.t's, the second conventional bipolar RF power devices.



G3XJP's STAR built in a PCB enclosure - shown with all compartment cover-plates removed. The overall dimensions of the case are 310mm deep by 240mm wide by 85mm high. This generous size allows good *in situ* access to all the boards.

Extract from articles:-

This would be of little concern were it not for our old friend Nyquist. He stated that in order to faithfully process a signal you must sample it at twice (at least) the rate of the highest frequency present.

For example, the incoming Rx signal (after conversion from the input signal) is around 15 kHz and so needs to be sampled at 30 kHz or more. In fact, 48 kHz is used to provide a useful margin.

The consequence of this is that having grabbed one sample you have no more than 20.83µs (by simple arithmetic) to do all the processing required before you have to get back to handle the next one. (Actually if you don't achieve it, the processor will interrupt whatever you are doing and drag you back, so important is it.)

(Continued on page 3)

What is a 'PICaSTAR' ?

(Continued from page 2)

It's not your average PIC controlled DDS VFO.

It uses the other recent innovation in electronics, a Digital Signal Processor [DSP]. Let us take a closer look at this project.

- Pricing for PIC's is now reasonably competitive. But the DDS chips are not "cheap". But you only need one at the 'heart' of the project.
- Amateur programming of the PIC chips is now easy and low cost.
- Even "emulation/simulation" can be done by the Amateur on his PC.
- More and more 'amateur' constructors are 'capable' of putting these units together. [Not just the youngsters]

When, how soon ?

- Is the club interested in doing this project?
- How soon can we get the components together?
- Can we 'source' these components locally in SA ?
- Getting the DDS chip direct from Analog Devices is no longer for 'free'. [Bad News!]

COSTS!

