The SPARC NEWSLETTER
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A publication of the Southern PA Amateur Radio Club

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More Repeater Site History, ATTLL Addendum

by W3IHM, TPA member (Telephone Pioneers of America)

Somebody asked me where I got the maps and information in my last article. Well, there's a nifty web site called the David Rumsey Map Collection. Here:

https://www.davidrumsey.com/

There is a plethora of maps here. Like my dad, I am a map-aholic. I can get lost, wasting hours upon hours looking around at various maps of various things. Be careful with this site. It can consume a vast amount of time.

If you want to explore the ATT long lines sites, here's a web site that has some:

https://memorial.bellsystem.com/

and for terrestrial microwave location maps, start here:

http://long-lines.net/places-routes/

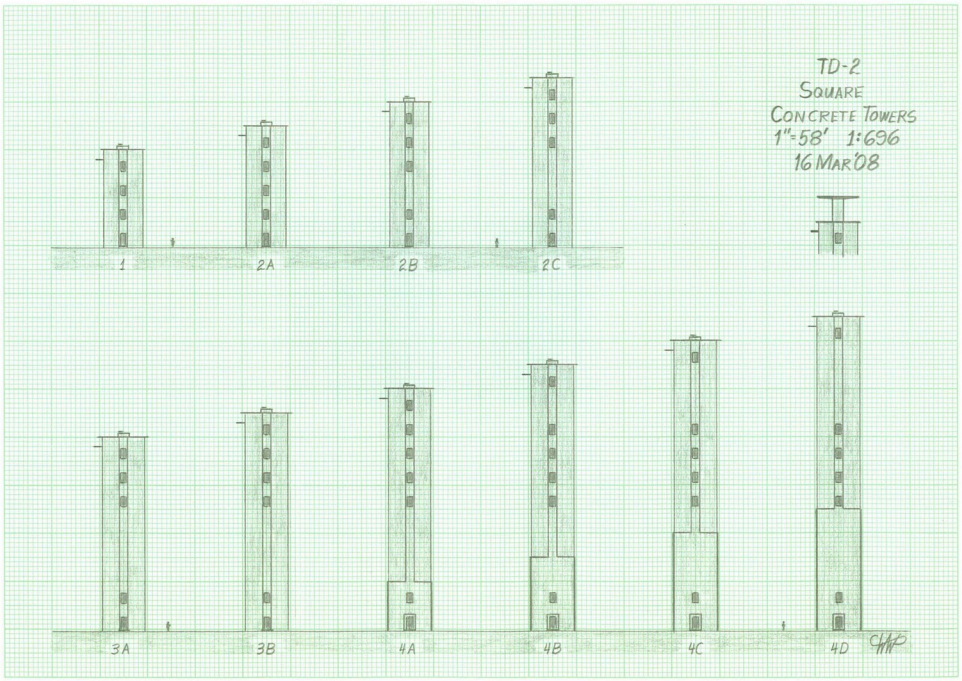
There is a great amount of data here, if you are interested. You can spend a great amount of time reading old articles about ATTLL infrastructure and lore.

For instance, here is an article that struck my fancy. You will see Beautiful New Holland indicated in the inaugural route from NYC to Chicago. There was a key microwave site that was installed at the earliest, to connect Chicago. The tower was located on “Tower Road”. That is some history that needs to be remembered! I wonder if anyone remembers seeing this in New Holland? Anyway, give this a look if you are interested.

https://www.long-lines.net/places-routes/1st_transcon_mw/LL0949/02.html

As an aside, I did a bit of digging about this, wondering what ever became of the long lines site there. Is it still around? Maybe we can put it back on the air.

Well, New Holland had a type “2B” square concrete tower. It is mentioned in this drawing as “New Holland (89 ft. Type 2B)” type. These buildings were 24 feet square with 1 foot thick walls, and was located where the TSC now is, I think. I wonder if any old pictures of New Holland show this tower in the back somewhere:



Remember these radio systems had radio licenses, too. The New Holland site had an FCC call of KGA35. It was still on the link maps, and on the air in 1970. Likewise, Cornwall

was KGO75, and sported ten 6 GHz horns. It was still active in 1970, too.

I initially thought that the SPARC FCC “Union” call would have been one of these:

Uniontown	PA	KGI21	11		8-6GHz
Unionville	PA	KGH92	6	88266	10-6GHz

But I am not sure. “Uniontown” is south of Pbgh. “Unionville” is down by Longwood Gardens, so I am doubtful that that either of these callsigns were active at our clubsite. I also think the site may just have been called “Union, PA”, and it’s FCC callsign was not listed.

