

FM BROADCAST RADIO RECEIVER

Ramsey Electronics Model No.

FR1

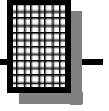
Build your own FM Broadcast receiver. Radio covers 70 to 110 Mhz, ideal for tuning in out-of-band FM wireless mikes, 'bugs' and other transmitters that exist where 'others' can't find them! An added feature of the FR1 is its SCA output, which allows easy connection of SCA decoders - for commercial -free music, stock quotes, sports, etc.

Typical uses for the FR1 FM radio receiver:

- Tuning in hidden FM wireless mikes and phone bugs
- Hooking up SCA adapters
- Learning how FM receivers operate
- Snooping around for clandestine transmitters
- Just plain ol' easy listening to the standard FM radio

The Ramsey FR1 FM Broadcast receiver features:

- Runs on 9 volt battery
- Choice of on-board whip antenna or external antenna
- Stable tuning from 70 to 110 Mhz
- Clear, concise step-by-step instructions
- Plenty of speaker volume
- Handy SCA demodulator output
- Lots of helpful hints and hook-ups



RAMSEY TRANSMITTER KITS

- FM100B Professional FM Stereo Transmitter
- FM25B Synthesized Stereo Transmitter
- AM1, AM25 AM Transmitters
- TV6 Television Transmitter

RAMSEY RECEIVER KITS

- FR1 FM Broadcast Receiver
- AR1 Aircraft Band Receiver
- SR2 Shortwave Receiver
- AA7 Active Antenna
- SC1 Shortwave Converter

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- SG7 Personal Speed Radar
- SS70A Speech Scrambler
- SP1 Speakerphone
- WCT20 Wizard Cable Tracer
- TFM3 Tri-Field Meter
- LC1 Inductance-Capacitance Meter
- WEB1 Walking Electronic Bug
- ECG1 Heart Monitor

RAMSEY AMATEUR RADIO KITS

- HR Series HF All Mode Receivers
- QRP Series HF CW Transmitters
- DDF1 Doppler Direction Finder
- CPO3 Code Practice Oscillator
- QRP Power Amplifiers

RAMSEY MINI-KITS

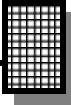
Many other kits are available for hobby, school, Scouts and just plain FUN. New kits are always under development. Write or call for our free Ramsey catalog.



FR1 FM RADIO RECEIVER KIT INSTRUCTION MANUAL

Ramsey Electronics publication No. MFR1 Revision D1

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**KIT ASSEMBLY
AND INSTRUCTION MANUAL FOR**

**FR1 FM RADIO
RECEIVER KIT**

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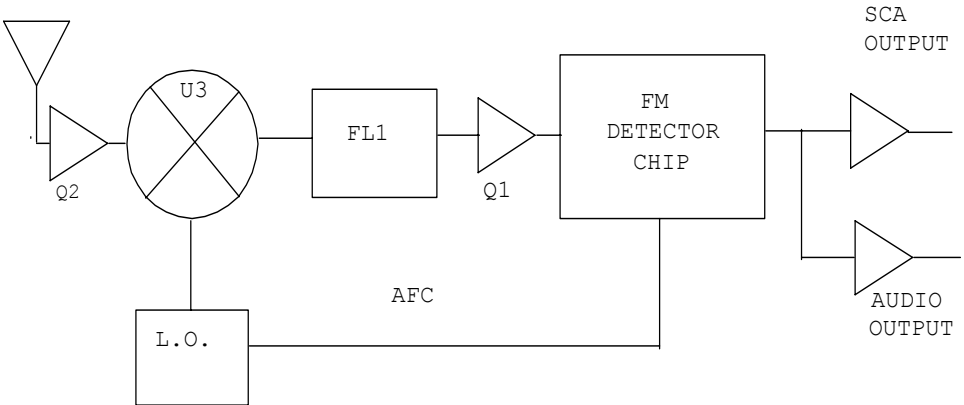
INTRODUCTION TO THE FR1 FM RADIO RECEIVER

Why you may ask does Ramsey sell a 'plain old FM radio' receiver? No better person to ask than yourself! The FR1; teaches radio theory, allows you to tune outside of the standard broadcast band (great for bugs, FM mikes and other goodies!), has easy hook up for SCA adapters, small size and is just plain fun.

