Smoke Signals

Newsletter of Fullerton Radio Club

July 2024

Presidents Column

The casual contester.

I have always thought of amateur radio contesting as being only appropriate for very competitive hams, striving to win by earning the most points. That always sounded to me more like work than fun. While I consider myself a mildly competitive person, I'm not aggressively so. Accordingly, I had always figured that contesting was not for me.

A couple of months ago, I heard FRC member Tom Smith KB6A mention that he enjoyed contests, but rather than trying to win, he was more interested in the experience than earning the most points. That was the moment I realized it was okay (and might be fun) to be a *casual contester*.

As most of you know by now, I particularly enjoy participating in the Parks on the Air program. I think the reason I enjoy participating in POTA is it provides me with a reason to set up my portable radio gear and make multiple contacts, but is relaxed enough that it doesn't feel like work.

For hams without a lot of HF experience, being a *casual contester* might be a good way to gain HF experience by providing practice in making contacts *IF you know the expected "exchange"

I'd like to acknowledge Tom Smith's encouragement by occasionally using the FRC-OC group to remind us when there is contest happening and what the expected exchange will be.

There are some VHF/UHF contests coming up this fall. It might be an excuse for a few of us to go to a hilltop and do some casual contesting.

Grunge Busting - Intermod Patrol

by Joe Moell K0OV

There was a recent TAG discussion and some FRC-OC mailing list posts regarding certain types of coax as potential sources of intermodulation interference to repeaters. It reminded me of a unique QRM-tracking experience that I had almost forty years ago.

In 1985, there were over 100 members of the Hughes Fullerton Employees Association Amateur Radio Club. Some of them were big-gun DXers who loved having a world-class HF station on the premises with a Collins 13-element log-periodic beam for 40 through 10 meters supported by two big 90-foot towers. The hamshack in the penthouse of Building 606 along Gilbert Street also housed K6QEH/R, the first two-meter repeater to be put on the air by a southern California aerospace industry ham club.

Shortly after the club installed a higher repeater antenna, a problem arose. Every evening, the repeater would begin transmitting a howling sound and some muffled scratching noises. Sometimes it was so severe that it would hold up the repeater until it timed out. As soon as

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FRC July 2024 Board Meeting Minutes

The monthly FRC Board Meeting was called to order by President Bob Houghton AD6QF at 5:31 PM on Wednesday, July 3rd, 2024. Additional board Members present included VP Robert Gimbel KG6WTQ, Treasurer Gene Thorpe KB6CMO, Members at Large Walter Clark, Larry McDavid W6FUB and Bart Pulverman WB6WUW. Board members absent: none.

The June Board Meeting minutes were reviewed and approved.

Treasurer's Report
- Bank balance: $6217.45 as of July 3.
- New deposits: interest $0.02 $20 Jesse James pending
- New expenditures: None
- New members: Jesse James KM6TEZ.
- Bob's records show 34 memberships 2024 paid and 1 life member as of 7/3/24.

Old Business
- Badges (Tabled pending further research)

New Business
- Paul Broden has resigned as Secretary due to health issues.
- Hands-on new ham training ideas

There being no further discussion the meeting was ended at 5:38 PM.

Submitted by President Bob Houghton

someone keyed up the repeater again, the cycle would begin anew. Heavy rain would make the problem go away for a day or so, but then it would come right back.

Audio howl and lockup were clues that intermodulation was involved. "Intermod" occurs when two or more signals on different frequencies interact to produce signals on additional frequencies that are related mathematically to the original signals.

Transmitter finals and receiver inputs are supposed to be linear, but sometimes improper tuning or incorrect device bias conditions will introduce nonlinearities. The result can be very serious. An example is the case in Ohio some years ago in which a strong signal from a TV broadcast transmitter went down the coax into the final stage of an FM broadcast transmitter at the same site. Intermodulation products were created and amplified in the FM transmitter, then radiated to cause widespread interference.