EME167 KIT1 PCB/2
PC Board & Instructions Only (Included In all Kits) $30.00 AUD

EME167 KIT1A

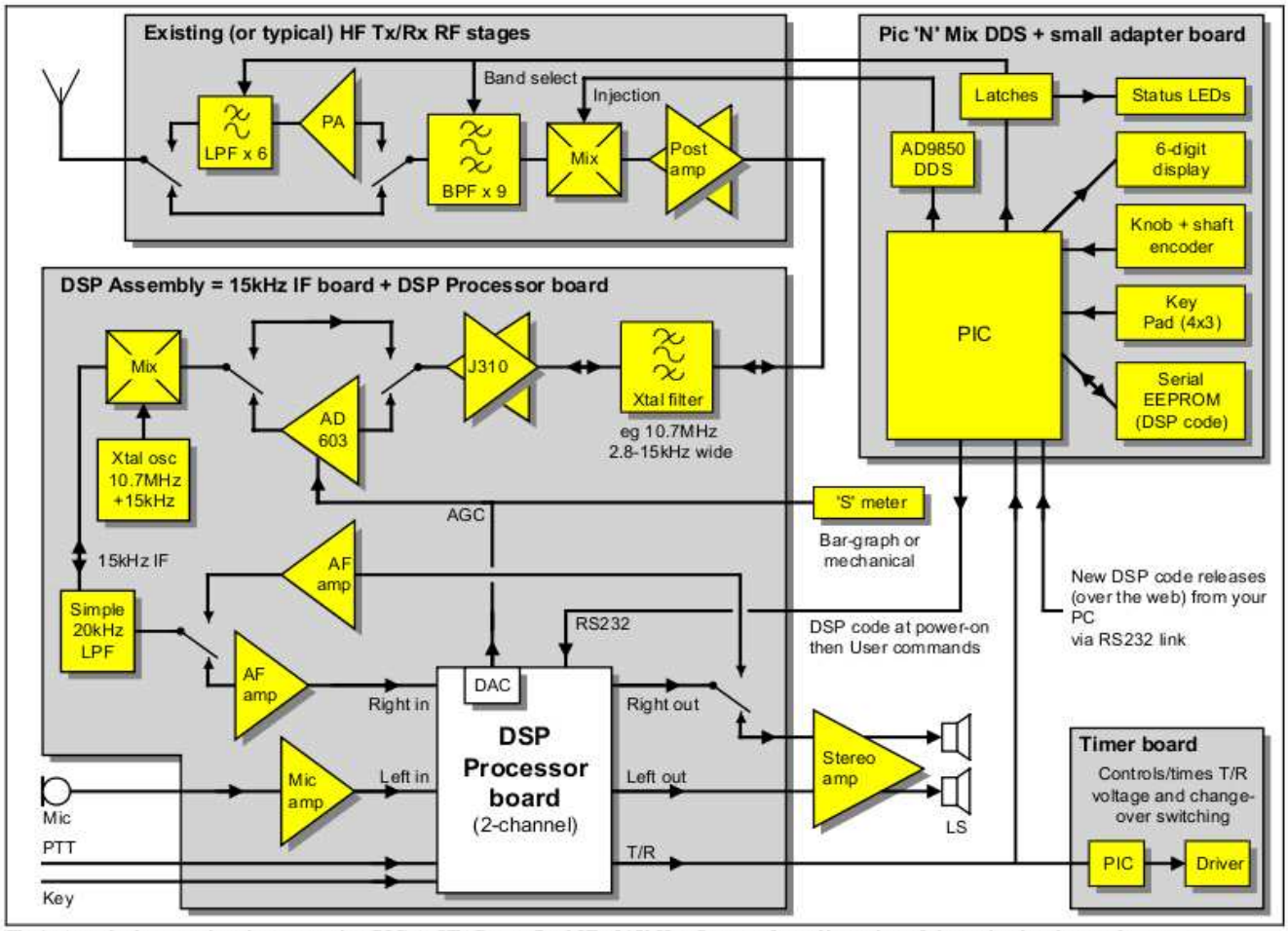


Fig 1: A typical transceiver incorporating PIC-A-STAR at a final IF of 15kHz. See text for a discussion of the major hardware elements.

(Continued on page 4)

What is a 'PICaSTAR' ?

(Continued from page 3)

Basic Kit (does not include the AD9851 DDS Soldered to the Board, or SMA33) $77.50 AUD

EME167 KIT1B
Same as EME167 KIT1A except the DDS is pre-soldered to the Board $88.50 AUD

EME167 KIT1C
EME167 KIT1A Built & Tested with SMA33
1 Week Delay to ship this Product $118.75 AUD

SMA33
SMA Socket 1.6 mm PCB Mount $3.30 AUD

AD9851BRSZ
Analogue Devices DDS Chip (Included In All Kits) $30.00 AUD

Alternatives for the Club to consider
An alternative "starter" project may be the "right way" to go. Such as this 'simple' DDS VFO.
http://g4oep.atspace.com/pic%20dds/picdds.htm

This sort of project can "rejuvenate" old (veteran) rigs and inspire others to construct QRP rigs.
[I personally need one as I have been given a Codan H.F. Rig.]

Homebrew PIC DDS
From the G4OEP page:-
http://g4oep.atspace.com/pic%20dds/picdds.htm
I have two other DDS systems in the shack. The first was conceived primarily as an external 5 MHz VFO for my trusty FT707 transceiver, but is useful as a general purpose VFO as well. It includes a frequency counter which allows it to capture frequencies from the '707's internal v.f.o. and store them in memory. This is a very flexible system which works well, but it is controlled by a 6502 CPU, and is very complex. The other was supplied as a kit by the GQRP Club. This is also conceived as a general purpose signal source which can be configured in different ways to serve as a local oscillator for a home brew receiver or transceiver project. It is an extremely useful device to have in the shack, and several of my HF projects have been designed to use it as an LO source. But my ambition is to develop a readily reproducible simple, and cheap DDS which can be manufactured as required and used in projects on a routine basis with frequencies programmed to suit each project.

