

June/July Meeting: Friday, 27 June at 7:30PM. The meeting will be held at the basement of the Springboro Huntington Bank. located at the SW corner of the intersection of SRs 73 and 741. Steve, WA3OSX will tell us what the Drake Co. has been into lately. (tentative) Gerd, WB8IFM will demonstrate his “Table Top Experiments”(see pg. 8)

Upcoming Club Events: Annual antenna measurements & picnic (Aug. or Sept.) Visible RF; Al, KP4AQI has been doing this (Pat. applied for), he will give us a presentation and demo!

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Upcoming Events:

- July 24-26, Central States VHF Conference, Hot Springs AR, W5ZN & WB5LUA
- Sep. 13-14, Weinheim VHF Conference, Germany
- Oct. 4, Midatlantic Conference (Packrats), Horsham PA
- Oct. 10-12 TAPR Digital Conference, Baltimore MD (near A/P)
- Oct. 17-19 AMSAT NA Symposium, Toronto Canada
- Oct. 23-26 Microwave Update, Sandusky OH, WA8WZG (see pg.11)

Correction: The e in the previous newsletter (Vol.11 No.4) on page 10 should read . E.g. in the line following “F” it should be... 89.0 -j 2.0 or (89.0-j2.0)

Radar detectors are still available, see previous issue. .

The Last Two Months Have Been....

busy and mostly fun, as far as the Society is concerned. Our booth at Hamvention was visited by a lot of folks, and we signed up eight new members, as well as many renewals. A number of you met with on-the-air friends. And out in the flea market, courtesy of N8ASB and KB8III, we sold over \$100 worth of radar detectors. The VHF/UHF/Microwave forum was moderated jointly by our own W9LCE and N8EHA, who put together a fine group of presentations. All in all, Hamvention went very well for us.

Outside of the big show, we have also been busy, selling more radar detectors and 6m amplifiers. There are still quite a few radar detectors left, and this is sue should give you some ideas what they can be used for. Part of our inventory includes boards assemblies without the horns and diodes, but which have several LED's, 8V regulators, switches, pots, FM IF IC's, etc. If you want to scrounge some basic parts, these are a good deal at \$1 apiece. We also have quite a few fully assembled units in cases, which could even be put to their intended use.

Also, there are still about six of the Quintron 6m amps left(most are in my garage). These things are really nice and include doc's for only \$150. My loving better half, Barbara, who supports and indulges my hobby misadventures without complaint, is beginning to express concern about when my half of the garage will again be occupied by my vehicle instead of amps and radar detectors. So please, if you are interested in any of these items, do not hesitate to call me at 937-667-5990.

Upcoming events include our annual picnic in August. Once again, we will be at the home of N8ASB for food, fun, and antenna measurements. Daun is still checking his calendar, so I don't have a date yet, but expect it to be one of the later Saturdays in August. Of course, we won't have a meeting in July to avoid a conflict with the Central States VHF Conference, this year in Hot Springs, Arkansas. And on October 23-26, in Sandusky, OH, Tom Whitted, WA8WZG, is hosting the annual Microwave Update conference. This is a great opportunity for us, having this literally in our own backyard. I expect that Tom will put on a great weekend, and I suspect that he will welcome any help with the legwork that we can provide. If you want to attend, it isn't too early to start making reservations(see pg. 11 for details) and thinking about sharing rides, rooms, etc.

Well, Gerd told me too keep it short this month, as he has a lot of really good stuff to publish and can't spare (waste?) very much space on my ramblings. See you on the 27th. **73, Tom, N8ZM.**

A SIMPLE X-BAND TUNABLE FM RECEIVER by Sam Laube, WB8ZDF

Often, I have been quite impressed with the sensitivity of X-band radar warning receivers. Usually, a 1 watt, X-band radar transmitter will trigger one of these little receivers from several miles away with out any problem, not to mention motion sensors and "door openers" that also trigger the receiver around supermarkets and banks. With the advent of laser radar, the popularity of these little receivers has dropped, such that one can find used units for a modest price. A bit of modification is all that is necessary to press a receiver into service as an X-band receiver for wide band FM audio.