Your receiver kit is designed to receive wideband FM transmissions typical of standard FM broadcast stations, wireless mikes, telephone transmitters and the like. It was not designed for Narrow Band FM transmissions (NBFM) as you would find on police and fire transmitters, Ramsey offers a complete line of receivers for those services.

The FR1 demonstrates a whole lot of basic radio theory in one compact, simple circuit! Separate circuits are 'on-board' for all basic parts of a receiver, making it easy to visualize every function. The latest in IC circuitry is used which allows high performance without requiring exotic construction skills.

We think you'll agree that this little radio offers a lot of bang-for- the-buck, so let's get building!



CIRCUIT DESCRIPTION

FM broadcast signals captured by the whip antenna or from the input jack are applied to the RF amplifier Q2, a high gain, low noise microwave style transistor. Signals are amplified about 20 dB, that's 100 times! After being boosted, these signals are routed to the SA602 mixer-oscillator chip for conversion down to the 10.7 Mhz Intermediate Frequency (IF). The SA602 is a very popular chip used in a great variety of receivers from cellular telephones to satellite receivers, in fact, here at Ramsey, we use it in every receiver kit we sell! The reason for its popularity is that it contains most of a receivers 'front end' circuitry on a single, easy to use chip.

Internal to the SA602 is an oscillator tuned by an external tank circuit; C11,12, L1 and varactor diode D1. A varactor diode acts like a voltage variable capacitor and the voltage applied across it comes from Tuning pot R12. This IF signal is an exact reproduction of the desired signal, but at 10.7 Mhz. We then band-pass filter it with ceramic filter FL-1. The ceramic filter allows only the desired 10.7 Mhz signal to pass, rejecting any adjacent channel signals. Transistor Q1 amplifies the IF signal before it is applied to the detector chip U1.

One of the primary advantages of FM is that the program information (modulation) is contained in carrier frequency variations and not in amplitude changes like AM, which would be susceptible to noise and interference. This means that we can limit or clip the signal, thus removing any noise and not affecting the desired information. The first section of U1 performs this limiting function, providing high gain and clipping any amplitude (noise) variations.

FM is detected in the second section using a process known as quadrature detection. We'll not get into this too deeply because it requires a knowledge of trigonometry identities - let's just say it extracts the frequency modulated program information. Capacitor C1 and coil assembly L2 comprise a phase shift network that is required by the quadrature detector. Demodulated signals are amplified and sent out through pin 1 to the; volume control, AFC circuitry and the SCA buffer amp. The AFC circuitry is used to properly keep the receiver locked on to the tuned in radio station. Resistor R9 and capacitor C17 filter out any audio voltage variations so that only major frequency changes will shift the tuning voltage to lock the frequency.

Audio signals from the volume control are amplified to speaker levels by U2, an LM-386 audio amplifier chip. Transistor Q3 provides a buffer stage to external SCA devices you may connect up to the FR1. SCA units decode (demodulate, actually) 'hidden' audio and data services transmitted over standard FM broadcast channels. These services include stock quotes, sports scores, talk shows and even background music - commercial free!

RAMSEY FR1 FM RADIO RECEIVER KIT PARTS LIST

CERAMIC DISC CAPACITORS:

- 4 .001 uf disc (marked .001 or 102 or 1 nf) [C4,5,15,27]
- 12 .01 uf disc (marked .01 or 103 or 10 nf) [C2,3,7,8,16,18,20,21,23,24,28,29]
- 1 .1 uf disc (marked .1 or 104) [C25]
- 1 4.7 or 5 pf disc (marked 5 or 5K) [C1]
- 2 22 pf disc (marked 22) [C11,12]
- 2 100 pf disc (marked 100, 101, or 101K) [C6,14]

ELECTROLYTIC CAPACITORS:

- 4 4.7 or 10 uf [C9,17,22,26]
- 3 100 to 220 uf [C10,13,19]

RESISTORS AND POTENTIOMETERS:

- 2 10K ohm potentiometers [R12,13]
- 1 2 ohm (red-black-gold) [R19]
- 3 270 ohm (red-violet-brown) [R3,16,17]
- 1 470 ohm (yellow-violet-brown) [R6]
- 2 1K resistor (brown-black-red) [R2,18]
- 1 2.2K ohm (red-red-red) [R10]
- 2 4.7k ohm (yellow-violet-red) [R1,15]
- 5 10K resistors (brown-black-orange) [R5,7,8,9,14]
- 2 47K ohm (yellow-violet-orange) [R4,11]

