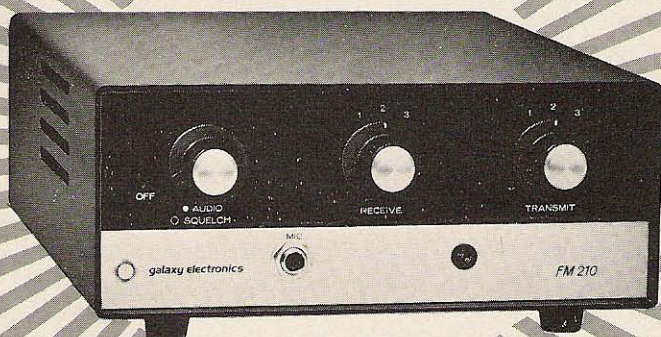


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The Galaxy



FM 210

If you ever had any doubts that FM as a mode for amateur operation was here to stay, you may quietly put that doubt to rest forever. A quick glance at the advertisements and articles in the amateur magazines should show you the impact that VHF FM operation is having on ham radio today. There are many concerns that are selling used police and taxi two-way gear and a number of small and large equipment manufacturers that are making gear strictly for amateur use. Until recently the only ready-made gear available for VHF FM operation was the stuff manufactured by the commercial and public safety two-way radio companies: Motorola, GE, RCA, Kaar, and a dozen or more others. Bargains were and still are commonplace in second-hand gear that has been retired from commercial service. But much of this gear is ten years or more old, designed with vacuum tubes, powered by

dynamotors, and strictly for mobile use. Some conversion is necessary for amateur use, depending on what frequency you are going to use and whether or not you plan to use it in your car.

Now, however, there are a number of completely transistorized units on the market, *designed solely for amateur use*, fully wired and ready to plug in and operate. Generally, these units have been of Japanese manufacture, designed for FM operation on 2 meters, running somewhere between 1 and 10 watts output. Most cost \$250 or more, but are selling quite well nonetheless. *Galaxy Electronics* has not only come out with a 2 meter FM transceiver that has features similar to the Japanese-made units on the market, but has incorporated the best feature of all, as far as Japanese electronic equipment is concerned: low price. *Galaxy* has beaten

the transistor technology of Tokyo at its own game by undercutting the price of even the *least* expensive Japanese rig by \$50. And mind you, the FM-210 is all-American, parts and labor.

The FM-210 has a trim and deceptively simple look to it. It almost looks more like a control head than a complete transceiver. On the front panel there are concentric controls for off-on-volume and squelch, receive channel, and transmit channel. Also there is a pilot lamp and mike jack for PTT hi-Z mike. To open up the unit, all you have to do is remove four sheet-metal screws on the bottom of the case and slide the entire chassis out of the cabinet. The cabinet, incidentally, is very rugged, being made of very heavy gage metal.

Inside, you find four printed circuit boards and some chassis-mounted wiring. One board is the front end and first mixer, another the i-f section and detector, a little one in the back is receiver audio, and the last board contains transmitter audio, oscillator-doubler, doubler, and the varicap modulator. Another doubler, the driver, and power amplifier are mounted on the chassis proper. Mounted on the back wall is a heavy duty T/R relay, antenna connector, and power plug.

The final transistor, by the way, has a separate power lead for its collector supply running to the power plug. That's so you can run 28V on the final collector for extra power. In fact, that's what is done in the AC-210 power supply for fixed station (or mobile) use. The AC-210 is available as an accessory for \$40. The transceiver requires 14–16V dc for power, but works nicely on a 12V storage battery. If you plan to use the FM-210 primarily for fixed use, you could build your own ac supply, or better yet, get an old storage battery to power the rig. That way, you still have a rig on the air during a power failure. For mobile use, however, that 16V rating is very comforting, especially if you're not sure exactly how much voltage is coming out of your car's generator or alternator.

Receiver Section

The receiver section starts with a 2N5485 FET rf amplifier feeding another

2N5485 operating as the first mixer. A third and fourth 2N5485 serve as oscillator and tripler to drive the mixer. A third and fourth 2N5485 serve as oscillator and tripler to drive the mixer. From the mixer the incoming signal is fed to a 2N3855 i-f amplifier operating at 10.7 MHz. Then, the signal is heterodyned by a 2N3855 mixer down to 450 kHz. A 2N2926 is the crystal-controlled second oscillator. The signal is now fed into a 4-pole filter which is adjusted at the factory for optimum FM reception. The filter is used to provide the selectivity necessary to eliminate adjacent-channel QRM. After filtering, the signal is fed to a pair of 2N2926s, which provide the needed i-f gain to drive the limiters. Yes, there are TWO limiters!