This little article focuses on modifications to a KRACO model KRD-16 radar detector. These are the units offered by the MVUS at a very reasonable price, along with a partial schematic of the receiver. With a little studying of the circuit diagram, everything was already present in the receiver to convert it to FM by simply re-wiring. I also added an AFC circuit, along with an audio amplifier to drive a small speaker and an S-meter for fun. A diagram of the modified KRD-16 is shown in figure 1. (pg.10)

Let's understand the theory behind the receiver before we do anything. The little KRD-16 has a swell double conversion scheme, as Gerd, WB8IFM figured out some time ago. The 10,000 MHz signal comes in the horn casting, and is mixed in the first mixer diode with the first LO Gunn oscillator that is tuned to 11,000 MHz. The diode outputs a 1,000 MHz first IF signal that is immediately amplified by a MRF 901, Q1. A second MRF901, Q2, is the second mixer, which mixes the 1,000 MHz from the first IF with a 1,0107 MHz second LO, Q3. The output of the second mixer is filtered by the T1 tank, giving 10.7 MHz for the LM3089 FM chip. The FM chip puts out detected audio, which is first amplified by 1/4 of the LM349, then further amplified by a low-power LM386 audio amplifier. The LM3089 also puts out AFC voltage that is fed back into the 1,0107 MHz second LO, D3, D2, along with a DC tuning offset. This way, we can tune the second LO and cover about 500 MHz of tuning range. Unfortunately, the down conversion from 1,000 MHz to 10.7 MHz gives us virtually no image rejection in the second conversion, so we should hear a signal and it's image 21.4 MHz away. This is a minor annoyance, but we should be aware of it. I use this to determine a "real" signal from a birdie.

First, make sure the receiver you have acquired actually works. Plug it in, and see if you get any alarms. I have a gunn oscillator that I use to test them, but if you do not have one, find a shopping mall with X-band motion sensors to test your unit. Throw the receiver in the car, and check it on the next trip to the mall. Next, you need to open up the box. There are 4 phillips screws that hold the case on. Take the screws out, and the case comes apart in two halves. There is nothing on the upper board that you will need, so just unsolder the cloth ribbon cables and put the board in the parts bin. The upper board only has threshold circuits, and an alarm that increases with signal strength. The upper board can be missing and the receiver RF guts still work fine.

Take a look inside, and see if you can match the insides with what's on the schematic. Practice doing this, and make sure you have a KRD-16. You should be able to find the LM3089, and Q1-Q3 MRF901's sprinkled around, as well as all the ancillary components called out in the RF circuit. The second LO/VCO parts are hidden under a shield that is made into the horn casting. There is a hole for adjusting CP3. Make sure you can trace the board out before you modify it. It's a double-sided one, so be prepared to flip the thing over and over again to see where the traces go. All the wiring was done by cutting traces and tack-soldering parts where needed. Make sure you know what you are cutting before you cut it.

This and That

- **Digital Technology spurns Pagers and Cell-phones.** The local “wireless” is growing by leaps and bounds. We just lost our area code on account of the demand for new telephone numbers. By the year 2,000 there will be an estimated 60 million cellphones in the US. The “walky talky age” for the common man is here! Included are visitors from overseas, who have their own number and even pay a monthly fee for the time they are back home in order not to lose their number.
- **LEDs visible in sunlight.** Aerospace Optics Inc. is advertising the first LEDs visible in sunlight. Ten years of research lead to this achievement. (888) 515-1486
- **“Cool”** is a powerful reason to spend money. And **“Software”** is a gas; it expands to fill its container. (Nathan Myhrvold, Vice Pres. of Applications, Microsoft)
- **Overrated Information.** How about all those savings and productivity improvements promised by the computer (not to mention the paper savings). Compared to the big economic bangs delivered by water-, steam-, electricity-powered machines, productivity growth in the information age has been a mere whimper. (Scientific American)
- **Fiber Optics Cables** are spanning the globe. There are presently eight cables crossing the Atlantic and six the Pacific. Telephone rates to the UK from the US are the same as Interstate calls.
- **High Speed CW.** The physical limits for straight key and hand writing are 150 characters per minute. With the help of a “bug” or electronic keyer and a type writer this can be improved to 300 characters per minute. But, of course, the problem is the human being’s mind. It takes more than simple exercise. In an (old) ad for high speed training by Candler it says: “It takes a thorough knowledge of the fundamentals of mind training...” Basically you have to develop the capability of “intermediate storage” in your brain, then the rest is easy. (DL3DO)
- **Adventurous Travel.** A trip from San Diego to San Antonio in 1857 was advertised as: “Going from no place through nothing to no where!” The trip cost \$200 and took 30 days.
- **First Year Traffic** (1937) over the Golden Gate bridge was light. Only 25 cars were the average for the day. The number to-day is 120,000.
- **Make notes of your work.** Henry Cavendish, a 18th century British scientist was an avid experimenter and developed a deep understanding in electricity. Unfortunately he rarely took notes. He discovered Ohm’s Law 50 years before Ohm did. However, Ohm got the credit and rightly so, because he made the information available to others. (G3LDO)
- **Precise Inaccuracy.** That’s what you get when you have an instrument with high resolution (lots of digits) but poor accuracy. (G3DLO)
- **Old Timer recommends Grease.** All “fixings”: u-bolts, hose clamps, turnbuckles etc. in antenna construction should be given a generous, protective layer of heavy grease. Especially different metals should be covered at the joints. The same treatment is good for cable connectors as well. Grease actually hardens with time and protects hardware quite well. However, be aware that with time the protective cover will wear off, so periodic check (every 2 to 3 years) are recommended. (KF4TP & G3LDO)

