The Wireless

July 2026

The Garden City Amateur Radio Club

PO Box 482 • Garden City, MI 48135-9998

Next Meeting:
Tuesday, September 15, 2026
7:00pm
Garden City Presbyterian Church
1841 Middlebelt (just south of Ford)
Garden City, MI 48135

Lt.Col. Linda S. Oswalt, KD8KGY/SK

Linda Oswalt, KD8KGY passed away on July 17, at the age of 76.
Beloved daughter of the late Neil and Kay. Dearest sister of David (Mary), Paul, Gary (Norma), and Terry. Linda is also survived by 8 nieces and nephews as well as 10 great-nieces and great-nephews.
Linda held an Amateur Extra class license, and served the GCARC as a club officer and a Volunteer Examiner.

Visitation will be Friday, July 24, 2026 from 9:30am until 11am, with Funeral Services immediately following at Ward Church Northville, 40000 Six Mild Road, Northville, Michigan 48168 (northwest corner of Six Mile and Haggerty Roads.) Please enter through door #3, as the Funeral Service will be held in the small chapel of the church.
In lieu of flowers, the family suggested a memorial donation to Ward Church Northville.

Congratulations:

John, KF8GYJ

Quinton, KF8HYK

Elliot, KF8GYF

11-year old Elliot, KF8GYF, shows his CSCE after passing his Technician exam.

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Mat-Matics # 132: The RAGC Repeater System

-Mat Breton, N8TW

The RAGC (Repeater Association of Garden City) repeater system is located in Garden City, Michigan. The repeater is an analog system using FM audio modulation and operating in the 2-meter VHF amateur radio band. It is usable by licensed amateur radio operators following FCC rules and regulations. The repeater is used by the local Amateur Radio Club and has also been used as a backup repeater by a local public service group.

This repeater is managed by the Repeater Association of Garden City, a domestic non-profit corporation. The FCC Amateur License for this repeater is KK8GC since K8GC is already assigned to the Garden City Amateur Radio Club (a different organization).

- Downlink 146.86000 MHz
- Uplink 146.26000 MHz
- Offset -0.600 MHz (-600 kHz)
- Uplink Tone 100.0 Hz

Antenna and Feedline

If you have taken any of our classes, you know that I stress the importance of your antenna and feedline. It does not matter what type of radio you have if your antenna performs poorly. In our case, the antenna is a professional Telewave Model ANT135F2 125–150 MHz collinear antenna in a radome, meaning the antenna has a protective fiberglass enclosure.

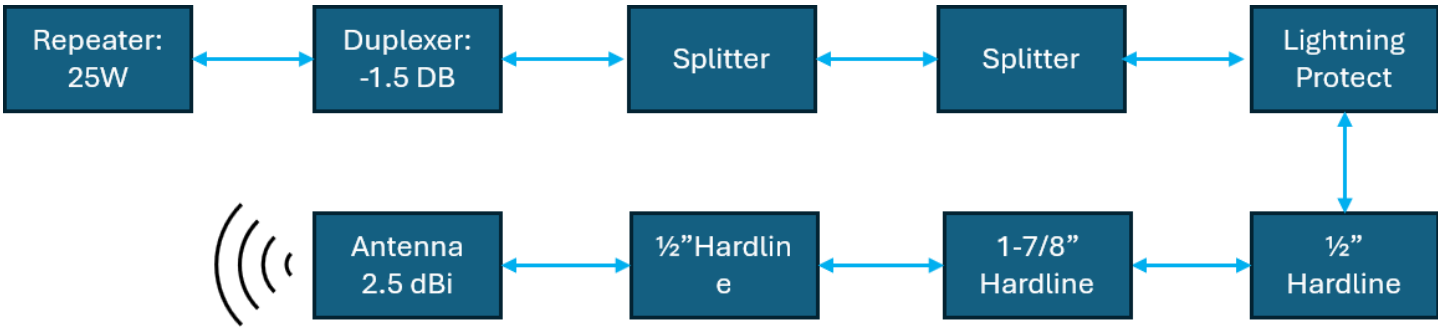
A collinear dipole-array antenna stacks multiple 1/4-wave or 1/2-wave elements end to end to increase gain and eliminate the need for a ground plane, radials, or counterpoise. The more stacked elements there are, the higher the horizontal gain. In our case, there are four 1/4-wave elements, and the total antenna length is about six feet (or 2-meters). The peak gain is a beneficial 2.15 dBi, or 2.15 dB gain over an isotropic reference, in a horizontal “donut-like” pattern around the antenna.