Also, none of these old FCC issued “3 by 2” callsigns are still active. All callsigns now are at least “3 by 3”. Also, remember that a site may not have a radio system, but contain only hard wire interconnects. Some of these are undoubtedly “dark” sites that still hub vital fiber or other infrastructure. Our site was definitely RF, though.

By the size of the holes in the bullwark, our “union” site had 4 GHz radios. Neither of the “uniontown” or “unionville” sites had 4 GHz equipment, but heaps of 6 GHz stuff. The 6 GHz stuff was for the “newer, high capacity” radios, and was a later “fill” site. If I am to find out the FCC issued callsign for the “Union” site, I need to find more data resources to research this.

OK, why bother with all this snoopery? Well, what would be a more appropriate callsign for our GMRS repeater, anyway?

Let’s talk about the equipment. What was put in the little building? Here’s a bunch of numbers. Look at the long-lines.net site for more information about the actual hardware. We are talking racks of gear.

The original 4 GHz stuff was either TD-2 or TD-3. This was what was installed at the “Union, PA” station.

The newer 6 GHz was TH, TM. This was what was installed up at Cornwall.

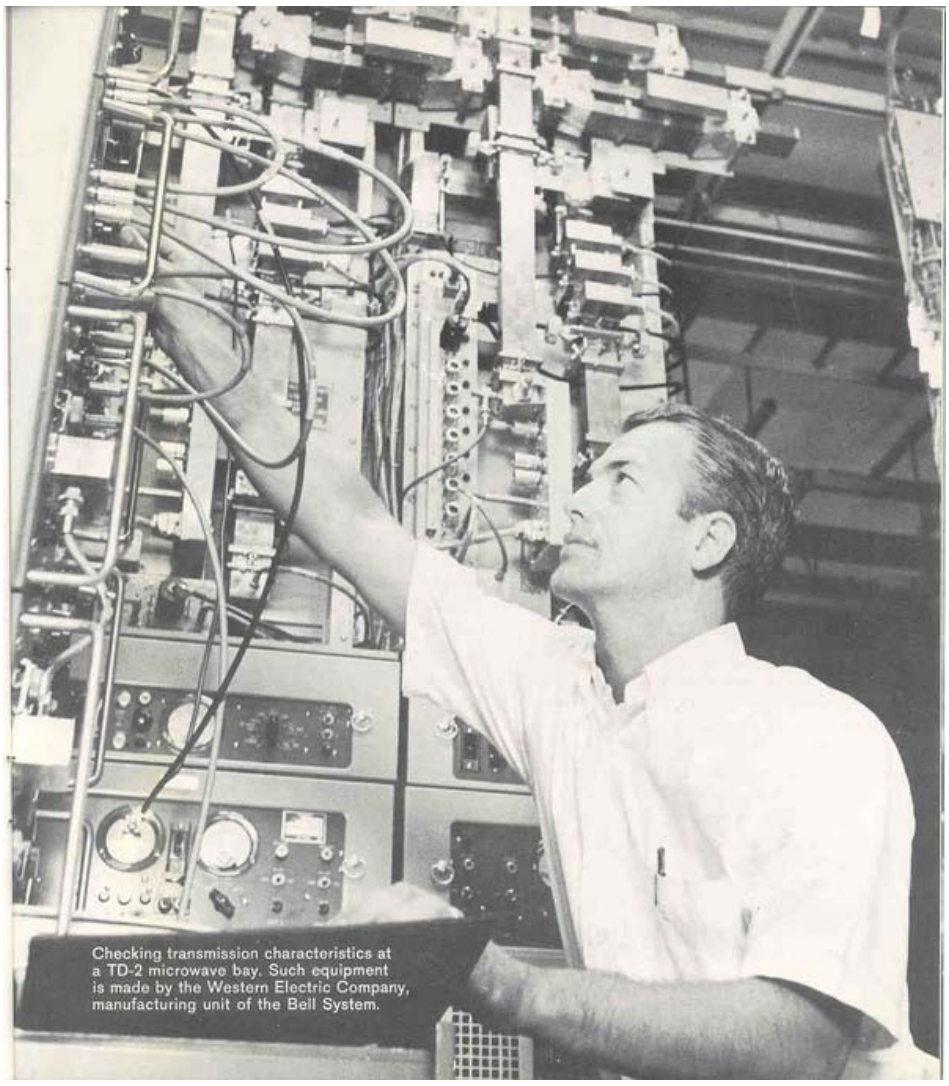
The 11 GHz radios were TJ, TL systems, and was limited to short haul, around major cities, like Philly and DC. The 11 GHz signals were short distance due to rain scattering and interference. Anyone who has played with 10 GHz radio knows about rain and snow scatter.