INDUCTORS AND FREQUENCY COMPONENTS:

- 1 10.7 Mhz ceramic filter (looks like 3 leaded disc capacitor) [FL1]
- 1 slug tuned plastic molded coil [L1]
- 1 10.7 Mhz shielded can style IF transformer [L2]

SEMICONDUCTORS:

- 1 varactor diode, 33pf (black with green and red bands) [D1]
- 1 Zener diode, 6.2 volt (gray with black band) [D2]
- 1 SA602 IC [U3]
- 1 LM386 IC [U2]
- 1 ULN2111 IC [U1]
- 1 2SC2498 or 2SC2570A NPN transistor [Q2]
- 2 2N3904 NPN transistor [Q1,3]

HARDWARE & MISC:

- 1 Printed-circuit board
- 1 9-volt battery hold-down bracket
- 1 9-volt battery connector
- 2 RCA-style jack (antenna connector)
- 1 subminiature earphone jack
- 1 PC mount pushbutton switch

REQUIRED, NOT SUPPLIED:

- 9-volt battery (alkaline or "heavy duty" type required)
- Earphone, or small speaker
- Antenna (whip or wire style)

OPTIONAL:

Ramsey Case, knob and whip antenna set, Model CRR1 or,
Your own choice of enclosure and hardware.

For each part, our word “**install**” always means these steps:

1. Pick the correct part value to start with.
2. Insert it into the correct PC board location.
3. Orient it correctly, follow the PC board drawing and the written directions for all parts- especially when there's a right way and a wrong way to solder it in. (Diode bands, electrolytic capacitor polarity, transistor shape, dotted or notched ends of IC's, and so forth.)
4. Solder all connections unless directed otherwise. Use enough heat and solder for clean, shiny, completed connections. Don't be afraid of any pen-style soldering iron having enough heat to damage a component.
5. Trim or “nip” the excess component lead wire after soldering.

BUILDING YOUR KIT

Check off each step as understood and completed. Examine the schematic circuit diagram and PC-board X-ray illustration as you proceed. In all steps, "install" means to insert the correct component in its correct PC board holes, solder properly, and cut or "nip" away any excess wire.

Use good soldering technique - let your soldering iron tip heat each connection wire enough so that the wire itself and the foil trace both become hot enough together to melt the applied solder so that it flows smoothly around the wire lead and on to the PC board trace.

- 1. Install J1, the RCA antenna jack. Solder all four points.
- 2. Install J3, the SCA output jack. Solder all four points.
- 3. Install J2, the speaker jack. Solder all three pins
- 4. Install potentiometer R12, the tuning control. Insert it into the PC board so it seats firmly and is straight and even. Solder the three pins and the two mounting tabs.
- 5. Install potentiometer R13, the Volume control in the same manner as above.

- 6. Install S1, the on-off pushbutton switch. Solder all six pins firmly.

We've installed some 'landmark' parts so far just to get us used to soldering our PC board. These parts also will give us our 'bearings' for future assembly steps.

- 7. Install R10 2.2K ohm (red-red-red) directly behind R12 tuning pot.
- 8. Install C27, .001 uf disc capacitor (marked .001, 102, or 1nF).
- 9. Install C26, 4.7 or 10 uf electrolytic capacitor. Electrolytic capacitors have polarity markings which must be observed when installing. If you look closely at C26, you'll see a black strip on one side indicating the negative lead, the other lead is therefore the positive. Install C26 properly as indicated on the parts layout diagram.
- 10. Install jumper wire JMP1. Jumper wires act as 'bridges' for carrying signals or power over PC traces on the board underneath. Now that you've nipped a few leads off of some already installed components, we'll 'recycle' a clipped lead and use it as our jumper wire! Bend the lead so it looks like a staple, insert and solder it just like a regular component.
- 11. Install C15, .001 uf disc capacitor (marked .001 or 102 or 1nf).
- 12. Install R15, 4.7K ohm (yellow-violet-red).

