

## Classic Radio

# The Regency HR-2 Transceiver

Two-meter FM grew rapidly after Regency introduced their low-cost but well-performing HR-2 solid-state 2-meter FM transceiver (see Figures 1 and 2). Regency was the marketplace name for the retail sales division of Industrial Development & Engineering Associates (IDEA) located in Indianapolis, Indiana.

### Regency Background

IDEA created the first transistor radio in 1954, the Regency model TR-1. Regency made the first solid-state amateur radio product — the ATC-1 shortwave converter with a built-in BFO and Q-multiplier circuit that was usually used with an automobile radio in mobile service.

In 1956, most amateur radio phone communication was on the AM mode, which could be received using the converter with an automobile radio. Regency made public service scanner radios that covered the VHF low band from 30 to 50 MHz, the high band from 152 to 174 MHz, and the UHF band from 450 to 470 MHz. The HR-2 was in the same size cabinet as the original scanner radio receivers. The public service scanner radios were very popular on their own.

### The Regency HR-2

Regency announced the HR-2, a 2-meter FM transceiver, in 1970 for \$229. It became wildly popular by 1971. It operated with a 13.8 V negative ground power source supplying 3 A during transmissions, which was perfect for mobile operation and practical for portable field use. It was protected against output transistor failure if the antenna voltage standing wave ratio (VSWR) was too high. It used a directional coupler to detect excessive



**Figure 1** — The Regency HR-2 transceiver. [Photo courtesy of [www.radiopics.com](http://www.radiopics.com)]

reflected power and circuitry to cut down the drive power to prevent damage to the Motorola final power output transistor.

### Modifications

Regency made many variations of the basic HR-2 design. They made very similar products for the 220 MHz and 440 MHz bands. The HR-6, a similar radio in a larger cabinet, was offered for sale as a 6-meter FM transceiver. Regency made radios for a base station with the ability to switch crystal frequencies for the receiver and transmitter separately, as the HR-6 had. This seemed like an important ability before the channel arrangements for 2-meter and 6-meter FM became much better defined. Regency combined the idea of a 2-meter FM transceiver (transmitter-receiver in reality) and the scanning receiver for public service monitoring to create a 2-meter radio that scanned for activity on the selected channels.

Today, transmitting on 146.16 MHz and receiving on 146.88 MHz is not very popular, but manufacturers in the early

1970s wanted to offer the option. The Regency HR-2 manual explained using jumpers to use the crystals in non-standard pairing. Looking back, it is obvious no one would use the jumpered crystal concept for anything.

### HR-2 Receiver Design

The Regency radios were designed with band-pass circuitry to meet the performance specifications over the entire band from 144 to 148 MHz on both the transmitter and receiver. Receiver sensitivity was specified at 0.35  $\mu$ V for 20 dB signal-to-noise ratio. Transmitter output power on the high-power setting was rated at a 10 or 15 W minimum, depending upon the version of the radio.

The receiver was a dual-conversion design using 10.7 MHz as the first intermediate frequency (IF) and a second IF of 455 kHz. To improve the selectivity, a Clevite ceramic filter was used on the second IF. The bandwidth of the receiver was a bit wide on the early models for 15 kHz spacing, which is now the standard on 2-meter FM. The receiver selectivity on the



HR-2B is 14 kHz at 6 dB from maximum signal and 20 kHz wide at 50 dB FM, replacing the wider 16 kHz at 6 dB and 32 kHz at 50 dB, which was the standard when the HR-2 was new on the amateur radio market.

The HR-2 had a 4-inch square internal speaker. There was a link on the rear panel that allowed an external speaker to be used. Regency claimed the radio would deliver 3 W of audio to the speaker with less than 10% distortion, or 5 W maximum power.

The unit used silicon transistors in all locations. Two of them were junction field-effect transistors (FETs). The FETs were used in the first receiver mixer and as the input stage in the microphone preamplifier in the transmitter to ensure an input impedance sufficiently high for crystal and ceramic microphone elements, in addition to high impedance dynamic microphones.

Two integrated circuits (ICs) were used in the HR-2 family of receivers. The first was the conversion stage between the first and second IF, 10.7 MHz to 455 kHz, and the second IC was the IF amplifier and FM detector at 455 kHz. The Clevite ceramic filter was after the converter IC and before the IF amplifier/detector IC. The conversion from 10.7 MHz to 455 kHz was crystal controlled, using an 11.155 MHz crystal.