Also, remember that these systems were designed to have a margin of around 10 dB SNR, so any interference would be an issue. These systems were not high power, but had very controlled RF radiation patterns and levels. Multiple systems would be on the same frequencies, with wide band modulation schemes, prone to easy interference. Stray radiation was a major issue of concern. Sites were not just chosen by height criteria, but

also not to be in direct line with other sites.

From the start to the late 1950's, the initial sites were all vacuum tube, requiring maintenance staff around at all times. By the mid 1960's these all-tube radios were slowly converted to semiconductor.

Likewise, by the mid 1970's, fiber optic lines were starting to come on line. Some of the old installer people I talked with, remember installing the microwave sites, rushing around, building towers, filing orders, putting in links, while they also knew that they would be taking them down within a few years, because of fiber. It was the progress of technology, in pursuit of ever widening bandwidth.



Checking transmission characteristics at a TD-2 microwave bay. Such equipment is made by the Western Electric Company, manufacturing unit of the Bell System.

I can also tell what old technology is going away by what shows up at hamfests. Although I saw lots of 4 and 6 GHz tube radio hardware with "WeCo" stamps on it during the '70s to early '80s, I never saw any of the semiconductor RF hardware at hamfests. This leads me to believe that much of this terrestrial equipment was sold to other countries as complete

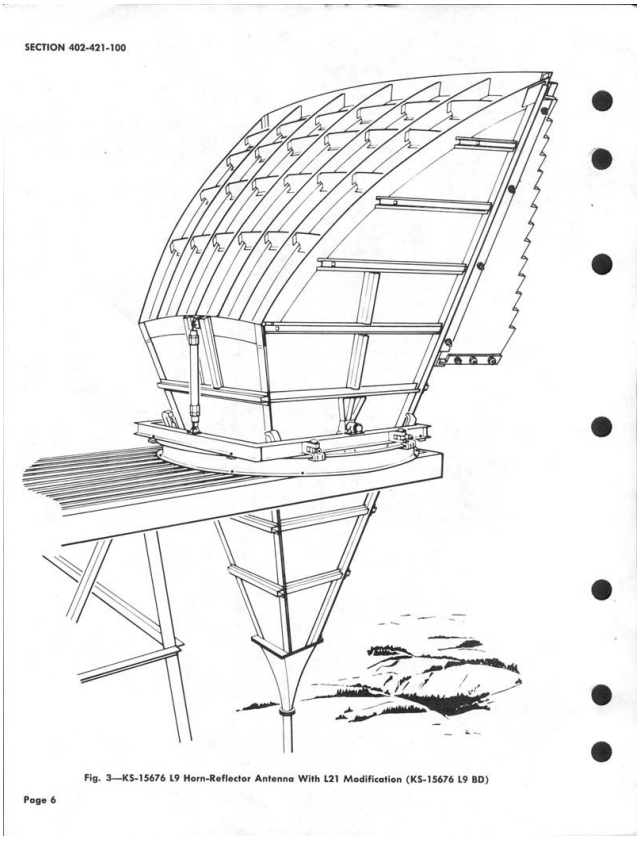
systems.

Who would want our old terrestrial microwave stuff, anyway? Well, microwave systems can be set up easily. A country that has no infrastructure at all, can set up an RF communication system relatively quickly. As an example, China has done this infrastructure “leapfrog” rapidly over the past 40 years, with cellular radios. They have avoided all the land line telephone building costs by just handing out cellphones and putting up towers. For awhile, I also know that much of our old mechanical telephone switch gear ended up south of the border. So this is nothing new. Reduce-Reuse-Recycle.

What about those “feed scoops”? Can I get better WiFi with one of those scoops?

The “feed scoop” antennas are really a “bisected parabolic” with very low sidelobe radiation. An array of Yagis would spray sidelobes all over the place, and make a real nuisance of itself. What’s needed is a dish or horn. So why not combine the dish and horn? We need some sort of parabolic surface, with a contained feed horn. Thus, the bisected parabolic.