When nonlinearity produces harmonics as well as sum/difference products, many more unwanted frequencies can be generated. For instance, here's what could happen if repeaters on 146.79(-) and 147.39(+) shared the same site and severe intermod occurred:

(2 X 146.79) - 147.39 = 146.19 MHz
(2 X 147.39) - 146.79 = 147.99 MHz
(3 X 146.79) - (2 X 147.39) = 145.59 MHz
(3 X 147.39) - (2 X 146.79) = 148.59 MHz
...and so forth

Any of these products could cause unwanted QRM if radiated. Even at very low level, the 146.19 product would lock up or severely desensitize the 146.79 repeater.

Now back to the Hughes repeater story: From the audio howl and lock up of the repeater, it was clear that the transmitter output was mixing with another signal (or signals) to create a spur on the input frequency. But what other transmitters were involved? Where was the mixing taking place? Usually when two signals mix in this manner, you can hear the audio of both at the same time, so why not in this case?

The K6QEH/R output is on 146.97(-). A few minutes with a calculator showed that signals or harmonics of signals on 147.57, 146.67, 147.27 and some out-of-band VHF frequencies could mix with the fundamental or harmonics of 146.97 to produce a signal on the input. But signals on these frequencies weren't strong, weren't continuous, and weren't dead carriers.

Careful checks with a dummy load and spectrum analyzer showed that there were no spurs from the transmitter on or near 146.37 MHz. The receiver antenna had to be picking it up from an external source. Perhaps direction-finding could be used to detect and locate the mix signal. With the transmitter locked on and the repeater howling away, I drove slowly through all parking lots of what was then the 300-acre facility, trying in vain to pick up a signal on the input with my 4-element RDF quad. No luck.

Apparently, I needed to get the RDF gear closer to the repeater. A visit to the Security office and some fast talking produced a letter of permission to bring my vehicle inside the facility gates. Nobody told the Security officers, however. As I drove up and stopped right in front of the gate in my car bristling with antennas, I think it was instinct that made the guard's hand move toward his weapon.

After some more fast talking, I got the car and gear inside, where the grunge remained elusive. Using a sideband receiver for maximum sensitivity, I found that the only traces of signal on 146.37 were coming from the direction of the rooftop hamshack. Was that weak carrier really the grunge signal, or was it just a birdie in my receiver caused by the very close and strong signal on the output?

I had to conclude that the grunge was coming from something in the club's hamshack or its antenna system. Unlike the hilltop communication sites occupied by many ham repeaters, this radio room was quite "clean" at the time. The only RF-generating system in 24-hour operation was the repeater. The rooftop had only the repeater antenna mast and the large log-periodic HF antenna on its tower.

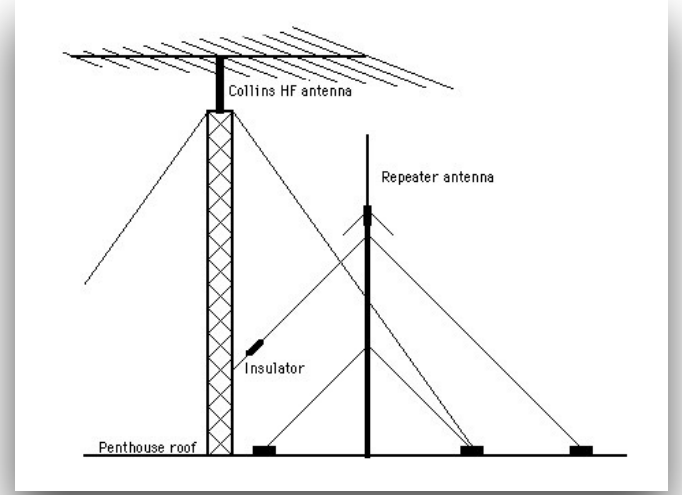
I stopped the howling lockup temporarily by putting a 10 dB RF attenuator between the duplexer and the receiver input. For a few days, I ruminated about the "scratchy" characteristics of the grunge and how it seemed to change suddenly (for better or worse) around sunrise and sunset each day. Maybe the spur was not made up of mixed narrowband FM signals.

If one signal were FM broadcast, the wideband modulation (+/- 75 KHz deviation) might sound like that on a narrowband (+/- 5 KHz) FM receiver. I took out the RF attenuation, opened the receiver squelch

and strained my ears to try to get some intelligence out of the scratchy grunge. Hmmm, this isn't music. It sounds like somebody talking, and talking, and talking.