- ❑ 13. Install R11, 47K ohm (yellow-violet-orange).
- ❑ 14. Install D1, varactor diode. It has a black body with green and red bands. Observe the correct positioning of the banded end by following the silkscreen. The green band is positioned as shown on the silkscreen.
- ❑ 15. Install C17, 4.7 or 10 uf electrolytic capacitor. Observe polarity.
- ❑ 16. Install C14, 100 pf disc capacitor (marked 100, 101, or 101K).
- ❑ 17. Install slug tuned coil L1.
- ❑ Time for a breather... So far we've installed all the parts necessary to tune our receiver. D1, the varactor diode acts as the variable tuning capacitor and the other resistors and capacitors are used to properly connect D1 to the tuning and AFC (Automatic Frequency Control) voltages.
- ❑ 18. Install C19, 100 to 220 uf electrolytic capacitor. Don't forget to observe proper polarity. C19 is a large value capacitor whose function is to 'smooth' out any voltage fluctuations which may appear on the power supply voltage to U3.
- ❑ 19. Install D2, the Zener diode. It has a gray painted glass body with a black band. Orient the band as shown on the layout diagram. A Zener diode acts as a voltage regulator, keeping the voltage across it constant. This keeps frequency drift to a minimum.
- ❑ 20. Install C6, 100 pf disc capacitor (marked 100, 101, or 101K).
- ❑ 21. Install R8, 10K ohm (brown-black-orange).
- ❑ 22. Install R16, 270 ohm (red-violet-brown).
- ❑ 23. Install C11 and C12, both 22 pf disc capacitors (marked 22).
- ❑ 24. Install C20 .01 uf disc capacitor (marked .01 or 103 or 10 nf).
- ❑ 25. Install U3, the SA602 IC mixer-oscillator. The marked end of the IC (band or dot) must face the EDGE of the PC board. If you wish, install an 8-pin DIP socket, still remembering to orient and install the SA602 correctly. PLEASE don't be afraid to solder U3 directly to the PC-board; we have seen more repair problems with DIP sockets than from direct soldering of ICs.
- ❑ 26. Install C21, .01 uf disc capacitor (marked .01 or 103 or 10 nf).
- ❑ 27. Install R17, 270 ohm (red-violet-brown).
- ❑ 28. Install C4, .001 uf disc capacitor (marked .001 or 102 or 1 nf).
- ❑ 29. Install R5, 10K ohm (brown-black-orange)
- ❑ 30. Install Q2, 2SC2498 or 2SC2570A NPN transistor. Transistors are VERY critical of correct orientation of their leads. Be sure to pay close attention to the position of the flat side of the transistor.

- 31. Install C5, .001 uf disc capacitor (marked .001 or 102 or 1 nf).

Time for another break. We've now assembled the whole 'front-end' of our receiver. Front-end means the beginning of a receiver up to where it converts to the IF (Intermediate Frequency).

- 32. Install C25, .1 uf disc capacitor (marked .1 or 104).
- 33. Install R19, 2 ohm (red-black-gold)
- 34. Install U2, the LM386 audio amplifier IC chip. The LM386 is a very popular part, and with good reason. Tucked inside that little plastic body are about twenty transistors that take a feeble audio signal and amplify it up to room filling volume!
- 35. Install C10 and C13, both 100 to 220 uf electrolytic capacitors, remembering to observe proper polarity of both.
- 36. Install C16 and C24, both .01 uf disc capacitors (marked .01 or 103 or 10 nf).
- 37. Install R3, 270 ohm resistor (red-violet-brown).
- 38. Install Jumper JMP2 using a scrap component lead.
- 39. Install C18, .01 uf disc capacitor (marked .01 or 103 or 10 nf).
- 40. Install FL1, the 10.7 Mhz ceramic IF filter. This part looks like a disc capacitor but has three leads. Amazingly, its function is equal to a small handful of inductors and capacitors hooked up in a bandpass filter configuration. For those techno-types, its bandwidth is 280 KHz centered at 10.7 Mhz with an insertion loss of only 6 dB.
- 41. Install Q1, a 2N3904 type. Watch placement of its flat side.
- 42. Install R4, 47K ohm (yellow-violet-orange)
- 43. Install R2, 1K ohm (brown-black-red)
- 44. Install C28, .01 uf disc capacitor (marked .01 or 103 or 10 nf).
- 45. Install jumpers JMP4 and JMP5.
- 46. Install Q3, 2N3904 transistor. Observe flat side orientation.
- 47. Install R18, 1K ohm (brown-black-red).
- 48. Install C22, 4.7 or 10 uf electrolytic capacitor. Watch polarity.
- 49. Install jumper JMP6.
- 50. Install resistor R6, 470 ohm (yellow-violet-brown)
- 51. Install C7 and C8, both .01 uf disc capacitors (marked .01 or 103 or 10 nf).