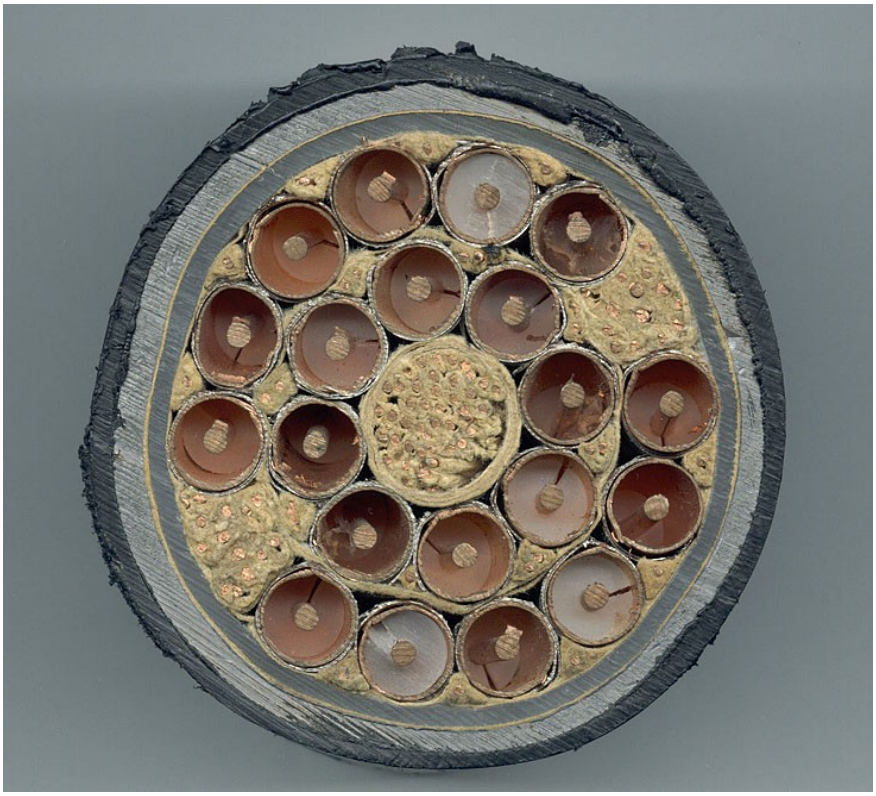
You can see the parabola section, combined with the enclosed feed horn design by looking at the way that it is, see? These big honker antennas also disappeared from surplus rather quickly, considering that one usually weighed in at a half-ton each, including leveling



and rotation ring, so were quite a spectacle to remove, requiring a crane or big Gin pole.

Hauling one of these to a hamfest to sell, or getting it home from there was reserved for only the most ardent of us. Few survive.

Remember the RF microwave link sites sometimes had cable and wire interconnects? Here is a cross section of what a coaxial telephone long line would look like in the 1950's. There were several coaxial cables, along with multiple twisted pairs of copper wire. There is still miles of this thick cable buried along right of ways, or sitting at the bottom of the ocean floor in various places around the world. Look up a pole. See that thick black wire? That's some copper up there.



Don't tell any copper scrap metal folks. They will be digging up the entire country looking for old copper lines.

I would think that you may be wondering why the "Union. PA" site has no "comfort" facilities, and why did we have to install the Taj-ma-potty? If people were stationed there, even if only for awhile, where would they do their business? Water could be trucked in, and stored in a tank, but what about waste? Where was the septic field?

Well, at our site, the grandfather of the Taj-ma-potty was the standard issue ATTLL Incinolet. Incinolet? Yes, an electric incinerating toilet. These things still exist, and provide a waterless facility that requires no water and has no need to be "pumped out". Here is a picture of one that was all the rage in the microwave terrestrial link era.

It looks basic, but it did the job. The industrial green bell systems units were part of the site equipment inventory. Yes, these things are still a thing. Here is their current website, if you want one.

https://incinolet.com

That’s enough for now. Giddyap!

Website

The new website is a thing now. Thanks to Jim, W3BYO, and Matt, N3NTJ, for their hard work in getting the new platform up and running. Also thanks to Dave, N3NTJ, for transferring the k3ir.org domain name to the new site.

Sure, so what did they do? Well, give it a try at k3ir.org. The nifty opening drone footage is spectacular to see. It makes me want to reach out and mess with the antennas. Also check out the net roster. There's a net every night for you to participate in. Look at the northern lights picture!

What time is the net? When is Elmer night? Where's the breakfast? What time and who is going to run the DMR roundtable? VE tests? That's what the website is for. I purposefully do NOT put that information in this newsletter. Check the calendar. It changes rapidly sometimes. Go there. K3IR.org.

Ok, there's also places with nothing in them yet. That's where you come in. What have you to post?