Perhaps the best way to start with these 'sophisticated' projects is to make the simple DDS 'daughter board' first.

AD9851 DDS VFO EXPERIMENTERS KIT
From:-
http://www.minikits.com.au/kits4.html

Direct Digital Synthesizer Experimenters Kit using an Analogue Devices 10 bit 180 MHz AD9851 DDS chip, which is suitable as an accurate signal generator, or as a VFO for a RX or TX project. The various connections on the header allows the board to be used with many micro controller projects found on the WEB, including the new EME170 PIC Controller Kit using the dd_synth ver2.3x software.

The DDS output uses a 70 MHz 5th order elliptic

(continued on page 5)

What is a 'PICaSTAR' ?

(Continued from page 4)

L.P.F. & 'Gali' amplifier for +10 dBm output.

The PC Board uses plated through holes & a single analogue & digital ground plane & power supply.

There are a number of Kit options listed below including a Basic Kit that does not include any of the listed options, & Kits that include all the options & the DDS chip soldered to the board.

Please Note: No software or Micro controller Hardware etc is included with Basic Experimenters Kits.

Specifications:

PCB Dimensions: 65.5x45 mm
Supply Voltage: +12v 130 mA
Frequency Range: DC-70 MHz (AD9851)
RF Output: +10 dBm (10 mW)+/-0.5 dB 1-40 MHz, -3 dBm @ 70 MHz
Spurious Output: 30 MHz clock -55 dBm, 2nd Harmonic -32 dBc, 3rd -50 dBc, all outer spurs -50 dBc
Board Interface: +5v logic Inputs & Outputs
Clock: Optional Onboard CMOS 5x7 mm or DIP 9x14 mm +5v up to 180 MHz.