- 52. Install jumper JMP3.

How about another break? Everything is done except for the demodulator section. The front-end is bringing in the signal, the IF amp and filter are amplifying the converted intermediate frequency signal and the audio amplifier is waiting to drive a speaker. The only thing missing is a demodulated audio signal to amplify.

- 53. Install C9, 4.7 or 10 uf electrolytic capacitor. Observe polarity.
- 54. Install C23, .01 uf disc capacitor (marked .01 or 103 or 10 nf).
- 55. Install R7, 10K ohm (brown-black-orange).
- 56. Install R14, 10K ohm (brown-black-orange). Note that R9 is not installed yet - we'll do that in: 'ALIGNMENT', step #9.
- 57. Install C2, .01 uf disc capacitor (marked .01 or 103 or 10 nf).
- 58. Install U1, the ULN2111 FM demodulator chip. Since this chip has 14 pins, be especially careful not to bend any pins under as you insert it into the PC board. When you solder the chip, verify that you are soldering all 14 pins.
- 59. Install R1, 4.7K ohm (yellow-violet-red).
- 60. Install C1, 4.7 pf disc capacitor.
- 61. Install C3 and C29, both .01 uf disc capacitors (marked .01 or 103 or 10 nf).
- 62. Install L2, the shielded metal Quadrature coil. Notice that it will only go into the PC board one way.
- 63. Install the 9 volt battery clamp. Use a scrap component lead wire looped through the holes in the clamp and into the holes in the PC board. Solder the wire to the clamp but don't use too much solder as this will prevent you from seating the battery fully into the clamp.
- 64. Install the 9 volt battery snap connector. Make sure you put the right color wire into the proper hole on the PC board.

Hey, all done and ready to listen to tunes from our radio... Well, at least we're ready to test and align it - then we'll listen to our tunes!

TESTING AND ALIGNMENT

A Hex head alignment tool is required to tune up your FR1. If you do not already have a set of plastic or nylon coil alignment tools and expect to build other radio or transmitter type kits, such tools are well worth having and can be found at any electronics store, including Radio Shack. While a hex style Allen wrench will fit the coil slug, the metal itself will drastically change the coil's inductance while it is in the slug. For this reason you should not use an Allen wrench unless you don't mind the trial and error process of; turning the slug, withdrawing the tool, checking tuning, reinserting the tool, retuning, checking and so on.

You can fabricate your own non-metallic tuning tool with some patience, a bit of sandpaper and a piece of plastic rod or wood stick. Try a large wooden matchstick, kabob skewer, or small plastic crochet needle. Carefully sand down the end to a hex shaped form and check for proper fit within the coil slug. It is better to have the tool fit loosely rather than too tight, since a tight tool will cause stress on the delicate slug.

1. Connect the following:

Fresh 9 volt battery (preferably heavy duty alkaline type)

Speaker or earphone

A short length of wire (about two feet) to serve as antenna or

The telescopic whip if the optional matching case and knob set was purchased.

2. Set the Volume and the Tune controls to the center of their range.

3. Press the power switch 'ON', you should hear some rushing noise from your speaker.

4. Rotate the volume control and see if it does its job.

5. Slowly turn L2's slug back and forth for maximum noise. This noise should be similar to what you would hear when a regular FM radio is tuned between stations. L2 may be tuned with a regular blade style screwdriver.

6. Try turning the Tune control. See if you can receive any stations, but don't be alarmed if nothing is received since we haven't adjusted the oscillator coil yet.

7. The oscillator coil, L1 is adjustable to receive from 70 to 110 Mhz. We have to adjust it to cover the frequency range of interest. For alignment purposes we'll work with the understanding that the standard FM 88-108 Mhz band is what we wish to receive.

8. Using your alignment tool, slowly rotate L1's slug gently so that the slug is even with the top of the coil form. (Do not force the slug; if it binds, rotate the slug back and gently 'rock it' to-and-fro as you would a thread forming tap. Slugs are by nature very brittle and will crack easily). Now carefully rotate the slug into the coil form seven turns. The slug will be in about 1/4 of an inch. Rotate the tune control until you hear an FM broadcast signal. Adjust L2 for best sound.

9. Install R9, 10K ohm (brown,black,orange). R9 adds in AFC voltage to stabilize against drift. Without it your radio may 'wander'.