Project ARGUS

Looking for another “WOW!”

Are we alone in the universe? This question is actively pursued by the SETI (Search for Extra-Terrestrial Intelligence) League, which a little over a year ago initiated project ARGUS. The project involves numerous volunteers who search the sky for unusual signals. It all goes back to the mysterious “WOW”- signal picked up by the Ohio State University radio telescope 20 years ago. This signal could not be explained by any known process or interference and is assumed to be of “extra-terrestrial intelligence”. About 5000 stations would be needed for a 100% coverage of the space all around us. To simplify matters and make the equipment affordable only one frequency, 1420 MHz, is received. Presently there are roughly 50 stations “on the air”; confirmed 20 in the US and 2 in Canada. Europe has 7, South America one and Australia two confirmed. So a lot more stations will be required to get “seamless” coverage. In our “neck of the woods” the University of Dayton is setting up a station and Lisa, N3TEP is giving us a brief introduction into this project. We will follow up with technical details as they become available later. On the next page is a diagram outlining a typical station and some comments on the software being used.

UD Radio Telescope, by Lisa Bush, N3TEP

The University of Dayton Amateur Radio Club (UDARC) has nearly completed work on the first radio telescope in the history of the University of Dayton. The radio telescope will be used for the SETI League’s Project Argus. UDARC members voted to participate in the project during the fall(97) semester. The Electrical and Computer Engineering Department of the University of Dayton granted UDARC funding for the SETI project at the beginning of the winter semester(97).

SETI was initially conducted by NASA. Unfortunately, in 1993 Congress terminated its funding for SETI. Various groups, including the SETI League, a non-profit organization, are working on the project. SETI League is a group of amateur and professional radio astronomers, amateur radio operators, and people interested in microwave and digital signal processing. Project Argus is an all-sky scan involving roughly 5,000 small radio telescopes around the world looking for microwave signals of possible intelligent extra-terrestrial origin. Once Project Argus is in full swing, it will be the first scan conducted in all directions in real time. Individual small radio telescopes are inexpensive to build and can scan larger sections of the sky in comparison to large radio telescopes such as Ohio State’s ”Big Ear.” These small telescopes are built and maintained by individuals at their own expense. Small radio telescopes are able to detect microwave signals out to a distance of several light years. Further information on the SETI League can be found on the Internet at <http://www.setileague.org>.

The SETI project involves student and faculty members of UDARC. Students from the Mechanical and Aerospace Engineering Department designed and built the mount for the satellite dish to be used in the project. The satellite dish was donated by the parents of an electrical engineering student at UD. Students have worked on this project throughout the past year. The SETI station is scheduled to be up and running before the end of the winter(97) semester. The University of Dayton Amateur Radio Club (UDARC) has nearly completed work on the first radio telescope in the history of the University of Dayton. The radio telescope will be used for the SETI(Search for Extra Terrestrial Intelligence) League’s Project Argus. UDARC members voted to participate in the project during the fall(97) semester. The Electrical and Computer Engineering Department of the University of Dayton granted UDARC funding for the SETI project at the beginning of the winter semester(97).

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10 GHz Antenna Experiments

The band allocated to hams with the most bandwidth, 500 MHz, is the 10 GHz band. So there is “room” for all kinds of modes and experiments. The frequency is 70 times higher than our “beloved” 2m band. And as we use a football field to carry out 2m antenna measurements at 10 GHz we can do it on the kitchen table.

John Kraus, W8JK, several years ago demonstrated this nicely to an audience and after watching a video of this at our last clubmeeting I decided to duplicate the hardware and have it available for educational purposes. Seeing is believing, and your imagination cannot thrive without inputs of that kind. Using parts of the “radar detectors” that the club is offering a test set can be built.