In those pre-Rush days, there was only one talk-radio station in the Los Angeles market, KABC on 790 KHz. Could that be it? I couldn't imagine how a 790 KHz signal could lock up a two-meter repeater with intermod.

How could I clearly copy AM signals coming through a narrowband FM repeater receiver? I tried something crude. The repeater receiver had an S-meter output, consisting of a diode detector on a second-IF stage, wired to a meter on the system panel. That diode ought to be a rudimentary AM detector. I hooked an audio amplifier and speaker to the S-meter output. Success! The sound of not just one, but two AM broadcast stations came plainly from the speaker. Quick comparisons with a pocket transistor radio verified that one was KABC on 790 KHz and the other was KGER (now KLTX) on 1390 KHz.



Now the mix equation was obvious:

146.97 - 1.39 + 0.79 = 146.37 MHz

It was also evident why the grunge made sudden changes at sunrise and sunset. That's when both stations changed their directional antenna patterns. But it still didn't explain where the mix was taking place and why broadcast-band signals were getting into a tight VHF receiver input.

For RDF in the broadcast band, I used a pocket transistor radio and its ferrite rod antenna. Such sets are very directional when the rod is oriented horizontally. There are sharp signal nulls off the ends of the rod and broad peaks off the side. As I "sniffed" on the penthouse rooftop with the radio tuned to either 790 or 1390, the strongest signal wasn't coming from the direction of the radio stations' towers, but from the heavy guy wires of the giant towers supporting the Collins HF antenna.

The five guy wires coming down to the roof from the 50-foot mast holding the repeater antenna had very little AM-band RF on them. A sixth guy went from the top of the repeater mast to a spot about 10 feet up on the Collins tower. What if that guy coupled RF between antenna supports? As an experiment, I disconnected it at the big tower attachment point, inserted an insulator, and re-installed it. Now the grunge was gone, never to return.

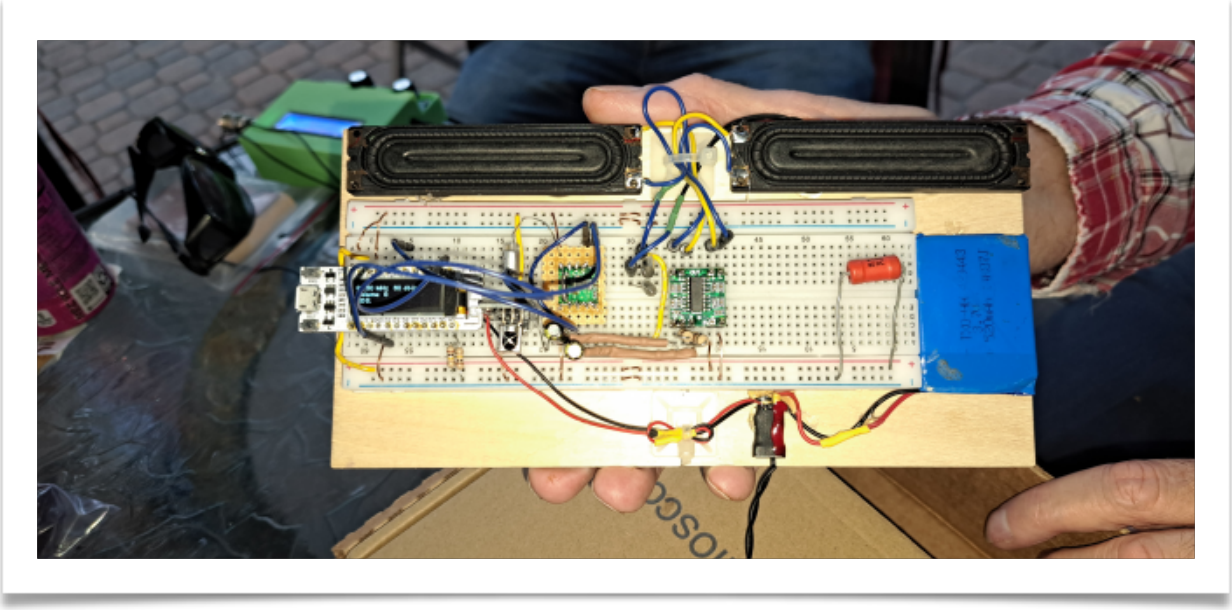
An intermod hunt can be just like a hidden transmitter hunt, because you never know where you'll end up and you never know what you'll find. In this case, the two AM stations were not super-power (only 5 KW each in the daytime) and not close (14 and 27 miles away at the time). Nevertheless, long guy wires with AM-band resonances and a corroded connection or two were all that it took to create enough unintentional QRM to render a repeater nearly unusable.