### The HR-2 Transmitter Design

The transmitter used normal push-to-talk (PTT) methods with an included handheld microphone. A Turner



## AMERICAN MADE Mobile 2 Meter FM Transceiver

Here is what the 2 meter, FM Ham World has been asking for.

Specifications: 90 day warranty

<p><b>RECEIVER</b> The HR-2 receiver is a double conversion, superhetrodyne with highly selective ceramic filter.</p> <p>Frequency Range...144-148 MHz Sensitivity.....0.35 <math>\mu</math>v (nom.) 20DB Quieting Selectivity.....5DB Down <math>\pm</math> 16KC 50DB Down <math>\pm</math> 32KC</p> <p>Audio Output (3-4 <math>\Omega</math> Speaker).....3 Watts 10% Distortion 5 Watts Maximum</p> <p>Channels.....6 Crystal controlled with provision for adding an additional 6 channels</p> <p>I.F. Frequencies.....10.7 MHz &amp; 455KHz</p>	<p><b>TRANSMITTER</b> The HR-2 transmitter uses phase modulation for the ultimate in carrier stability. Built in SWR load mismatch circuitry provides protection against open and shorted antenna conditions.</p> <p>Frequency Range...144-148 MHz Power Output.....10 Watts (min.) @ 13.6 VDC Modulation.....Phase Modulation with automatic deviation limiting Deviation.....Automatic Limiting with internal adjustments from 0-15KC deviation</p> <p>Microphone.....Plug-in, hand held, high Z Ceramic supplied</p> <p>Channels.....6 Crystal controlled with individual trimmer capacitors for Frequency netting</p>
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<p><b>GENERAL</b> Power Requirements 13.6 Volts (nominal) Receive (Squeched) 180 MA. Receive (Max. audio output).....800 MA. Transmit.....2.5 Amps (max.)</p>	<p><b>STANDARD EQUIPMENT</b> Built-in 4" Speaker Mobile Mounting Bracket SO-239 Antenna Connector Socket T &amp; R Crystals for 146.94 MHz PTT Ceramic Mike</p>
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only \$229<sup>00</sup> Amateur Net

**Regency** ELECTRONICS, INC.  
7900 Pendleton Pike, Indianapolis, Indiana 46226

Figure 2 — A specifications sheet for the HR-2 transceiver from a 1950s-era Regency brochure.

ceramic microphone was supplied with the Regency HR-2. It had a right-angle three-circuit quarter-inch phone plug. The transmitter had two output power levels — 1 W and at least 10 W of RF from the first version HR-2, and 15 W from the HR-2A and HR-2B. Balanced emitter silicon transistors by Motorola were used in all versions of the HR-2. One was the driver transistor, and one was the output transistor.

Transmit-receive switching was done by a relay that was operated by the PTT control on the microphone. No pin diodes were used in the antenna switching, which was accomplished by

the relay. The inductance of the relay was not tuned out, as it was in the Dentron Clipperton V with series capacitance to cancel out the series inductance.

### Crystal Types for the HR-2 Family

The transmitter of the HR-2 and HR-2A used crystals that were at  $\frac{1}{24}$  of the output frequency. The crystals were in a HC-25U miniature enclosure. The HR-2B version used a crystal that was  $\frac{1}{18}$  of the output frequency, as was done with most 2-meter AM radios. The receive crystals used the following formula:

$$\text{(Frequency} - 10.70 \text{ MHz)} / 3$$

This crystal was also in an HC-25U miniature holder. The HR-2 and HR-2A had six trimmers for setting the operating frequency of the crystal. Instructions were included in the manual for using the crystals in pairs that used each transmitting crystal twice in two combinations each. As 2-meter FM operation changed, the

HR-2B came with 12 trimmers to allow a different transmit crystal to be used in each switch position as the crystal frequencies for many repeaters became better defined. The need to create odd channel pairs essentially disappeared.

### The AR-2 RF Power Amplifier

Regency also made the AR-2, a one-stage non-linear RF amplifier for the HR-2, for use in FM mobile service. It was not suitable for SSB or AM use. Regency was considerably responsible for the very rapid growth of amateur radio 2-meter FM operation.