More Plate Tectonics

by Sam W3IHM

Guess what I saw on QRZ? Free radio! Free! NO cost! Cost-less! Free!

WOW! A genuine TS-520 for free! This is an all-analog, hybrid, load and tune, he-man's rig, with crystal calibrated analog dial, big stable VFO, and scant IF filters, with no digital trickery nonsense inside. Ah! What a radio! I remember when the TS-520 came

out back in 1974, when I was in Highschool! It was cool, five bands, 80, 40, 20, 15, and 10 meters, SSB and CW, and ran a pair of 6146's for about 100 watts. It also sported 12 VDC or 120 VAC operation, with a totally solid state receiver section. They were about $629 new, back then, which is equivalent to about $58,000 in 2025 dollars nowadays.

And here I was, stumbling around QRZ, bored, looking for something, and Gary, AE1CT, hangs this out for me to catch. I bit.

This radio and I had a long thing going. I remember when the Yaesu FT-101 came out. It was about the same cost, but then a year or so later, along came Kenwood, with the TS-520, for a few bucks cheaper. This was more radio for less bucks.

Sure, I should tell you that I ran out and bought one, but at this time in my life, I was earning about $1.95 an hour washing right front fender, with alcoholics and pot heads. Why low wages? Well, it was explained by "Wilson", our employer, that the wage is "Not including da-tips." Yeah, sure. I never received a single "da-tip." But hey, it was a job, even though I had to walk the four miles to and from home, usually wet from the spray machines. I remember that my wet pants used to freeze solid in wintertime. It was a good thing they were bell bottoms.

Still, I was saving up for car parts to get my BMW 1800 on the road. I needed a battery and a rebuild kit for the carburetor. The seals were all shot, and it dumped gas on the intake manifold. The muffler would also have to wait. The bus did not run out that far in town, so it was bicycle, hoofing, or thumbing for work transport. And someone stole my

bicycle the first week at the carwash. So it was the feet. Swell.

About this time, in my ham-o-sphere, my neighbor, Keith, WB8ZDC, somehow got a job that paid like $5 an hour, because his dad knew someone, I guess. SO guess what he got? Yep, cash to spend, but more importantly, a new TS-520 and a swell Hy-Gain trap vertical for the antenna, located on his folks roof, complete with at least three bell wire ground radials cut to length for each band, draped out across the roof, and tucked under a shingle here or there. This yielded an almost perfect ground plane on each band, all coming in on one single coax line, terminating into the ultimate of TS-520 radio perfection. He even had a single thick number 10 wire drooped town to a copper ground stake for lightning protection. Sweetness.

Of course, he had me over to enviously drool over his complete instant band switching sold state receiving ham station, and proceeded to work SSB DX right in front of my

eyes. Furthermore, he “tut-tut’ed” a UK ham calling CQ. Apparently, it was not “real” DX enough for him. After all, he had “the most powerful antennas under the sun!”, combined with the much coveted TS-520 dream rig. I suppose, one could get bored with simple “across the pond” DX to the UK. Heck, they even speak english, too.

So, when Gary dangled this TS-520 out there, I wanted it. Easy. Several people expressed interest, but I was the first to express my interest by Vinmo’ing him the $50 he wanted in shipping charges. Fair enough.

OK, my XYL started picking on me, about this “free” radio already costing $50, but the skin is thick, after 35 years of wedding bliss. Besides, I was about to have my TS-520 youth dreams fulfilled. What’s a little XYL ribbing, anyway?

After awhile, Gary got the thing in the mail. Gary’s a bit further along than I am, like in his 80’s, so it takes him time to do things. But like me, it also takes time for me to do things, too, so I didn’t care. He said the radio received, but he could not get the transmitter section to work. I took this as a gleeful challenge, because I knew the TS-520 was a magic design, and would leap to life as soon as I got my scope probe out, and took on a posture that I meant business.

Power, you say? The power plug on the back of the TS-520 is one of these Jones type connectors. It can be configured as a 120 VAC or 12 VDC inlet. Cinch still makes connectors like this, but apparently does not do this type of 12 pin connector anywhere. Check www.cinch.com. So I guess I am hunting for a jack that will mate with the connector on line. Something that looks like this is what I need.

After a few outrageous E-bay prices, I found one that I won as the only bidder, for like $15 with a swell DC power cord already attached. So we are up to $65 already, for the "free" radio. I didn't tell my XYL about the extra bucks for the connector and cord. Hush.