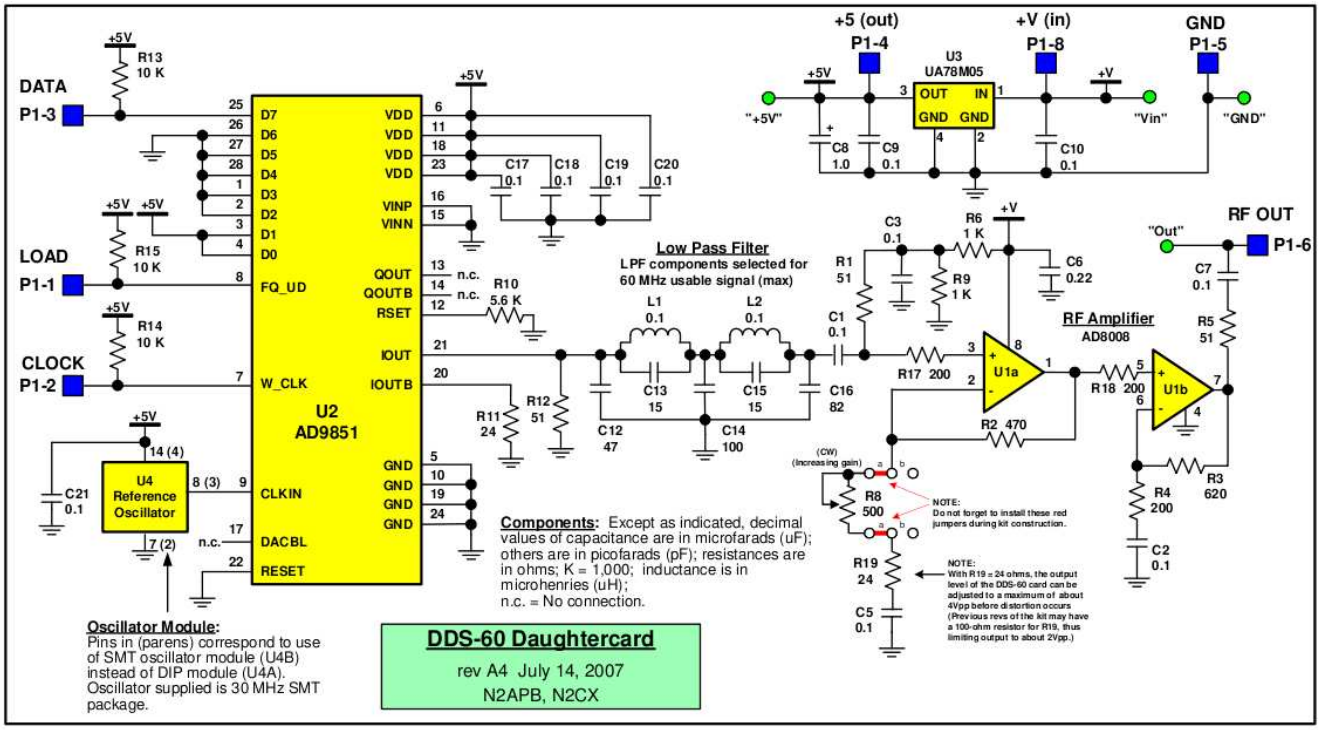
The QRP Club of America's DDS

Shown below is the circuit of their 'daughter card' DDS. It can be used for a variety of functions. The most likely being a V.F.O. for use in a direct conversion receiver/transmitter.

It should be noted that this is 'obsolete' according to them. A lot of these were made and are in use. But their design has been superseded by their own later models.

[My note: This design could easily be fabricated locally here in SA. With only small modifications this could be the core element for future club projects.]

Please note that this article in no way represents a realistic research of this magnificent project.



Anode Editor's Comments

(Continued from page 1)

amateur allocation to prevent loss of life, render assistance, call for assistance or convey health and welfare messages directly connected with the emergency,

So, use of the station outside the amateur bands is permitted in one clause, but then they also have this clause:

MISCELLANEOUS PROVISIONS

(1) Radio apparatus shall satisfy ICASA requirements at all times and may not be capable of being tuned to frequencies other than those laid down for use by licensees

That's very clever. You're not allowed to have a rig that tunes outside the amateur bands, but you are allowed to transmit outside of them during an emergency !

Other interesting bits..

MISCELLANEOUS PROVISIONS
G1 Allocation and display of call sign
(1) ICASA allocates a call sign to a radio station. Such call sign shall be conspicuously displayed on the relative radio set by the licensee and the call sign must be transmitted at least once during each separate transmission.

Oh god! Don't let anyone from the RSGB see that one - they'll be requesting it at the next OFCOM/RSGB meeting ;-)

Also allocated in the licence:

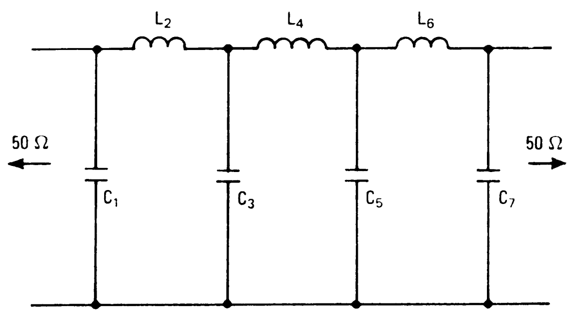
40.675 - 40,685 Mhz, Primary A1 = 13 dBW, Propagation study only.

Also interesting is that some HF/VHF bands are not permitted for certain lower classes of licence.

Chebyshev Low Pass filter design

If a low-pass filtering requirement is such that a roll-off attenuation of 40 decibels per octave is adequate, this table will enable rapid design of seven-element filters of the Chebyshev variety using standard-value capacitors. Both L and C values are given directly for operation in the 1-to-10-megahertz region and are scaled for frequencies outside this range. Element values, specified for filters having a source and load impedance of 50 ohms, are easily calculated for any impedance.

configuration and for the equally terminated case, C1 = C7, C3 =C5 and L2 = L6. Once a standard-capacitor value for C3/C5 is specified, capacitors C1/C7 and inductors L2, L4 and L6 are found for a given reflection coefficient selected to ensure that C1 is also a standard value. The frequencies corresponding to the 1-, 3-, and 50-dB attenuation points are also calculated.