10. After a signal is received, rotate the tune control to receive other stations. If the stations seem to 'jump away' as you try to tune one in, the coil L1 is adjusted incorrectly and should be retuned. The reason for this odd phenomenon is that the AFC circuit is pushing the signal away rather than pulling it in. This is caused by having the oscillator 10.7 Mhz below the desired signal rather than 10.7 Mhz above it. A similar example of this is closing your eyes, hearing a sound, but not being able to determine if it is in front of, or behind you. Readjusting L1 will correct this situation. Make sure the slug is about three turns from the top of the coil form.

11. Calibrating the receiver is easy:

- a. Tune in a station known to operate at the low end (88 Mhz) of the FM broadcast band.
- b. Rotate the tune control almost fully counter-clockwise to where that station should logically be located on the dial.
- c. Turn L1's slug until that same station is received. The tune control should now tune in the entire FM broadcast band.

RECEIVER SENSITIVITY

Your FR1 FM receiver will exhibit sensitivity equal to most standard radio receivers. For the ultimate in sensitivity when using an external antenna, our SA7 broadband preamp is an ideal choice. Or, our AA-7 Active Antenna interfaces extremely well, boasts both an internal telescopic whip, external antenna jack and even a matching case!

OUT-OF-BAND OPERATION

Although many folks use their FR1 for comfortable FM broadcast reception, some James Bond types will want to use it to receive clandestine transmissions from phone bugs, room transmitters and the like. It's a simple matter to retune coil L1 to receive the frequency band of interest; however, we ask that you first verify that your FR1 receives the FM broadcast band correctly before retuning.

SPEAKER SELECTION

A fifty-cent' speaker, lying naked on your workbench will not give you a fair test of your FR1 audio quality or volume. Speaker quality and well-designed enclosures have their clear purposes! A reasonable speaker in a box delivers a pleasant listening volume as well as significantly improved fidelity.

ADDING A POWER-ON INDICATOR

Adding a simple LED power-on indicator to your Ramsey kit receiver is easy. All you need is the LED itself and a small 1K ohm resistor. Study the PC-traces between the positive battery supply wire and the on-off switch. The unused connectors on top of your switch are an ideal point to get the + DC voltage needed for the anode (longer lead) of the LED.

Plan where and how you wish to install the LED in your enclosure. Locating the LED immediately above the on-off switch is logical and ideal. The simplest way to make a neat installation is to drill a hole just slightly smaller than the diameter of the LED. Then, enlarge the hole a little bit at a time, just enough to let the LED be pressed in and held firmly. The resistor may be connected to either the anode or cathode of the LED, but the anode side **MUST** go to + DC, with the cathode connected to the nearest common ground point.

If you are wondering why we did not include these pennies worth of parts with your kit, you can believe any of the following reasons: (1) We wanted to stretch your battery budget: drawing about 15 ma., how long will your battery last if you leave you receiver on for a few days, just like we leave our computers, ham radios or accessories on all the time? (2) We thought you'd have more fun planning and installing you own lamp that glows in the dark! (3) We couldn't decide which color you would like best.

TROUBLESHOOTING TIPS:

PROBLEM: ALL signals are hard to tune, unstable, 'jumps away'.

SOLUTION: The oscillator is tuned on the wrong side (10.7 Mhz **BELOW** rather than above) of the desired receive frequency. Retune coil L1. Also this condition could be caused by a weak battery! Use a fresh alkaline cell. Any strong signal forces the audio circuit to rob voltage from the oscillator, which causes the instability.

PROBLEM: Occasionally good but erratic operation.

SOLUTION: Check very carefully for poor solder connections.

PROBLEM: Loud AC hum or buzz.

SOLUTION: . If you are using a 9-volt AC power adapter, the adapter design may not be of sufficient quality for this application. Try bypass capacitors, a

different adapter or a well designed and filtered DC power supply.

PROBLEM: Signals have unpleasant distortion.

SOLUTION: Quadrature coil L2 is not adjusted properly.

PROBLEM: Oscillator inoperative or wrong frequency.

SOLUTION: In addition to checking solder joints, be sure that L1 is tuned correctly, and the frequency determining capacitors, C11,12 are the correct values.

PROBLEM: Unit receives when L1 is adjusted, but not able to be tuned with Tune control.

SOLUTION: Check position of varactor diode and capacitors; C6,14. A careful check of all construction WILL solve your problem. Over 95% of the kits returned for repair have nothing more than a simple assembly or construction error! Have another pair of eyes check your work first.