The RAGC antenna is located near the top of the Garden City Police/Fire Municipal Tower, more than one hundred feet above ground level. The antenna is vertically polarized. To do any work on the antenna, we must hire an approved and licensed contractor; we cannot do it ourselves. The cost to climb the tower and replace the antenna in 2016 was $400 for labor alone.

RAGC Antenna, Patterns, and Installation

Mat-Matics #132 cont'd:

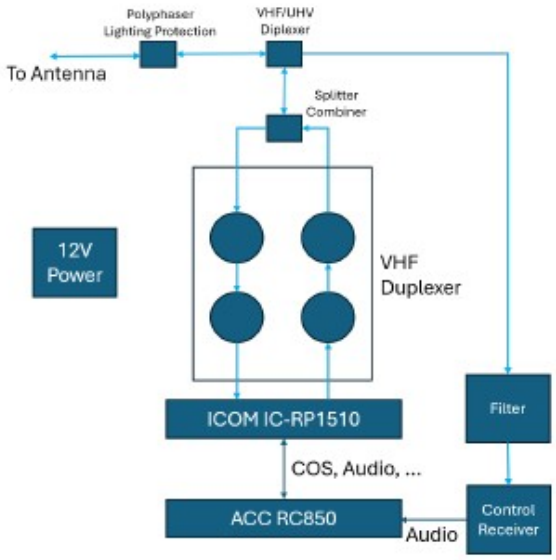
To demonstrate the effectiveness of this antenna, we regularly receive good reports from more than thirty miles away with output power of less than 15 W at the antenna feed point. The total signal chain of the repeater system is shown below. The total signal chain of the repeater system is shown below. Note that although the repeater outputs 25W, the power reaching the antenna is less than 15W:



Similarly, if you have a poor feedline, neither your antenna nor your radio is going to work well. Our feedline between the repeater and the antenna is hardline, selected for minimum loss and maximum robustness. As frequency rises, feedline loss also rises. Hardline has exceptionally low loss at VHF frequencies, especially compared with conventional coax cable. The exposed elements of the feedline also do not degrade like the exterior sheathing on coax cable.

Repeater and Associated Equipment

The repeater and associated equipment are located in a city building inside a locked telecom rack in a locked room. Access by approved RAGC members is by appointment only.



KA8SPW, designer of the GCRA (now RAGC) repeater

We Got Mail! :

"Elliot (KF8GYF) had a really great time operating. Big thanks to Rich, AC8FJ for taking the time to help Elliot get on the air. It meant a lot to him; he couldn't stop talking about it. We went to (another) Field Day later that evening, but his experience with Garden City was far more fun. The (other) club event was too "serious" and stressful in comparison, and he didn't enjoy it nearly as much."

-Matt Parnell, K8BWX

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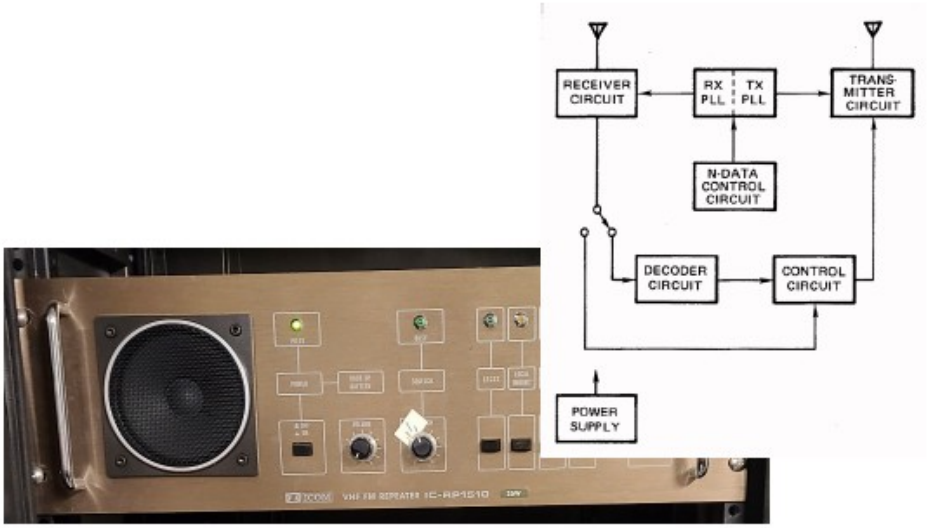
Mat-Matics #131 cont'd:

Repeater

The repeater itself is an ICOM Model RP-1510. These repeaters were sold in the early 1980s specifically for amateur service. The repeater contains a primitive internal repeater controller, though this controller is largely bypassed in the RAGC application so that a more capable external controller can be used. The unit contains an internal power supply, so 120 V AC is all that is required. The receiver is a double-conversion superhet with sensitivity of 0.32 µV at 12 dB SINAD. The receiver contains an internal programmable tone gate (PL/CTCSS) that we use to limit input access. The transmitter uses variable-reactance FM and has an output of 25 W.

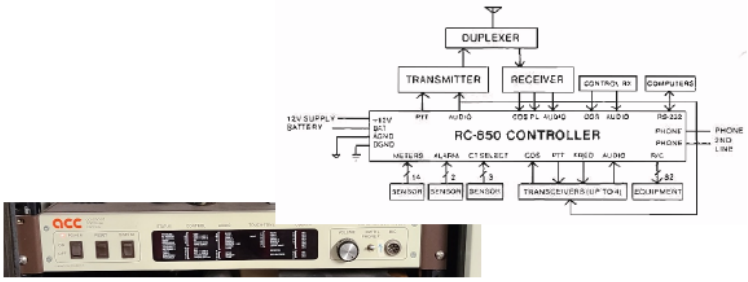


RP-1510 Front and Rear Panels (left), and block diagram (right)

Many components of the power supply, transmitter subunit, and receiver subunit are discrete and repairable. Unfortunately, some items related to specific features, such as the N-Data control circuit, CTCSS decoder, controller memory, and similar assemblies, are not as easily obtained or replaced.

Controller

The ACC RC-850 was sold during the 1980s. ACC was the first commercially successful independent repeater controller company. During its heyday, the RC-850 was the "Cadillac" of amateur repeater controllers. Even today, its capabilities are extensive. Link Communications purchased ACC, and later Audio Test Solutions purchased ACC and another company called RLC. Audio Test Solutions, ACC, Link Communications, and RLC no longer support these products, although RLC sells newer repeater controllers.



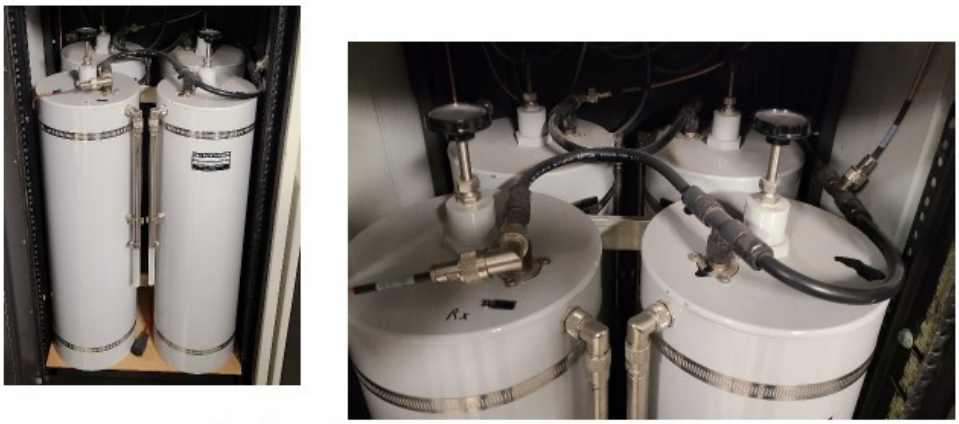
Controller front panel (left), interfaces (right)