Following the limiters is a novel fixed-tuned discriminator built around a Clevite ceramic resonant component. The detected audio is fed through two stages of amplification provided by another pair of 2N2926s and then to a 2N3638 audio driver and a D42C1-D43C1 matched "complementary pair" transistor output stage, which drives the built-in speaker.

According to the manufacturer, the receiver sensitivity is rated as 0.5 μ V for 12 dB SINAD and 1.0 μ V will give 20 dB quieting. At my QTH, with a homebrew groundplane about 25 feet in the air, I heard a mobile station in New York City, about 35 miles away. His signal was noisy, but Q5 nonetheless. And this was a "direct" signal — no repeater. Speaking of repeaters, I've been able to key up two different repeaters from my fixed location, and one of them from the car. All this with full-quieting signals at the repeater's receiver. Not bad for only a few watts, eh?

Transmitter Section

The transmitter section begins with a two-stage audio amplifier (a pair of 2N2926s) driving a 2N4916 clipper. There are controls on the printed circuit board for clipping depth (mike gain) and modulation deviation (clipper output level). Following the clipper, the audio is processed by an active filter. A 2N2926Y and a 2N4916 serve in the active filter

section. Modulation of the transmitter is accomplished by an MV1628 varicap in series with the transmitter's crystal.

A single 2N3563 serves as the transmitter oscillator and first doubler, followed by a 2N3904 second doubler, 2N442 third doubler, 2N4427 driver, and a 2N5641 power amplifier. The final is rated for 10W output at frequencies up to 500 MHz, so you are not pushing it at all when you run the FM-210 on 12V. According to the instruction manual, the transmitter is tuned up for operation, with the crystals supplied, into a 50Ω resistive load. That means that you shouldn't have to touch anything inside the transmitter if you use a groundplane or coaxial type antenna and stay within a half megahertz or so from 146.94. The transmitter is fairly broadbanded: I can switch between 146.34 and 146.94 with no appreciable change in output.

Channel Selection

Channel selection for the three possible receive and three possible transmit frequencies is accomplished by two front-panel switches. Notice that there are two selectors: one for transmit, one for receive. This is a very flexible arrangement since it enables you to choose any combination of receive and transmit frequencies for which you have crystals. The FM operator will quite often transmit on a different frequency from the one on which he is receiving. This is the procedure when using an FM repeater, for example. For those times when your friendly local repeater is out of service, all you have to do is switch your transmit frequency to the repeater output channel and you are all set to operate "simplex." At this point, however, you will appreciate the value of a repeater, unless your QTH happens to be on top of a mountain. For strictly local contacts it's a good idea to operate simplex anyway, so that you won't tie up the repeater when you don't really need it. The extra receive frequencies are especially useful if you plan to operate mobile and do a lot of traveling to different cities; not all repeaters are set up to transmit on 146.94 — some are on 146.88 or 146.76. It all depends on what

the local clubs have decided should be the proper channel for their particular area. And, too, some areas have several repeaters in service.

The FM-210 comes with crystals for transmitting and receiving on 146.94 MHz., the nationwide standard FM channel, so you should be able to talk to someone as soon as you wire up the power connector and hook the rig up to an antenna. However, I'm sure you will want to avail yourself of your local repeater, so find out what the input and output frequencies are and order the proper crystals.

The entire transceiver is very well constructed, and it is obvious that a good deal of thought has gone into the design of the rig, especially when you inspect the insides and look over the schematic. If your local dealer will let you, open it up and take a look at the guts of the thing! American-made components of good quality are used throughout and all rf transistors (except the final) are mounted in *sockets*, just in case you do something nasty to this fine little rig. Make sure, though, that all transistors are firmly seated in their respective sockets. They could loosen up in shipment or during excessively bumpy mobile operation. Layout of components is neat and very accessible, should service ever be needed.

The FM-210 is a fine little rig — at home both in the car and in the shack. Its only real limitation is its low power: over a long haul, you'll have a rough time of it. Most of the boys with commercial gear are running at least 30W or more. And that's 30W output. But for local QSOs and contacts through a repeater, the FM-210 can't be beat.

One final note: each of the dozen or so hams to whom I have shown the instruction manual for the FM-210 has been very impressed with the quality of the book: it is easy to read, indexed, spiral bound to lie flat, and tells everything you need to know — even where to order crystals. And the schematic is very large. It's a foldout about three feet long, clearly drawn, and easy to read. You have to see it to appreciate it.

...K2ULR ■