For the transmitter a 10 mW Gunn-diode-oscillator attached to a small horn is used. It is pulse (amplitude) modulated at a rate of approximately 500 Hz with a “555” IC which controls an IRF 510 FET (Radio Shack). This creates a rather wide spectrum but perfectly suitable for the simple diode detector with a similar small horn that we use on the receiving end.

For audio we use “computer amplified speakers” which can be had for under \$ 10.- You get a pair of speakers which have a dual amplifier with volume control built into one of the speaker boxes. I used only the speaker with the amplifier and added a single transistor to boost the somewhat meager amplification.

A SIMPLE X-BAND TUNABLE RECEIVER by Sam Laube, WB8ZDF

X-band FM receiver continued from page 3

The real guts of these receivers is the LM3089 FM IF system on a chip. These were quite popular chips back in the mid-seventies, and were used extensively as the core of an FM broadcast radio. This chip has several stages of IF gain, a quadrature discriminator, AFC, AGC, and S-meter driver circuits, as well as an audio mute control and audio amp. The chip takes 10.7 MHz IF directly, and puts out audio with the addition of a few external components.

Originally, the KRD-16 LM3089 is wired to discriminate over a wide bandwidth. One must do some minimal re-wiring in the discriminator tank circuit to convert the chip to detect FM audio. This is done by re-connecting the existing SUMID 690-050 tank coil, T2, to pins 9 and 10, and adding a 27 uH choke between pins 8 and 9 of the LM3089. I used a little molded choke that I attached to the bottom of the circuit board. I also added a 5.6k resistor between pins 10 and 7 to enable the AFC. I did spend some time trying to get the squelch circuit to work, but found out that I needed to cut a hole through the circuit board and underneath the LM3089 to break a circuit trace to unground pin 5 of the LM3089. I managed to do this with my trusty Dremmel tool only once successfully without knocking a hole in the bottom of the LM3089. It's tricky, so I didn't include it here, or on the schematic.

Next, I re-wired the existing LM349. I used one of the four op-amps as a current driver for the AFC. I also used the front panel "normal-mute-auto" switch to activate the AFC. I attached the volume and tuning controls to a piece of #14 wire, and soldered it to two ground points on the circuit board, although you may want to make up a front panel. I also found a small S-meter in the junk box and glued it to the top of the circuit board. I hung the speaker on a piece of plastic and attached it to one of the screw holes in the horn casting. As you can tell, I am not big on mechanical layout, but I hope you are better than I. As I found out at Dayton, a nice metal box would help this receiver out a great deal.

The audio amplifier is straightforward. I added the LM386 sideways by the LM349, with pins 2 and 4 soldered to the board upper groundplane. Don't forget to use shielded audio cable to connect the volume control. I live about 5 miles from WLW, and find that shielded audio cable is a must. I brought the 12 volt power over on a red wire that I tacked to the protection diode from the power input lead. You may find that this does not provide enough audio. If you want to drive the LM386 to full power, you can utilize one of the LM349 op-amps as a gain-of-ten driver. I did this the night before going to Dayton, because my brothers, N8MBS and KC8HGQ, were talking loudly and drinking my beer, thus making it difficult for me to align my receiver.

Assuming you followed the schematic and got things hooked up right, you should be ready to smoke-test the receiver. In lieu of hooking it up to a 12 V supply directly, try bringing it up on a current-limited supply slowly. Once you have the receiver up to 12 volts, check to see if you have regulated 8V, as well as check pin 7 of the LM349. You should see around 6V on pin 7. You should also hear a rushing sound in the speaker that sounds like un-squelched FM noise. If you don't, touch pin 3 of the LM386. You should get a nice 60 Hz buzz. If the audio PA works, backtrack to pin 6 of the LM3089. Check pin 11 of the LM3089 for regulated 8V. Leave the RF circuits alone. Resist your fiddling urge, because you will only regret it later. You shouldn't have needed to add anything to them, and they should still be working.

Hopefully, you have a rushing sound in the speaker by now. You might notice the S-meter is not "zeroed". That's good, because the gain of the LM3089 is quite high. The S-meter deflection is probably due to detection of the noise from the first mixer diode. You can use this as a way of tuning the discriminator coil, T2. Peak it for maximum noise in the speaker, as well as maximum S-meter deflection. You can also then peak T1 in the same fashion. Be careful with CP2. You need a signal source to tweak the second mixer. By now, you should have acquired a gunn oscillator somewhere, but if you still did not find one, it's back to the mall to finish your tune-up. Once you have a signal source, tune around and find it. You can tell it is a genuine signal by noticing the signal and it's image 21.4MHz away. Also, movement of the horn 1.5 cm should cause the signal to fade in and out on a multipath signal. That's a half wavelength at 3cm. If you got this far, you are probably getting excited that it actually is working. I know I was. I played with my receiver for days when I first got it working. It is neat to see how 3 cm signals bounce.