Mat-Matics #132 cont'd:

The controller could control up to four radios and was programmable through a serial port option or by remote DTMF/audio. It supported autopatch and autodial, PL access and control, I/O, courtesy tones, computer-generated voice response as an option, delays, a scheduler, clock, calendar, macros, telemetry, paging, and mailbox functions. It was ahead of its time, and future repeater controllers drew upon its feature set.
In our case we use the repeater for controller the crossover from receiver to transmitter, for our 10-minute ID (FCC requirement), and for announcements. The other functions (phone patch, mailbox, etc.) are not currently in use.

Duplexer

The duplexer ensures that the transmitter does not interfere with the receiver. Unlike a conventional ham radio, which is half duplex, a repeater has both the transmitter and receiver active at the same time. If care is not taken, transmitter operation can desensitize the receiver by overloading its front end, preventing it from hearing incoming signals. The duplexer also allows the receiver and transmitter to share a common antenna without transmitter power damaging the receiver.
A duplexer is divided into transmit and receive sections. It has three ports: the antenna port, TX port, and RX port.
The duplexer operates using electromagnetic resonance, confining radio-frequency energy within hollow metal cavities. Similar to how blowing over a glass bottle produces a specific musical note, these cavities naturally resonate at specific electromagnetic frequencies. Because of this design, the duplexer provides extremely low power loss and sharp signal selectivity. The hollow metal body acts as a resonant circuit. Adjusting a mechanical rod or plunger changes the effective length or volume inside the cavity. Pushing a plunger in lowers the resonant frequency, while pulling it out raises the resonant frequency.



Duplexer Section (left), and wiring (right)

Control Radio

The repeater controller can be accessed through a control radio using a different frequency. For example, the repeater can be disabled or enabled through this interface in the case of misuse. Details on this interface are kept confidential for security reasons.

Power Supply

AC mains power is supplied by the Garden City Police and has emergency generator backup. The control HT and repeater controller use a 12 V supply running off the mains, while the repeater itself runs directly from 120 V AC.

Mat-Matics #132 cont'd:

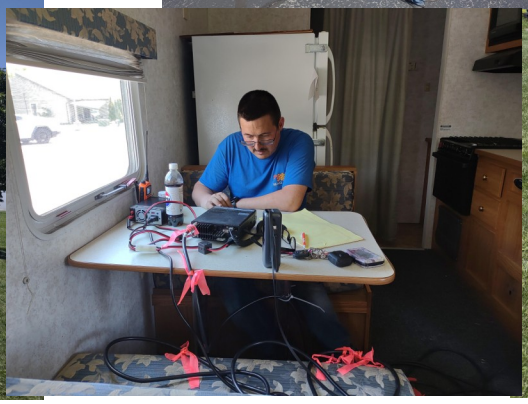
Future Planning

The biggest issue for this repeater association is continued long-term support of certain pieces of equipment. Some of the equipment is old enough so that we cannot secure direct drop-in replacements, and repair may be exceedingly difficult because the ICs and other parts are no longer available for purchase. The crystal oscillator in the unit is old enough that it causes the clock to drift rapidly. While it is likely that the crystal can be replaced or upgraded, I am very nervous about operating on a piece of critical gear that old … with no backup plan.

The repeater association has a plan to upgrade much of the repeater system over the next few years. The first piece of gear to be replaced will be the controller, because it has the highest probability of failing and the lowest chance of being repairable. At the same time, the 12 V power supply will be replaced by a fully redundant failover system. Planned enhancements include an EchoLink interface, a weather alert system, and related improvements. At a later time, the repeater itself will be replaced. These upgrades should help keep the repeater operational for many more years.

It is part of the RAGC charter that we will maintain an analog repeater system, rather than moving exclusively to digital systems such as Fusion, D-STAR, and DMR. There are already area-wide DSTAR and other systems available. If the RAGC adds digital capability in the future, we will continue to support analog FM operation.

Field Day 2026



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