Joe Moell K0OV

TAG Activity Report for July 2024

Larry McDavid, Ray Rounds, Dick Palmer, Dick Bremer, John Mock, Bill Webb and Walter Clark. The theme for the evening was Software Defined Radio. SDR.

Bill Webb put together for us an FM broadcast band SDR. Just for us. It is on a proto board and commanded by --that is the software part resides in-- an ESP32 he already had; it's on the left. The SDR radio is the small green module. It was 34¢ from Ali Express. Adafruit sells the same thing but for $24. But then it's American Made, you see. Well the board is made in China but an American company makes sure it's good. You see.



The device between the ESP8266 and the receiver board is an IR receiver for the remote control. He did not have to buy one for this project, he had one in his junk box. It controls the radio chip.

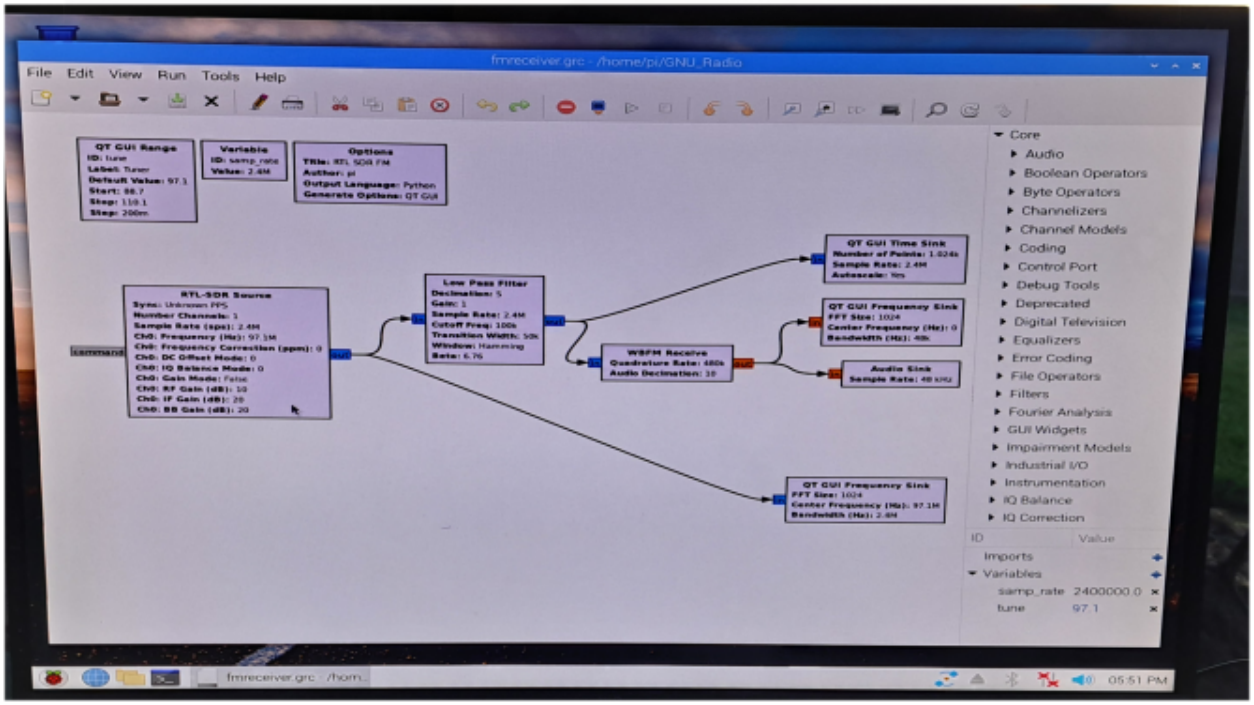
The output of the 34¢ SDR radio is enough for headphone but Bill couldn't resist spending an additional $1.10 for a 3 watt audio amplifier (right most module above). His speakers were tiny to fit on the breadboard and kind of lame but it can easily drive a 12" woofer.