When the large, heavy TS-520 package arrived, I noticed that Gary had to spend an extra $25 to ship it, because the TS-520 was in excess of 35 lbs. This required extra handling charges. He would have eaten that, but I wanted to do him right, so off to get the XYL to Vinmo the extra $25. We are up to $90, now. That is ok, because even the bestest most magical radio in the world would cost big bucks to ship, I guess, with more XYL ribbing included.

Gary said the radio did not transmit. When I got it, I hooked up some alligator clips to the unobtanium Jones plug and powered it up. The radio did "transmit," but mostly 36 MHz, except on perhaps 80 meters, when it transmitted a 3.5 MHz modulated 36 MHz signal. There was also no plate current registering on the meter, and plenty of free, unhinged RF spilling out the SO-239 output connector on the back. So it oscillated just fine. Well, you know what that means? The PA tubes must be OK.

The receiver did work, but seemed to lack gain and AVC. The S-meter would not budge unless I fed a couple volts into the thing, so I cleaned the controls and switches, to passs the time.

I also hammered out a corner of the cabinet. It looked like the radio took a dive at some time in it's history. Nothing seemed cracked, but that was to be determined, when I got a more careful, brooding visual on the insides. Maybe the USPS did it some hatred. It wouldn't surprise me. That's what the extra fee is for, I guess.

I opened the cabinet, and pulled out the finals, after clipping the B+ HV to ground. One came out without it's centering pin, so some heating or shock had done this tube wrong. I noticed that the tubes were stamped with a meatball "GE 6146A", but also on the bulb was 6146B, like Sylvania style, etched in the glass.

I could tell by looking at the plates that these were 6146B's. Plus, the white "GE 6146A" crap rubbed off with my finger. OK. These were bogus relabeled 6146B's that someone wanted to pass off as "A" tubes. Why? I don't know. I went with the Sylvania markings. They are etched into the glass. Plus, someone "sharpie" wrote on the tube sockets "6146A", like that would make it happen. It was a 6146B on the inside of the bulb. I recognized the guts.

OK. That's fine. The TS-520 required that 6146B's be used, so that the neutralization

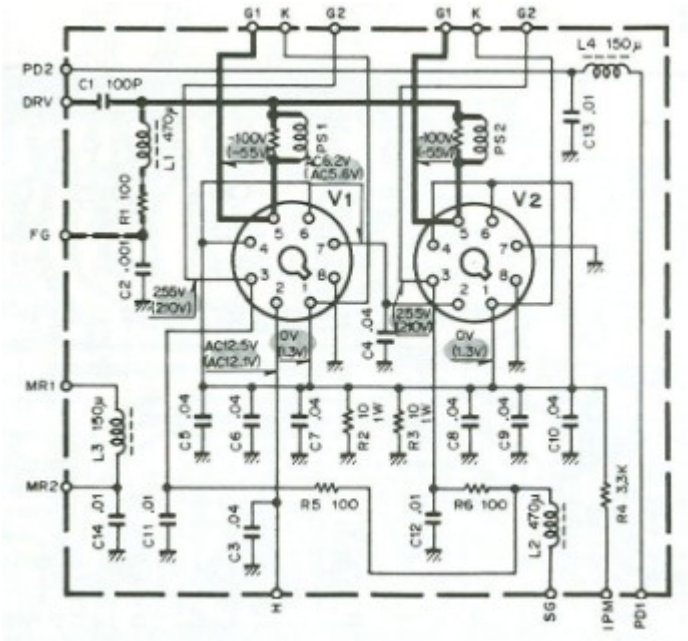
range would be sufficient. Powering the rig up again, I could get a nice minimum on the 36 MHz oscillation about halfway on the neutralization trimmer. These 6146's were definitely B's. OK, that means that the neutralization part of the circuit is OK, but this amplifier is oscillating, not amplifying. Typical.

There seems to be so much grief over tubes nowadays. For instance, do a web search on 6146 lore. "...blah-blah ...never mix tube types… you need a matched pair of 6146A's… ...6146W's are EVIL!… ...the straight 6146's are the only tubes that will work in radio XYZ… ...you need only original S2001 tubes…. ...blah-blah..."

What a bunch of noise. It's electrons. They don't know what type of radio you have, nor do they care. They also are sub-atomic, and are never happy or sad. They are also incapable of mind reading. There is some reason that things don't do what you want. Find it, and you can use a 6146 (A, B or W) with an 807 (Black plate, Silver plate, or Blue plate special) in push-pull, if you really want to.