Tweak CP2 and CP1 with a non-metallic tool for maximum deflection on the S-meter. You may need to tune the screw on the gunn oscillator first LO, but I wouldn't unless you have an accurate frequency source. Most motion sensors and police radars are at around 10,525MHz. The ham band ends at 10,500 MHz. It is not trivial to know what frequency you are listening to. I have a slotted waveguide that I can calculate frequency with, but unfortunately the KRD-16 is not WR-90 waveguide, so I have no idea what frequencies are covered by the first LO gunn oscillator.

Well, that's it for now. This project is not too difficult. Just follow the schematic diagram, and use your own particular construction technique. (Mine is "slop-dash") The next project will be a companion wide band FM transmitter. Try to find a gunn oscillator that will tune down to below 10,500 MHz. That's the major part you will need to get started on the companion transmitter. Most gunn diodes take 8 V to power up. Get one with WR-90 waveguide, if you can. Good luck, and see you around.

Microwave Update 23 to 26 October 1997 in Sandusky Ohio

Contact: Tom Whitted, WA8WZG

Schedule of events

* Thursday - Surplus tour of A.R.E. Surplus in Findlay, Ohio. Electronic, medical, military, industrial, surplus, tubes, wire, hardware, and occasional microwave goodies. This is the sister store of A.R.E. Surplus in Phoenix that was on the Update '96 tour. Next on the tour will be Fair radio in Lima, Ohio, the premier military and industrial surplus store. You've all heard of it, now experience it! Tons of microwave and RF goodies and over 1000 types of transformers. Huge selection of connectors, waveguides relays, and antique gear and parts. Price bargaining permitted! A must for any ham, regardless of your operating preference. Last stop will be CTR Surplus in Crestline, Ohio. A new store with lots of mechanical parts, right angle drives, hydraulic cylinders, gears, bearings, RF devices, semiconductors, relays, and wire. Again, you can haggle for your best price.

* Friday and Saturday - 8:30am to 4:30pm. Conference preceding with speakers such as N1BWT, WA1MBA, WB5LUA, W5ZN, NJ2L, N6TX, N2CEI, WA5VJB, K9LNV, WB2VVV, K2DH, VE4MA, N6TX (SETI), KB8OIU, AB4CR and more to come.

* Friday night - Noise figure measurements and microwave flea market. Ladies program will be offered.

* Saturday Night - Bar-B-Q (ladies included) and EME demonstration at QTH of WA8WZG plus setup in building for more flea market "goodies".

* Sunday - Wrap up of conference and possibly a tour of the W8JK "Big Ear" at Ohio State University.

If you haven't registered for Update in the last 2 years, please E-Mail me with your correct mailing address so your packet can be sent. Online registration also available: ww.wa8wzg.com/update97/reg.html

Conference Fee If registered before October 2, 1997: \$40.00, \$45.00 later.

Includes 1 copy of proceedings. Each additional copy is \$10.

Saturday night BBQ Dinner: \$18.00

Hotel Reservation Information: Holiday Inn Conference Center in Sandusky, Ohio. For reservations, call them directly at (419) 626-6671 and mention that you are part of the Microwave Update conference.

* For one person in one room: \$69.95 per night This includes buffet breakfast and lunch on Friday and Saturday and breakfast only on Thursday and Sunday. * If two people want to share a room: \$47.95 per night per person (\$95.90 total per night) This price also includes the same buffet breakfast and lunch service as above.

General Information Sandusky, Ohio is 50 miles west of Cleveland, Ohio on the shore of beautiful Lake Erie. The Holiday Inn Conference Center has a holidome and is located within walking distance of two large shopping malls. For more information on what the area has to offer, contact the Erie County Visitor's Bureau at 1-800-255-ERIE, or check out their web page at <http://www.buckeyenorth.com>.

Finally, it was decided that a ladies program will be offered at this year's conference. We are planning a shopping and sightseeing tour of the north coast area. More information on this will be posted when available.

If you have any questions regarding any of this information, or would like to be a speaker or write an article for the proceedings, here is how to get a hold of me:

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