Filter No.	Frequency (MHz) 1 dB	3 dB	50 dB	Reflection coefficient %	$C_{1,7}$ (pF)	$C_{3,5}$ (pF)	$L_{2,6}$ (μH)	L_4 (μH)
1	.95	1.04	2.28	.455E-02	1500	5600	10.1	15.3
2	.99	1.06	2.17	.255E 00	1800	5600	10.9	14.8
3	1.04	1.10	2.08	.178E 01	2200	5600	11.4	14.0
4	1.12	1.16	2.06	.663E 01	2700	5600	10.9	12.6
5	1.29	1.33	2.19	.189E 02	3300	5600	8.86	9.69
6	1.07	1.15	2.43	.630E-01	1500	5100	9.61	13.7
7	1.11	1.18	2.33	.720E 00	1800	5100	10.2	13.2
8	1.17	1.23	2.26	.341E 01	2200	5100	10.3	12.3
9	1.29	1.34	2.30	.110E 02	2700	5100	9.29	10.4
10	1.61	1.64	2.62	.302E 02	3300	5100	6.45	6.92
11	1.12	1.23	2.75	.206E-03	1200	4700	8.28	12.9
12	1.18	1.26	2.58	.233E 00	1500	4700	9.14	12.4
13	1.23	1.30	2.49	.147E 01	1800	4700	9.52	11.9
14	1.31	1.37	2.45	.560E 01	2200	4700	9.27	10.8
15	1.50	1.54	2.57	.166E 02	2700	4700	7.75	8.53
51	2.39	2.62	5.88	.148E-03	560	2200	3.87	6.06
52	2.50	2.69	5.57	.148E 00	680	2200	4.23	5.84
53	2.61	2.76	5.34	.117E 01	820	2200	4.44	5.61
54	2.77	2.89	5.23	.471E 01	1000	2200	4.38	5.15
55	3.06	3.16	5.38	.128E 02	1200	2200	3.88	4.33
56	2.69	2.92	6.29	.203E-01	560	2000	3.69	5.41
57	2.81	3.00	5.98	.494E 00	680	2000	3.96	5.22
58	2.94	3.09	5.79	.243E 01	820	2000	4.06	4.93
59	3.18	3.31	5.79	.810E 01	1000	2000	3.81	4.35
60	3.68	3.78	6.22	.207E 02	1200	2000	3.06	3.33
61	2.94	3.22	7.13	.124E-02	470	1800	3.21	4.93
62	3.06	3.29	6.79	.163E 00	560	1800	3.47	4.78
63	3.20	3.38	6.51	.131E 01	680	1800	3.64	4.57
64	3.39	3.54	6.39	.478E 01	820	1800	3.59	4.21
65	3.80	3.92	6.62	.141E 02	1000	1800	3.11	3.45
66	3.40	3.68	7.76	.614E-01	470	1600	3.01	4.29
67	3.53	3.76	7.43	.664E 00	560	1600	3.19	4.15
68	3.72	3.90	7.21	.309E 01	680	1600	3.24	3.88
69	4.04	4.19	7.27	.925E 01	820	1600	3.00	3.39
70	4.85	4.97	8.04	.254E 02	1000	1600	2.23	2.41
71	3.52	3.86	8.57	.938E-03	390	1500	2.67	4.11
72	3.68	3.95	8.14	.181E 00	470	1500	2.90	3.97
73	3.83	4.05	7.82	.119E 01	560	1500	3.03	3.82
74	4.06	4.24	7.67	.464E 01	680	1500	2.99	3.52
75	4.50	4.65	7.89	.129E 02	820	1500	2.64	2.94
76	4.04	4.43	9.96	.106E-03	330	1300	2.28	3.58
77	4.21	4.54	9.50	.908E-01	390	1300	2.47	3.47
78	4.38	4.65	9.08	.901E 00	470	1300	2.61	3.34
79	4.60	4.82	8.87	.338E 01	560	1300	2.62	3.14
80	5.03	5.21	8.99	.103E 02	680	1300	2.39	2.70
81	4.47	4.86	10.5	.119E-01	330	1200	2.19	3.25
82	4.64	4.97	10.1	.294E 00	390	1200	2.35	3.16
83	4.84	5.11	9.70	.174E 01	470	1200	2.43	3.01
84	5.13	5.35	9.59	.550E 01	560	1200	2.37	2.76
85	5.79	5.97	10.0	.155E 02	680	1200	2.02	2.23