OTHER HOOK-UPS:

ALTERNATE POWER SOURCES

Most of the FR1 circuitry can be operated from 6 to 14 volts without damage or significant modification. However, it is quite important that you carefully hook up with the correct polarity - reverse polarity or excessive voltages WILL damage your kit.

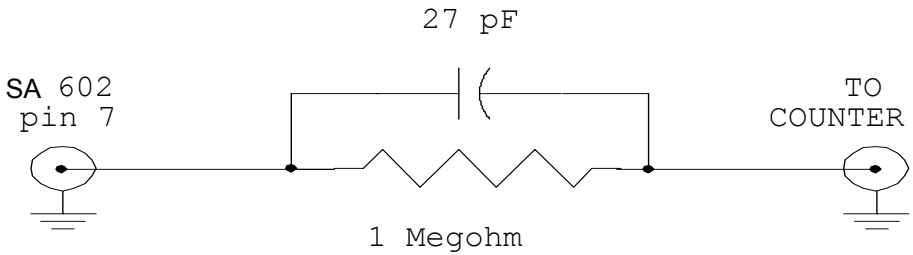
DIGITAL READOUT

A novel hook-up is to add a general purpose frequency counter such as the Ramsey CT-90 to give a direct readout of oscillator frequency. Of course, we know that the oscillator is not oscillating at the same frequency that we're receiving - it's actually 10.7 Mhz above the dialed in frequency.

This may seem like overkill, but we mention it to point out the possibilities that a low cost kit offers you in experimenting and just plain 'fooling around!' And we don't mind suggesting that a Ramsey counter makes an attractive, matching companion to your Ramsey kit as well as being a valuable tool with lots of practical uses for any electronic hobbyist.

While you could experiment with an RF pickup loop or tuned circuit and counter preamplifier to boost the oscillator's tiny output to a level suitable for the counter, the most reliable method is to wire a high-impedance counter probe line directly to pin 7 of the SA602, terminated to a rear-panel frequency counter connector of your choice. This will consist of a short piece of mini - coax to a 1 megohm resistor bridged by a 27 or 33 pf capacitor as shown:

On weak signals it may be possible to hear the counter's busy humming action in the background, but not to a serious degree. If you decide to add such a counter connection to your receiver, remember that the coax as well as the coupling capacitor becomes part of the oscillator circuit. Make the coaxial cable connecting the counter to the receiver as short as possible. You will experience a frequency change of several hundred KHz when connecting or disconnecting up the counter. Also, this additional capacitance in the oscillator circuit may reduce the tuning range.



METHODS OF DIAL CALIBRATION

An easy way of making your own dial is to paste a small rectangle of paper behind the tuning dial knob. Then as you tune in different frequencies, pencil in on the paper the received frequency.

SCA OUTPUT

The SCA output is a baseband demodulated signal output before any low pass filtering or de-emphasis. It provides a handy connection point for add-on SCA adapters such as the Ramsey SCA-1 kit. You can also connect this output to a receiver capable of receiving 30 to 75 KHz FM signals, or a PLL demodulator you've built yourself. Check out the data sheet from Signetics concerning the NE-565 PLL chip, an SCA demodulator is featured.

BOOSTING AUDIO OUTPUT

Your FR1 was designed for clean, undistorted audio from average FM broadcast stations, while keeping battery current drain low. You may significantly increase the FR1's audio output by adding a single 10 uf electrolytic capacitor across pins 1 and 8 on the LM-386 audio amplifier IC. The '+' side should connect to pin 1. An easy way of adding this capacitor is to simply 'tack' solder it right on the IC pins on the solder side of the PC board.

IN CLOSING...

Finally, we remind you that modifications of the kit put you on your own, voiding your Ramsey limited warranty, making your unit ineligible for factory repair. Make sure the receiver is working properly and that you understand how to use and repair it BEFORE making any changes in the original design. If you've enjoyed building this Ramsey kit, there are plenty more! Our nifty FM25B Stereo FM Transmitter is especially popular. Ask for our free catalog - kit building's a blast!

The Ramsey Kit Warranty

Please read carefully BEFORE calling or writing in about your kit. Most problems can be solved without contacting the factory.

