



EQUIPMENT REPORTS

RAMSEY ELECTRONICS FM-25 STEREO BROADCASTING KIT

Put a signal out on the air!

CIRCLE 15 ON FREE INFORMATION CARD



The Ramsey Electronics FM-25 kit lets you build a FM stereo broadcaster and put your signal anywhere on the FM band. Why would you want to do that? Well, the reasons are numerous. How about using it as a kind of whole-house audio system? With the FM-25, you could listen to your CD changer anywhere in the house where you had an FM receiver. Better yet, you could listen to it outside with a portable radio. We find that it's a great way to enjoy commercial-free music when we have some friends over.

We also find the FM-25 a great way to let us listen to our favorite radio station on a personal portable when we're outside doing yard work. It just so happens that our favorite station has a low-power transmitter operating from a university about 30 miles away. We have no problem picking up the signal with a rooftop antenna, but we have almost no luck on a portable. Now, we can feed the output of our stereo receiver into the FM-25, and then re-broadcast it to our portable.

Building the transmitter

The FM-25 kit is relatively easy to build. All of the components are mounted on a single-sided printed-circuit board. The component side of the board is silk-screened with the location of all parts. The solder

side of the board features a solder mask that help to reduce the chance of creating an inadvertent solder bridge across adjacent pads. An experienced builder should be able to assemble the kit in one evening; a beginner will probably require twice that to complete the 265 solder points.

The heart of the circuit consists of three integrated circuits: a Rohm BA1404 stereo transmitter IC, a Motorola MC145170 phase-locked loop (PLL) frequency synthesizer with serial interface, and a 68HC705 8-bit microcontroller.

The Rohm chip was originally designed for use in automotive CD systems, where it would allow signals from the CD player to be fed to the existing audio system throughout the antenna input. As it turns out, of course, the BA1404 also makes an excellent stereo broadcaster.

One potential problem with FM transmitters comes into play when a digital tuner is used to receive them. If the transmitted signal isn't exactly on frequency, the receiver won't be able to receive it. Analog radios, of course, can tune in an off-frequency signal without problems. A digital receiver, with its discrete tuning steps, cannot. The MC145170 PLL and the 68HC705 8-bit microcontroller ensure good on-frequency performance.

The microcontroller looks at the settings of three DIP switches to determine the frequency of operation. Each DIP switch has four positions, and they allow the frequency to be entered in binary-coded decimal format. For example, to set the transmitter to a frequency of 89.9 MHz, the switches would be set, in binary, to 8, 9, and 9 respectively. For frequencies above 100 MHz, the first switch would be set to a value of 10.

The microcontroller is smart enough to disallow any illegal frequencies. For example, only the first DIP switch can be set to a value of 10. Any other switch setting greater than 9 will be read as a zero. Also, and out-of band frequencies will not be allowed, and the transmitter will default to a frequency of 88.1 MHz.

After the microcontroller reads the switches, it sends the 16 bits of frequency information to the PLL frequency synthesizer serially. An additional 32 control bits of control information are also sent.

The PLL IC operates with a 4-MHz crystal. Under control of the microprocessor, it divides the 4-MHz clock by 40 to obtain a stable reference frequency of 100 kHz. The PLL also examines the output of the BA1404 FM transmitter chip and divides it by N, where N is the desired frequency in megahertz times 10.

Using the example frequency of 89.9 MHz, the PLL would divide the output of the transmitter chip by 899, and compare it with the 100-kHz reference frequency. It uses this information to increase or decrease the voltage across a varactor diode.

A varactor diode is a specially

manufactured diode whose capacitance varies with changes in its reverse-bias voltage. In essence, a varactor is a voltage-variable capacitor. In the transmitter, the varactor is placed in the tuned circuit that sets the operating frequency. The PLL in combination with the varactor perform create a rock-steady, drift-free output from the transmitter.

Under Part 15 of the FCC rules, it is perfectly legal to operate the FM-25 anywhere in the FM band of 88 to 108 MHz. However, you may *not* cause interference with any licensed FM broadcast stations or listeners. You must stop transmitting immediately if any interference is detected.

When choosing an operating frequency, for example, you can't casually tune across the band with a cheap radio and assume that there's no signal available just because you can't hear one. You should really use a quality receiver and rotatable antenna to determine which frequencies are truly open.

In our location outside of New York City, there are few open frequencies. Plus, the population density is high enough that there are a lot of people within the range of the FM-25 transmitter. Unless we were careful, operating the transmitter could cause great interference to someone who was using a good receiver and antenna to pull in what might usually be considered an out-of-market station.

The FM-25 also provides a high-power option. Adding a single jumper across a resistor increases the output power of the FM-25, making its operation illegal in the U.S. However, in some countries it would be perfectly legal to operate in the high-power mode. According to Ramsey, some entire Caribbean islands are served by radio stations using the FM-25 as their transmitter.

All in all, the FM-25 is a quality kit that is designed to work the first time you throw the switch on. It is supplied with a plastic case, a whip antenna, an AC power adapter, and a well-written assembly manual. The kit is available from Ramsey Electronics, Inc., 793 Canning Parkway, Victor, NY 14564; tel: 716-924-4560. The price of the kit is \$129.95. **EN**

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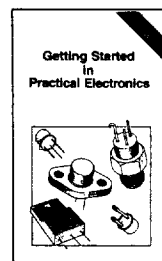
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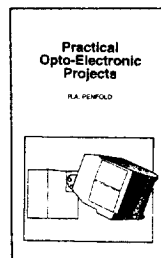


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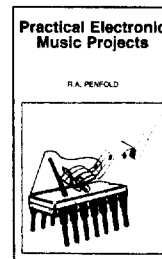
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