Table from article - sorry only this portion appears to have been scanned.

Component values for the Chebyshev filter (see table), which is characterized by low-level equi-ripple response throughout its passband, have been derived by an 85-line program written in Basic. In this

A simple example illustrates the use of the table.

- Consider the case of a filter whose 3-dB cut-off frequency, Fx[3dB] is 6 MegaHertz and

(Continued on page 8)

Chebyshev Low Pass filter design

(Continued from page 7)

whose terminating impedance, Zx is 75 ohms. The user must:

- Find the scaled impedance factor R = Zx / 50.
- Calculate the 3-dB cut-off frequency of the 50 Ohm filter from F50[3 dB] = R * Fx[3 dB] dividing Zx by 10^n where n 1, 2, 3 … if necessary to ensure F50[3 dB] < 10 MHz.
- From the table, select the design closest to that meeting the calculated F50[3 dB] requirement. Note the tabulated values of C will be used directly in this design, and the L values will be scaled.
- Calculate the exact value of Fx [3 dB] = F50 [3 dB] / R, where F50[3 dB] is the tabulated value.
- Calculate the new L2/L6 and L4 values for the given terminating impedance from L = R^2 . L[5o].

Given Fx[3 dB] = 6.0 MHz and Zx = 75 Ohms, it is seen that R = 75/50 = 1.5, R^2 = 2.25 and F50 [3 dB] = 1.5(6) MHz = 9.0MHz. Filter number 109 is selected because its F50[3 dB] value is closest to the desired specified value. Thus C1, 7 = 390pF, and C3, 5 = 750 pF Inductors L2, 6 = R^2 (1.39) = 3.13 Microhenries; L4 = R^2 (1.57) = 3.53 uH.

These components may be conveniently hand-wound on standard toroidal cores that are readily available. Note that design 109 has a reflection coefficient of 9.99%. If the filter must be operated at a low voltage standing-wave ratio, then design 113, which has a reflection coefficient of only 1.93%, should be used.

Engineer's notebook is a regular feature in Electronics. We invite readers to submit original design shortcuts, calculation aids, measurement and test techniques, and other ideas for saving engineering time or cost. We'll pay $50 for each item published.

Taken from:-
Electronics/ June 19, 1980

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

Radio Amateurs do it with more frequency!

Chairman (technical)	**Phillip van Tonder**	**ZS6PVT**	**083 267 3835**	**zs6wr.club@gmail.com OR zs6pvt@gmail.com**
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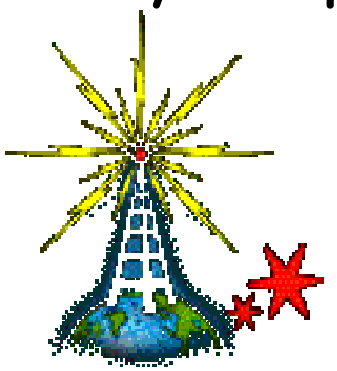
West Rand members - we need your input!

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.

See Club website at www.zs6wr.co.za for all ANODE back issues.



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