Dick Palmer brought a 5 watt QRP radio in the form of an SDR. It was a kit which in this case involved wiring modules together. The surface mount parts were already soldered in place. The S in SDR is inside a microcontroller, no outboard computer is needed. His QRP SDR is the qcx

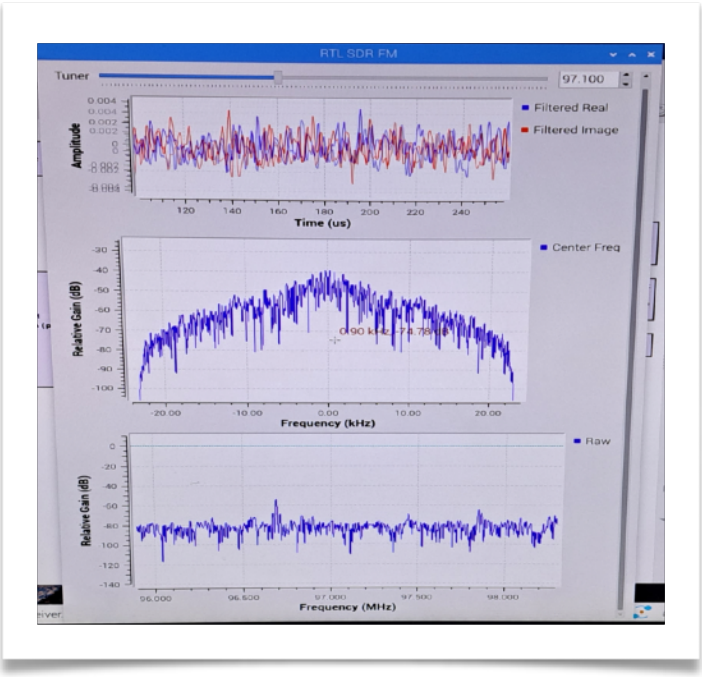
model, which is discontinued. The fellow who made this one is Hans Summers an extremely prolific designer and builder. In his website are 9 menus to select from. Since the computer is a microcontroller the whole thing is in a small the box that looks like an ordinary, but small, shortwave radio. Transceiver actually. That's instead of a computer which is what you look at in a normal Software Defined Radio. Dick spent $55 on this one. The green box, by the way was made by Bill Webb.

Ray Rounds had a very impressive demonstration of his SDR project. As you can see in this case the S in SDR is a laptop computer not a microcontroller.

The way it is programmed is graphically using a free and open source environment called GNU Radio. You move modules around and interconnect them. The software tool converts that to Python which is then loaded into the microcontroller. It is thus a computer within a computer.



The frequency range goes from 500K Hz to 1.6 GHz. The 1.6 end is L-band. The most common usage is for GPS signals. Older Mobile Phone



Networks work around 1.6 GHz. 1,240 MHz to 1,300 MHz (23 centimeters) is the very popular Amateur Radio band. Weather radar is L-band. 500KHz is a relatively new allocation for amateur radio, often referred to as the 630-meter band. Frequencies around 500 kHz are used for various scientific and experimental purposes, including studies of the Earth's ionosphere and natural radio emissions.

Larry McDavid showed us Part Two in his fascination with large coax. In this case TNC instead of BNC. That's **t**hreaded instead of **b**ayonet. He showed us the tool created for cutting and crimping. He also talked about when reverse thread is a standard and the reliability of crimping over soldering.

Here's the RTL-SDR that **John Mock** brought. It was an older version of what Ray Rounds brought. The dongle is a Nooelec Nesdr Smart XTR. It attaches to a Nooelec "Ham It Up" upconverter so you can listen to the ham bands. The reason is that the dongle only goes down to 55MHz (instead of Larry's 0.5 MHz)