Notice that this is not a "fine print" warranty. We want you to understand your rights and ours too! All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that a team of knowledgeable people have field-tested several "copies" of this kit straight from the Ramsey Inventory. If you need help, please read through your manual carefully, all information required to properly build and test your kit is contained within the pages!

1. DEFECTIVE PARTS: It's always easy to blame a part for a problem in your kit, Before you conclude that a part may be bad, thoroughly check your work. Today's semiconductors and passive components have reached incredibly high reliability levels, and it's sad to say that our human construction skills have not! But on rare occasions a sour component can slip through. All our kit parts carry the Ramsey Electronics Warranty that they are free from defects for a full ninety (90) days from the date of purchase. Defective parts will be replaced promptly at our expense. If you suspect any part to be defective, please mail it to our factory for testing and replacement. Please send only the defective part (s), not the entire kit. The part(s) MUST be returned to us in suitable condition for testing. Please be aware that testing can usually determine if the part was truly defective or damaged by assembly or usage. Don't be afraid of telling us that you 'blew-it', we're all human and in most cases, replacement parts are very reasonably priced.

2. MISSING PARTS: Before assuming a part value is incorrect, check the parts listing carefully to see if it is a critical value such as a specific coil or IC, or whether a RANGE of values is suitable (such as "100 to 500 uF"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the '1K ohm' resistors are actually the 'missing' 10 K parts ("Hum-m-m, I guess the 'red' band really does look orange!") Ramsey Electronics project kits are packed with pride in the USA. If you believe we packed an incorrect part or omitted a part clearly indicated in your assembly manual as supplied with the basic kit by Ramsey, please write or call us with information on the part you need and proof of kit purchase

3. FACTORY REPAIR OF ASSEMBLED KITS:

To qualify for Ramsey Electronics factory repair, kits MUST:

1. NOT be assembled with acid core solder or flux.
2. NOT be modified in any manner.
3. BE returned in fully-assembled form, not partially assembled.
4. BE accompanied by the proper repair fee. No repair will be undertaken until we have received the MINIMUM repair fee (1/2 hour labor) of \$25.00, or authorization to charge it to your credit card account.
5. INCLUDE a description of the problem and legible return address. DO NOT send a separate letter; include all correspondence with the unit. Please do not include your own hardware such as non-Ramsey cabinets, knobs, cables, external battery packs and the like. Ramsey Electronics, Inc., reserves the right to refuse repair on ANY item in which we find excessive problems or damage due to construction methods. To assist customers in such situations, Ramsey Electronics, Inc., reserves the right to solve their needs on a case-by-case basis.

The repair is \$50.00 per hour, regardless of the cost of the kit. Please understand that our technicians are not volunteers and that set-up, testing, diagnosis, repair and repacking and paperwork can take nearly an hour of paid employee time on even a simple kit. Of course, if we find that a part was defective in manufacture, there will be no charge to repair your kit (But please realize that our technicians know the difference between a defective part and parts burned out or damaged through improper use or assembly).

4. REFUNDS: You are given ten (10) days to examine our products. If you are not satisfied, you may return your unassembled kit with all the parts and instructions and proof of purchase to the factory for a full refund. The return package should be packed securely. Insurance is recommended. Please do not cause needless delays, read all information carefully.

FR1 FM BROADCAST RECEIVER

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REQUIRED TOOLS

- Soldering Iron Ramsey WLC100
- Thin Rosin Core Solder Ramsey RTS12
- Needle Nose Pliers Ramsey MPP4 or RTS05
- Small Diagonal Cutters Ramsey RTS04
- <OR> Technician's Tool Kit TK405

ADDITIONAL SUGGESTED ITEMS

- Holder for PC Board/Parts Ramsey HH3
- Desoldering Braid Ramsey RTS08
- Digital Multimeter Ramsey M133

Price: \$5.00

Ramsey Publication No. MFR1

Assembly and Instruction manual for:

**RAMSEY MODEL NO. FR1 FM BROADCAST
RADIO RECEIVER KIT**

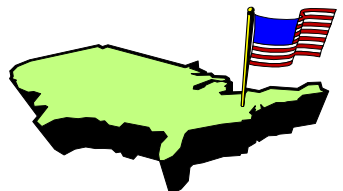
TOTAL SOLDER POINTS

202

ESTIMATED ASSEMBLY

TIME

Beginner..... 6 hrs
Intermediate..... 3.4 hrs
Advanced 2.6 hrs



This Quality Electronics
Kit was designed and
packed in the USA