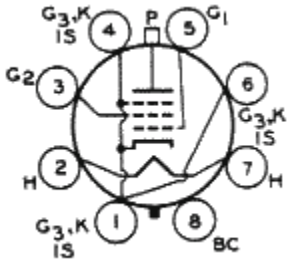
So let me think. The plate choke in these kind of radios is usually self-resonant somewhere about the mid 30's of MHz. How do I know this? From stuff I did. Like I made some new plate chokes, when my FT-102 fried it's choke. I read old ARRL handbooks. I studied different types of plate choke designs over the past years. I wound and built some. I fried some. I learned. It comes in handy, now. Life is for learning.

This amplifier wants to oscillate around the mid 30's of MHz, so what does that tell us? There must be something floating that is supposed to be at ground potential. The tubes are running to that sweet spot and making Dr. Barkhausen happy. We have a gain of >1 and 360 degrees of phase shift. The 360 degrees would come from the choke self resonant LC. The gain >1 will come from the tubes. SAY! Is the cathode floating?



Here’s a nice picture by Ken, K4EAA. It shows a final cage diagram of the TS-820. It is pretty much the same as the TS-520, down to the 100 pF driver coupling capacitor. I use this picture because Ken does a beautiful job.

Look at C5,6,7,8,9,10. What is that about? That looks like someone was real concerned with getting something to go to ground there. Look. There’s biggish bypass type capacitors or direct grounds hanging on the tube pins 1,2,3,4,6,7,8. Only pin 5 (signal grid) doesn’t have a bypass on it. What is hooked on those pins? Apparently they need to look like RF ground. Here’s the tube pinout. Stuff comes in on pin 5, and goes out on the plate cap. Everything else should be at RF ground, right?



Whenever I hear about 6146’s oscillating, that’s the first thing I check for. Something is not grounded that should be. The 6146 is a high gain tube, meaning if it doesn’t know where ground is, it will take off and never come home. It will spread it’s glorious 6146 wings, and take along with it, any resonant thing or things nearby, and make that it’s new oscillatory home.

It reminds me of the Bohemian saying: “We come from the dirt, and we return to the dirt. Once a man looses sight of this, he is truly lost.”

Once a 6146 looses sight of where ground is, it is truly lost.

SO... I seriously studied the underside of this particular TS-520 PA cage. I saw many replaced bypass capacitors. I saw new shining 10 ohm metal film meter shunt resistors. I saw great shining globs of solder everywhere. Everything looked secure, but electrons don’t have eyes, do they? No.

I took my electron-measuring ohm meter and prodded betwixt a solder glob and chassis ground. 100 ohms. Hum…. Another bypass glob, directly to the chassis, and there is 230 ohms. What gives? How can these solder joints directly to the chassis be resistive? I tried my many meters, and all concurred. Is this solder some magical resistive stuff?

Still incredulous, I fired up the oscillator/amplifier, and sure enough, there was a huge sine wave between the chassis ground and the tube pins that were supposed to be ground. No, It wasn’t my scope probe ground loop pickup, either. I used the little springy pokey probe thingie. Some grounds just weren’t. Thar’s the problem.

Soldering directly to a metal chassis is a good ground strategy but sometimes oxide layers form with time. This Kenwood is over 50 years old. There is a sort of salt water crust on a few places of the chassis. Maybe this rig lived by the beach and picked up some oxide addiction. Maybe that’s what happened. The solder to metal chassis formed an oxide layer, making all these grounds resistive.

Ask me how I chased brass rivets at 1.2 GHz sometime. Oh. They ohm just fine. Tears. Many tears. RF does fun stuff, sometimes.

I wicked off all these chassis direct grounds and found a thick black kind of oxide coating that had formed between solder and chassis. So I dremmeled off the whole mess, and got clean shiny metal to solder to. Re-soldering my tube bypass capacitors, and all the pesky oscillations went away. Ground was ground, now.

Some alchemy acting upon solder, flux, and mild steel, combined with RF currents, no doubt. Could be quantum effects, don’t-cha-know? … I am amazed that I can still hear the signal from Oscar-7. It’s about the same age as this radio. Tune Oscar-7 in before it’s too late! One rivet, and it’s QRT. Gotta hand it to those DE Hams that built that bird, though. ACES, guys!

Kudos to the other people who tackled this TS-520 thing before me, though. The chassis solder points looked totally legit. I had to poke with my meter a few times to convince

myself that the connections were ohmic, but the scope probing made me a believer.

Now I could set the bias current to 60 mA, and heat up the tubes by quickly cranking it up to max for a second, to see if the tubes were healthy, and red in the plate. They did the tube thing just fine, at DC. The bias control worked just fine. Everything was quiet, and ready to amplify.

OK, now the oscillator was stopped, but still no RF. I could tune and load, but only for brief times. The RF would come on, but stop after a few seconds of transmit. I hooked my scope to a handy pin 5 grid, and sure enough, the thing would transmit for a second, and then the drive would just disappear.

I found that someone, in all the fury to replace all the capacitors, left one side of the 100 pF drive coupling capacitor loosely soldered. Once the tubes started generating heat, this solder joint would open, shutting off the drive signal. It had a ball of leftover wire stubs from previously hacked out capacitors on this terminal. I cleaned all this off, and resoldered it together.

Now I haven't touched the receiver yet, but I threw on a 10 meter antenna, after getting a dummy load too hot to handle. I wanted to run the amp to make sure it was going to amplify for awhile longer, and not oscillate. I usually like to feel some heat huff out of the back mounted fan on the 6146's, before I put the final cage back together. I figure I would bake it out on a dead 10 meters into an antenna, and spare my poor dummy load. I tuned up on 10 meters, and spun the knob.

Spin…. I heard a lone signal on 28.015, CW, with the metal analog dial ring lining up exactly at 015. N4KUM was calling CQ DX. He was the only signal on the band. 10 meters is like that, sometimes.

How could I resist? I was not really DX to Florida, but he came back anyway. We straight key QSO'd for about an hour, as one does sometimes, late at night, with him running a modern ham rig into some CB linear he got together at 500 W, with an english WW2 straight key, and me, with my recently repaired TS-520, and a cheap pot metal radio shack straight key lying on the workbench.

The CW sidetone doesn't work, and the RX is still a bit stodgy, but once I get it shined up a bit, this is truly going to be a magic radio.

Meeting Night

Like most clubs, there sets in a sort of monthly pattern of meetings, etc. Like, for

SPARC, the usual average monthly general membership meeting is held the fourth Tuesday of the month, June the 24th at 7:00 PM, at the Clubhouse. Sometimes these things change, especially in the winter. Why are you looking at this newsletter for such information? Go to K3IR.org and check the calendar tab.

License Test Sessions

Want to upgrade your license? How about get a license? You will need one to be a ham operator. There IS a test. You are required to know something. It's not just a $$$ thing. Demonstrating that you indeed know something is another matter altogether.

So you will need to study some materials. There is plenty of on-line information to help you get your license. Ask us. We are here to serve. Go to k3ir.org and ask for help.

Usually, testing is conducted at the SPARC site on the first Tuesday of every month. The fee to take the exam is usually $14.00 payable on the K3IR website or in person, cash or check only. Go to K3IR.org and check the calendar tab to make sure.

If you do not already have one, go to fcc.gov and register for a FRN (Federal Registration Number). You will need this to interact with the FCC.

You can also pre-register to take the technician test, or upgrade, at Hamstudy.org. There is also a link on the K3IR web site to follow. Check the k3ir.org website for the latest in fashionable ham test news.

Upcoming Hamfests

There may be others. Poke around on QRZ and Facebook, but here's a few.

Thursday to Sunday, August 21-24, 2025

HamXposition
ARRL New England Division Convention
Best Western Hotel and Conference Center
Marlborough, MA

ticketing.hamxposition.org

This is a dinner, and show type convention, with a flea market.

Saturday, September 6, 2025

Saratoga County Fairgrounds
162 Prospect Street
Ballston Spa, NY 12020

www.K2DLL.org

Saturday, October 1, 2025

Red Rose Hamfest
339 East Main Street
New Holland, PA

www.w3rrr.org

Looking For Volunteers

SPARC currently has 131 “active” members on the roster. We have a lot to offer to our members. At this time we have a dedicated group of hardworking volunteers who keep the site running. Some say this is typical with most organizations. I don't think SPARC should be “typical” We need more real active members. Jobs range from the highly technical to the mundane but ALL are important. Please look at the list below and see if there is a place for you.

IT Team

Tower climbers and ground help

Operating building maintenance and cleaning

Operating building equipment maintenance and improvement

Porta Potty cleaning (not Pumping!)

Adopt a Highway crew

Elmers and Elm’ettes

Hamfest help, planning, etc.

Meeting programs and talks

Antennas! ...always more, bigger, higher.

Someone to take the trash home and pitch it when it’s full.

Someone else to either eat or toss the old stuff in the fridge.

Joke Corner:

From the 1974 Signetics Timer IC Databook: