4-19.5 MHz SHORTWAVE RADIO

Ramsey Electronics Model No. SR2

Have you ever wanted to get into the fascinating world of radio? The Ramsey SR2 is a fine performer that will bring in the world using just a few feet of wire as an antenna! Folks of all ages have successfully built and enjoyed this easy and fun kit.

- **Enjoy hours of fascinating international listening using just a simple indoor wire antenna**
- **Select portions of the 4 to 19.5 MHz shortwave band, easily re-tuned at any time**
- **Smooth varactor diode tuning**
- **Excellent sensitivity and selectivity**
- **Front panel Volume and Tuning controls**
- **Multi-stage audio amplifier for room filling volume**
- **Well designed superhetrodyne circuit is easy to build, makes a nice one-evening project**
- **Ideal scout, school, or club project**
- **Clear, concise step-by-step instructions carefully guide you to a finished kit that not only works - but you'll also learn too!**
- **Runs on a standard 9 volt battery**
- **Add our matching case and knob set for a finished 'pro' look**

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- **FM100B Professional Synthesized FM Stereo Broadcaster**
- **FM25B Synthesized FM Stereo Transmitter**
- **AM25 Synthesized AM Transmitter**
- **AM1 AM Transmitter**

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

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- **SG7 Personal Speed Radar**
- **SS70A Speech Scrambler**
- **TT1 Telephone Recorder**
- **SP1 Speakerphone**
- **MD3 Microwave Motion Detector**
- **PH10 Peak hold Meter**
- **LC1 Inductance-Capacitance Meter**

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- **HR Series HF All Mode Receivers**
- **QRP Series HF CW Transmitters**
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- **VLF1 Low Bander Low Frequency SWL Converter**
- **QRP Power Amplifiers**

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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.

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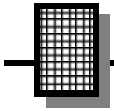

KIT ASSEMBLY AND INSTRUCTION MANUAL FOR

4-19.5MHz SHORTWAVE RADIO

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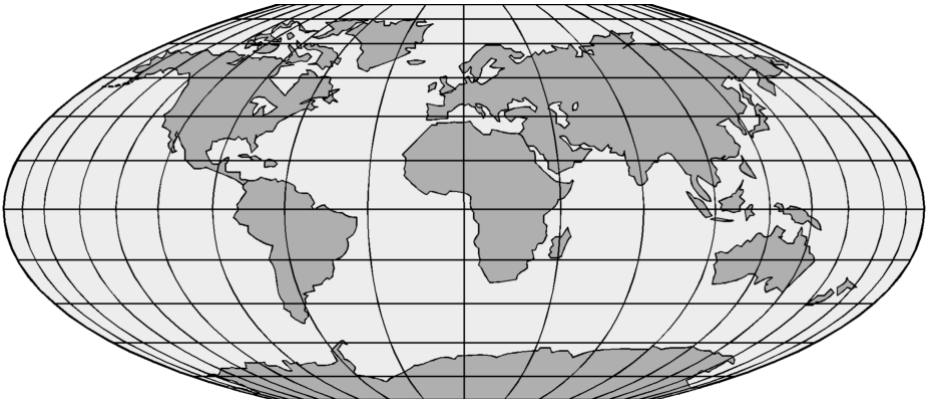


INTRODUCTION TO THE SR2

The SR2 is a single-conversion superheterodyne receiver designed specifically for listening to AM broadcasting stations in the range of 4 to 19.5 MHz. Because of this "superhet" design, your favorite foreign broadcasting services will come in loud and clear, with pleasing audio sound quality, with a minimum of overload, frequency drift or heterodyne whistles. Because of this broadcast oriented design, other shortwave signals such as Morse code (CW), single-sideband (SSB) voice communications and some Teletype signals will usually sound like garbled hisses. On the other hand, similarly inexpensive receivers designed for CW and SSB can give only marginal performance in receiving broadcast stations due to the lack of superheterodyne design. For example, our popular Ramsey direct-conversion receivers for the 40,30 and 20 Meter Amateur bands will also pick up AM broadcast stations, but you'll mainly hear their strong AM "carrier" signal due to the lack of the superheterodyne circuitry. Even if such a carrier is tuned to a "null," listening fidelity is less than desirable.

WHAT YOU CAN EXPECT TO HEAR

First, let's take a look at what is POSSIBLE to hear on your SR2. The following are the international shortwave broadcasting bands within its tuning range:

4.750-5.060 MHz. (Lower power, regional "tropical" broadcasting)
5.950-6.200 MHz (Late evening)
7.100-7.300 MHz. (Late afternoon, early evening) (This band is always shared with the 7.0-7.3 MHz Amateur Radio Band)
9.500-19.500 MHz. (Always "something" on, 24 hours a day!)

Especially strong signals include these, among others:

- BBC London: an intelligent perspective on world affairs
- Radio Canada International: editorial quality similar to BBC
- Radio Moscow: powerful signals, increasingly honest and open
- Voice of America: VOA broadcasts are "aimed" outside the USA, but if you're in the "path" you'll hear it loud and clear!
- U.S. Armed Forces Radio-TV "Feed" Service: Master programming source for U.S. military radio- hear CBS-NBC-ABC-Mutual news all on the same "channel," plus many other features and spots which give a feel for how it's going with those in uniform
- Numerous South American stations
- USA religious broadcasting to other continents

You'll easily tune in broadcasts from many other countries as well. As you become more and more familiar with the world of shortwave broadcasting, you'll be deciding on your own favorite band.

You will hear a variety of other "interesting" sounds, but just remember that this receiver is designed for AM only. If a Morse Code signal really sounds "good," it is because it is being transmitted in AM tone-modulated form, or perhaps the signal is so close to an AM broadcast carrier that the carrier acts as a "beat-frequency-oscillator" (BFO). Even though this receiver can let you tune through several different HAM radio bands, the signals are not likely to be intelligible. Reception of CW and SSB signals on an AM receiver requires a BFO. This is not a complicated feature, but it is beyond the purpose of the SR2. Our companion receivers designed for the HAM bands will let you tune into these SSB and CW broadcasts.

SHORTWAVE LISTENING AS A HOBBY

Many people worldwide enjoy listening to shortwave broadcasts of all kinds, and they keep written records of what they hear. Almost every nation on earth has some sort of shortwave broadcast service, though many are much more challenging to tune than the powerful signals of Radio Moscow and the BBC. In addition, these "SWLs" (Shortwave Listeners) listen to HAM operators, government and commercial stations and even clandestine operations. Some shortwave listeners enjoy collecting QSL cards from stations which they have logged. Shortwave listening is, for some, a step toward getting a HAM radio license. For others, it is a great hobby in itself. The SR2 Shortwave Receiver is a good introductory receiver for this hobby. After you decide exactly what kinds of listening are of the most interest to

you, you'll be in a better position to choose a more elaborate receiver. While there are various multi-band portable radios available, you can expect to pay at least $100 for a receiver offering a significant improvement over your trusty SR2.

To learn more about this SWL hobby, look for a copy of "Popular Communications" at newsstands. An inexpensive and interesting general introduction to all kinds of radio listening is the book, "Shortwave Listening Guide" by William Barded, Jr. (1987; Radio Shack Catalog Number 62-1084). This book also includes helpful introductory information about VHF monitoring, which you can enjoy with the Ramsey FR-146 and AR-1 receiver kits, as well as HAM radio, CB, antennas, and other topics.

To learn more about Ramsey Electronics HAM radio kits, write for our complete catalog. (And, be sure to tell us how you're doing with your SR2 Receiver!) To learn more about the hobby of HAM radio, write ARRL (American Radio Relay League), 225 Main Street, Newington, CT 06111 or visit their website: http://www.arrl.org/.

CIRCUIT DESCRIPTION

The following paragraphs describe the circuit operation of the SR-2 Shortwave Receiver kit. Through the use of a simplified block diagram the basic circuit theory is easy to understand. The full schematic (pg. 14) shows the details concerning specific operation and component variable configurations.

Take a moment and examine the circuit block diagram found on page 9. The simplified signal flow of the block diagram shows the basic sections of the receiver. The corresponding components are noted under each main block and can be cross referenced to the schematic

The start of our circuit begins with the Antenna. RF Signals (Fc = carrier frequency) from the Antenna are applied to the RF Input and Filtering allowing only the signals of interest to pass through. The high pass filter helps eliminate unwanted signals picked up by the antenna improving the overall reception quality of the radio.

After the input signal is filtered, it moves to the Mixer stage. Notice on the diagram that there are two inputs to the mixer. We have discussed one of these input signals coming into the mixer but not the other as of yet. Drop down to the Local Oscillator block. The local oscillator (LO for short) acts as your tuning control for what frequencies you can receive by generating a signal on the board close in value to that which will be used by the mixer. There is a direct relationship between the generated frequency of the local oscillator (LO) and the exact receive frequency (Fc) you want to listen to. This will become clear when we finish discussing the block diagram.

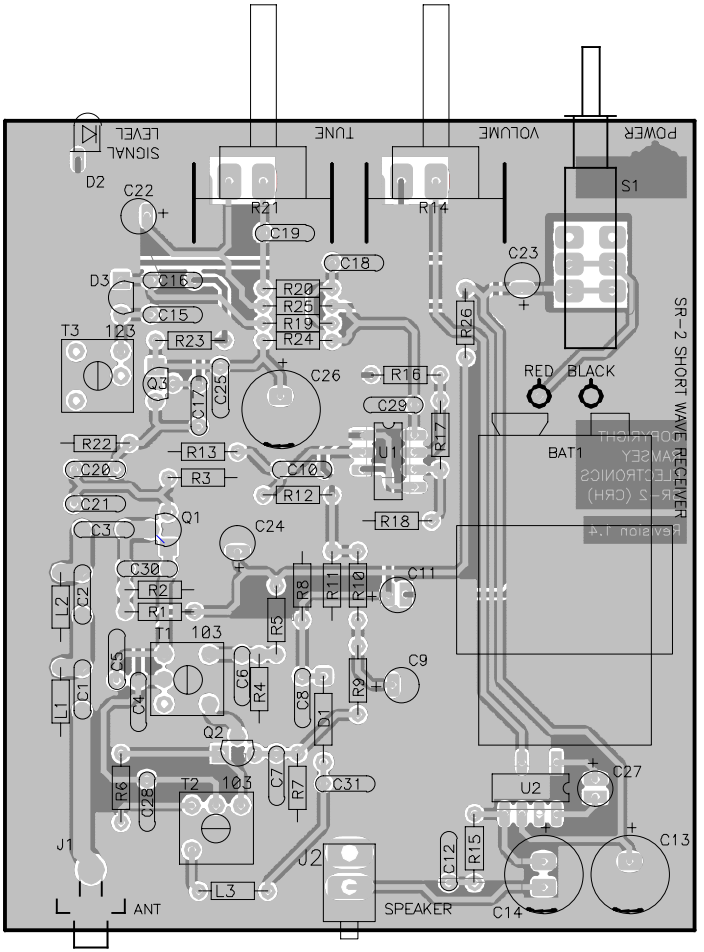
The LO section is a Colpitts oscillator that takes advantage of smooth

varactor diode tuning. The varactor (D3) forms an L/C (Inductor/Capacitor) tank circuit with T3. Increasing the voltage on the varactor diode with R21 (Tuning Pot) increases the capacitance of D3 thus increasing the frequency output of the LO section.
Now that we know the two signals coming into the Mixer stage, both the Fc (receive carrier frequency) and the LO (generated local oscillator), we can better cover its operation. The mixer takes these input signals and performs a few very basic operations. The technical explanation of how the mixer combines these signals through Fourier Series is interesting but very drawn out. The point of using the block diagram, however, is to simplify matters. Therefore, the function of the mixer is to obtain the 'product' and the 'sum' of the input signals. This means you take the input signals and merely 'add' and 'subtract' their values to determine what you get on the output. The general formulas to use are quite simply, 'Fc + LO = Mixer Output' and 'Fc – LO = Mixer Output'.
The realistic output of the mixer stage unfortunately has other signals besides the ones we want. This brings us to the next stage, Intermediate Frequency Filtering. An Intermediate Frequency (IF) is a signal somewhere between the RF signal Fc we started with and the final audio message we are trying to get. The desired IF we are dealing with is a fixed number, such as 455 kHz. As long as the proper relationship between Fc and the LO exists, the IF value will stay constant. Due to the fact that the IF frequency stays the same all the time, the Intermediate Frequency Filter can be very narrow. The filter will remove any other signals coming from the mixer that are not in the proper pass band and yield a clean signal for further processing.
The next stage is an Amplifier with an adjustable gain feedback loop. The gain control is dependant on the amount of signal being received (this Automatic Gain Control 'AGC' will be covered in a moment). The amplifier boosts the signal level of the incoming IF and gives us a stronger signal to work with.
After the amplifier stage is another Intermediate Frequency Filter. This helps remove any unwanted residual signals still present and cleans up the amplified IF for a high quality signal.
At this point the audio signal we are trying to obtain is riding on the IF signal. The Demodulator circuit finally extracts the message from the IF through a process called envelope detection. Now that we have our message back in the audio realm, it is directed through the audio circuitry to the speaker output.
Wait, there are still a few sections we have not discussed!
The demodulated audio branches off before the audio circuitry and is used to perform some useful functions. The RSSI LED, Received Signal Strength Indicator Light Emitting Diode, gives us a general signal level feature. The stronger the signal we receive, the brighter the LED will glow. This is great for help pulling in those weak transglobal transmitter signals. The gain of the

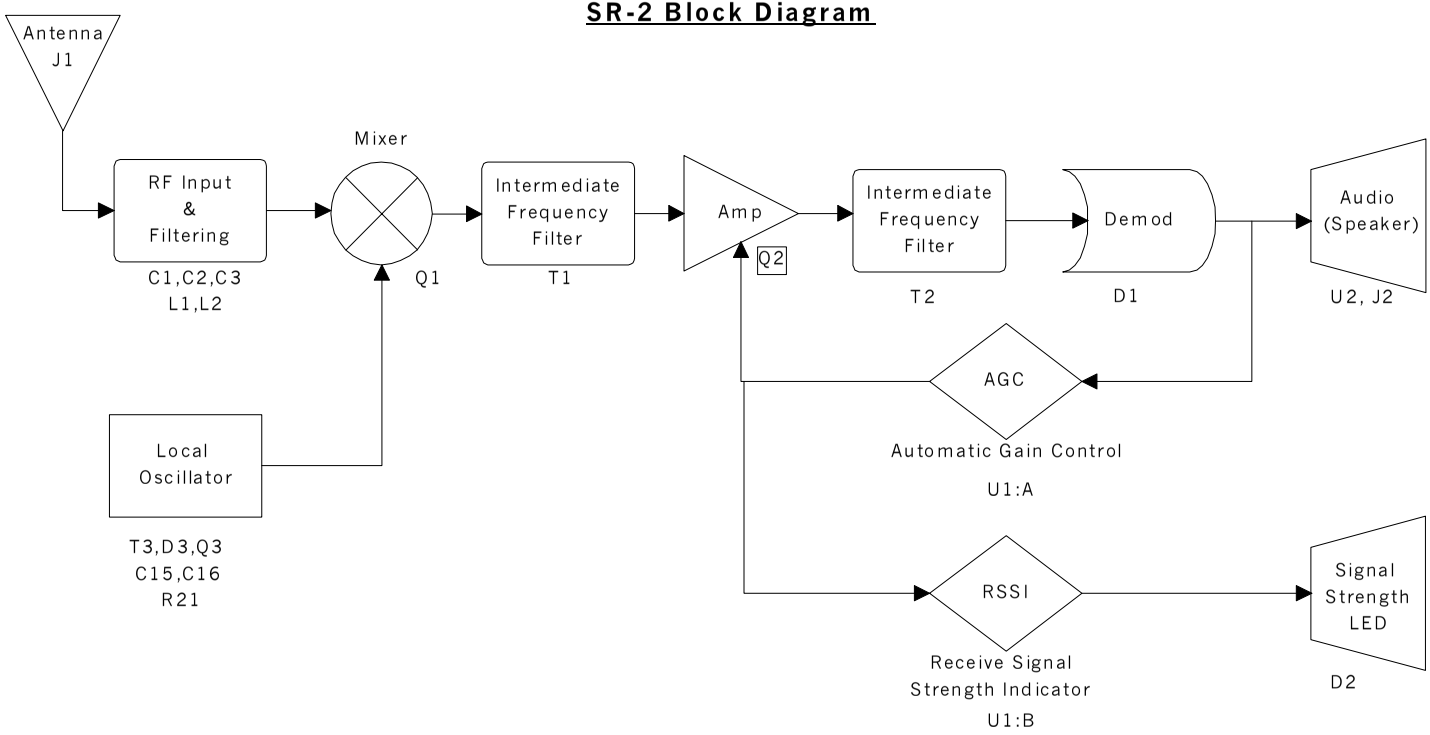
RSSI circuit is controlled by the value the feedback resistor R17. If you are commonly using a small antenna and listening to weak signals, increase the value of R17 to customize the response indication of D2, the signal strength LED.

The final stage, and the real secret to the sensitivity of the receiver, is the Automatic Gain Control (AGC). The gain control looks at the amount of signal level present at the output of the demodulator and varies the amount of gain the Amplifier has accordingly. If there is a strong signal coming through the demodulator the AGC circuit lowers the gain of the amplifier. If the receive signal coming through the demodulator is very weak, the AGC circuit increases the gain of the amplifier (Q2) allowing us to receive signals from around the world and listen to them with clarity.

SR2 PARTS LAYOUT DIAGRAM



SR-2 Block Diagram



PARTS LIST

CAPACITORS

- ❒ 1 10 pF ceramic disc capacitor [marked 10] (C30)
- ❒ 1 47 pF ceramic disc capacitor [marked 47] (C15*)
- ❒ 4 100 pF disc capacitor [marked 100, 101, or 100K] (C5,15*,16*,17)
- ❒ 1 330pF disc capacitor [marked 330 or 331] (C2)
- ❒ 6 .001µF disc capacitors [marked .001, 102, or 1nF] (C1,3,16*,20,21,25)
- ❒ 1 .0039 uF disc capacitor [marked 392 or 392K] (C31)
- ❒ 4 .01µF disc capacitors [marked .01, 103, or 10nF] (C4,6,8,28)
- ❒ 6 .1µF ceramic disc capacitor [marked .1 or 104] (C7,10,12,18,19,29)
- ❒ 2 1µF electrolytic capacitors (C9,24)
- ❒ 3 10µF electrolytic capacitors (C11,22,23)
- ❒ 2 220µF electrolytic capacitors (C13,14)
- ❒ 1 1000 µF electrolytic capacitor (C26)

INDUCTORS

- ❒ 2 1 µH inductors [looks like a resistor with brown-black-gold bands] (L1,L2)
- ❒ 1 12 µH inductor [looks like a resistor with brown-red-black bands] (L3)
- ❒ 2 Shielded can inductors [marked 42IF-103] (T1,2)
- ❒ 1 Shielded can inductors [marked 42IF-123] (T3)

RESISTORS

- ❒ 1 2 ohm [red-black-gold] (R15)
- ❒ 1 100 ohm [brown-black-brown] (R26)
- ❒ 3 270 ohm [red-violet-brown] (R16,22,25)
- ❒ 8 1K ohm [brown-black-red] (R3,7,9,10,13,17,18,24)
- ❒ 5 10K ohm [brown-black-orange] (R6,8,11,19,23)
- ❒ 2 22K ohm [red-red-orange] (R2,4)
- ❒ 3 100K ohm [brown-black-yellow] (R1,5,20)
- ❒ 1 1M ohm [brown-black-green] (R12)

SEMICONDUCTORS

- ❒ 1 Red LED (D2)
- ❒ 1 1N270 diode, glass bead style (D1)
- ❒ 1 Varactor diode, transistor style body with two leads (MVAM108) (D3)
- ❒ 3 NPN transistors, 2N3904 or similar (Q1,2,3)
- ❒ 1 LM358 8-pin DIP IC (U1)
- ❒ 1 LM386 8-pin DIP IC (U2)

HARDWARE AND MISCELLANEOUS

- ❒ 1 SR2 printed circuit board
- ❒ 2 10K potentiometers (R14,21)
- ❒ 1 DPDT PC-mount push button switch (S1)
- ❒ 1 RCA-type PC-mount jack (J1)
- ❒ 1 Subminiature phone jack (J2)
- ❒ 1 9-volt battery snap connector
- ❒ 1 9-volt battery hold-down clamp

REQUIRED, NOT SUPPLIED:

- ❒ 9-volt alkaline or heavy-duty battery
- ❒ Earphone, small speaker, or external amplifier with speaker
- ❒ Antenna or suitable cable, connector, grounding

OPTIONAL

Ramsey SR2 case and knob set (CSR), or your own enclosure

ASSEMBLY INSTRUCTIONS

In ALL PC-board assembly steps, our word "INSTALL" means to do this:

- ❒ Insert the part, oriented or "pointed" correctly, into its holes in the PC board.
- ❒ If helpful, gently BEND the part's wire leads or tabs to hold it in place, with the body of the part snugly against the top side ("component side") of the circuit board.
- ❒ Solder ALL wires or pins of the part.
- ❒ Trim or "nip" all excess wire lengths extending beyond each solder connection, taking care that wire trimmings do not become lodged in solder connections.

You can see that this circuit board, the center portion in particular, is fairly well-filled with components. There's more to this receiver than the average beginner's radio or even our popular Amateur Band receivers.

Follow the assembly instructions IN SEQUENCE and check off each step as understood and completed. Some of the components require modification! Examine the schematic circuit diagram and PC Board parts layout diagram as you proceed.

Use good soldering techniques! Let your soldering iron tip heat both the component lead wire and PC board trace enough so that the wire itself AND the foil trace BOTH become hot enough TOGETHER to melt a bit of solder so that it flows smoothly from the pin to the PC board trace.

Enough said... Let's get building!

- ❒ 1. Install S1, the DPDT push button switch. Ensure that the white plastic switch extends out over the edge of the PC board and that the switch is flush to the board. Solder all six pins.
- ❒ 2. Install one of the 10K PC mount potentiometers, R14. Be sure it is seated flush to the PC board, then solder all 5 pins.
- ❒ 3. Install the other 10K PC mount pot, R21. Take care to seat it properly before soldering the 5 pins.
- ❒ 4. Install J1, the RCA jack. You will want to check your placement before soldering and be sure to solder all 4 tabs.

We will now begin constructing the local oscillator section.

- ❒ 5. Install C22, one of the 10µF electrolytic capacitors. Electrolytic capacitors have a right and wrong way to be installed. Usually, capacitors have a wide stripe which indicates their negative lead and the PC board or Parts Layout Diagram will show the positive side of the capacitor's installation hole. Be sure to place the (+) capacitor lead into the PC board (+) hole and the (-) lead into the (-) hole before soldering.
- ❒ 6. Install D3, the varactor diode, marked MVAM108. This part looks like a transistor except that it only has two leads. It must be installed with the proper polarity to work correctly. You will note that it has a flat side. Be sure to look at the PC board silkscreen or parts layout diagram for proper placement of the flat side. Once you have correctly placed the part, solder the leads.
- ❒ 7. Install R23, 10K ohm [brown-black-orange].
- ❒ 8. Install Q3, an NPN transistor, [marked 2N3904]. This part is also oriented by the flat side so check your parts layout diagram for proper placement. Bend the center lead out until it fits in the board and seat the part as close to the PC board as possible. Solder all three leads.
- ❒ 9. Install C17, a 100 pF capacitor [marked 100, 101, or 100K].
- ❒ 10. Install C25, .001µF disc capacitor [marked .001, 102, or 1nF].
- ❒ 11. Install C19, a .1µF ceramic disc capacitor [marked .1 or 104].
- ❒ 12. Install C18, another .1µF ceramic disc capacitor [marked .1 or 104].
- ❒ 13. Install R20, 100K ohms [brown-black-yellow].
- ❒ 14. Install R25, a 270 ohm resistor [red-violet-brown].
- ❒ 15. Install R19, 10K ohms [brown-black-orange].
- ❒ 16. Install R24, 1K ohms [brown-black-red].
- ❒ 17. Install C26, the 1000µF electrolytic capacitor. Remember to check the polarity and install properly before soldering.
- ❒ 18. Install R22, 270 ohms [red-violet-brown].
- ❒ 19. Install C20, .001µF disc capacitor [marked .001, 102, or 1nF].
- ❒ 20. Install C21, another .001µF disc capacitor [marked .001, 102, or 1nF].

Before installing T3, the shielded can inductor [marked 42IF123] we must make a modification to the part. It's time for a little "destruction"! (If you

jumped ahead and installed T3, we've got bad news for you). Before this shielded transformer can be installed, its internal capacitor needs to be removed. Looking at the underside of this transformer, you'll see a tubular part, probably white with a brown band, somewhat like the resistors in this kit. This is brittle and easily crushed with any sharp object that can be pressed against it with mild force (small nail, nutpick, small screwdriver). You'll find this capacitor will easily disintegrate into particles. DO NOT crush the capacitors in the other two inductors!

❒ 21. After crushing the internal capacitor, install T3. The part fits in the board only one way. Solder all pins.

That completes assembly of the local oscillator section except for two parts. You may notice that we skipped over C15 and C16 while installing the other parts in the area. The reason is that you will have to decide the frequency range you're trying to receive to know what value capacitors to install. We'll leave that until the end of the assembly process.

We'll now move on to the RF section of your SR2 kit. The next few parts form an input filter and mixer section, to combine the RF input with the L.O. section just built. The output of the mixer is the IF, from which we'll extract the final audio. But let's not get ahead of ourselves.

❒ 22. Install L1, 1µH inductor [looks like a fat resistor with brown-black-gold bands].

❒ 23. Install L2, the other 1µH inductor [looks like a fat resistor with brown-black-gold bands].

❒ 24. Install C3, .001µF disc capacitor [marked .001, 102, or 1nF].

❒ 25. Install C2, 330 pF disc capacitor [marked 330 or 331].

❒ 26. Install C1, .001µF disc capacitor [marked .001, 102, or 1nF].

❒ 27. Install R13, 1K ohms [brown-black-red]. R13 isn't part of the RF section but is easier to install now, while we're in the area.

❒ 28. Install R3, 1K ohm [brown-black-red]. Watch that third color band as red is easily confused with orange!

❒ 29. Install Q1, another of the NPN transistors [marked 3904]. Observe correct orientation of the flat side when placing this part.

❒ 30. Install C10, .1µF ceramic disc capacitor [marked .1 or 104].

❒ 31. Install R12, 1M ohm [brown-black-green]. C10 and R12 are part of the bias circuit for the audio amplifier, U1. Like R13, it is easier to install these parts now.

❒ 32. Install C30, 10pF [marked 10].

- ❒ 33. Install R2, 22K ohms [red-red-orange].
- ❒ 34. Install R1, 100K ohms [brown-black-yellow].
- ❒ 35. Install C24, 1µF electrolytic capacitor. Remember to watch polarity when installing.
- ❒ 36. Install C5, 100 pF disc capacitor [marked 100, 101, or 100K].
- ❒ 37. Install C4, .01µF disc capacitor [marked .01, 103, or 10nF].
- ❒ 38. Install R26, 100 ohms [brown-black-brown].
- ❒ 39. Install C23, 10 µF electrolytic. Remember to check the polarity before installing.
- ❒ 40. Install Q2, the last 3904 transistor. Check the parts placement diagram for correct orientation, then install and solder the three leads.
- ❒ 41. Install C6, .01µF disc capacitor [marked .01, 103, or 10nF].
- ❒ 42. Install R4, 22K ohm [red-red-orange].
- ❒ 43. Install T1, one of the shielded can inductors [marked 42IF-103].
- ❒ 44. Install R5, 100K ohm [brown-black-yellow].
- ❒ 45. Install R6, 10K ohm [brown-black-orange].
- ❒ 46. Install C28, .01µF disc capacitor [marked .01, 103, or 10nF].
- ❒ 47. Install C7, .1µF ceramic disc capacitor [marked .1 or 104].
- ❒ 48. Install R7, 1K ohm [brown-black-red].
- ❒ 49. Install C31, .0039 uF disc capacitor [marked 392 or 392K].
- ❒ 50. Install R8, 10K ohm [brown-black-orange].
- ❒ 51. Install C8, .01µF disc capacitor [marked .01, 103, or 10nF].
- ❒ 52. Install D1, 1N270 glass bead style diode. The banded end (cathode) MUST be oriented as shown on parts layout.
- ❒ 53. Install R11, 10K ohm [brown-black-orange].
- ❒ 54. Install R10, 1K ohm [brown-black-red].
- ❒ 55. Install R9, 1K ohm [brown-black-red].
- ❒ 56. Install T2, the other shielded can inductors [marked 42IF-103].
- ❒ 57. Install L3, 12 µH inductor [looks like a fat resistor with brown-red-black bands].

❒ 58. Install C9, 1µF electrolytic capacitor. Check polarity when installing.

❒ 59. Install C11, 10 µF electrolytic. Observe correct polarity before installing.

❒ 60. Install R16, 270 ohm [red-violet-brown].

PROGRESS SUMMARY

Now is a good time to take a break. Examine your work so far checking things such as component values, parts placement, and solder connections. Remember the old adage “The bigger the glob the better the job” does not hold true with RF electronics!

To this point, we have assembled a majority of the receiver. The RF, LO, IF and Demodulator sections have been built leaving us with the final audio stage, RSSI circuit, and AGC circuit. Sound like a lot more work? Not at all; we are going to take advantage of today’s power packed ICs! The LM386 audio chip takes care of our audio needs while the LM358 opamp is used two-fold in the RSSI and AGC circuits!

❒ 61. Install C29, .1µF ceramic disc capacitor [marked .1 or 104].

❒ 62. Install U1, the LM358 8 pin IC. Do not confuse it with the other IC; read the chip marking carefully. You will notice a notch, band or dot on one end of the IC. This should be oriented as shown on the parts layout diagram and PC board silkscreen. Be sure the part is seated close to the PC board before soldering all 8 pins.

❒ 63. Install R17, 1K ohm [brown-black-red].

❒ 64. Install R18, also 1K ohm [brown-black-red]..

❒ 65. Install J2, the subminiature speaker-headphone jack.

❒ 66. Install C12, .1µF ceramic disc capacitor [marked .1 or 104].

❒ 67. Install R15, 2 ohms [red-black-gold].

❒ 68. Next, install U2, the LM386 audio amplifier IC. As with U1, orient the notched or dotted end as shown in the parts layout diagram and on the PC board silkscreen. Solder all 8 pins.

❒ 69. Install C14, 220µF electrolytic capacitor. The positive lead of the capacitor must be placed in the hole next to the (+) sign.In the same way,

❒ 70. Install C13, placing the positive lead in the correct PC board hole. Remember, the banded side indicates the negative lead.

- 71. Install the 9-volt battery snap connector, making sure that the red (+) black (-) leads are inserted correctly.

❒ 72. Install the battery clamp. Position battery and holder so as not to cover nearby PC board mounting holes. Use the method for securing the clamp that is most convenient for you, such as:

- wire looped through clamp and PC board holes, soldered.
- small screws
- double-faced adhesive strips
- hot-melt glue

❒ 73. If you desire increased audio output, C27, 10 µF, may be installed. Be sure the (+) and (-) leads are inserted correctly.

❒ 74. We're at the end now, just one part left to install. Install D2, the red LED signal indicator. The short lead is the cathode; it goes toward potentiometer R21. Leave it standing about 1/2 an inch off of the board when soldering. After soldering bend it over to a 90º angle at its midpoint so that it faces the outside of the board.

Your shortwave broadcast receiver is now finished, except for the capacitors that will determine the frequency range you will receive.

SHORTWAVE ANTENNA IDEAS

The type of antenna you'll want to use for your SR2 depends on the degree of interest you have in shortwave listening, whether you are limited to an indoor or balcony antenna, and whether you think you may soon want to obtain a HAM radio license. If the latter is true, you may want to consult HAM radio literature and build the dipole or vertical antenna which you also plan to use for HAM listening and transmitting. A 40-meter (7 MHz) antenna is quite nice for the tuning range of the SR2.
The rest of these notes on antennas are for the benefit of SR2 builders who simply wish to enjoy some shortwave broadcast listening. The SR2 is very sensitive, so its antenna requirements are minimal for casual evening listening when international broadcast signals are quite strong. 10 to 20 feet of insulated hookup wire can be neatly strung behind furniture and curtains for an adequate indoor antenna. The same length of wire, or more, outdoors or up in the attic, will be an even better receiving antenna.

1. The ideal antenna setup for this frequency range is considered to be an outdoor wire 25 to 50 feet in length, with the ground side of the antenna jack connected to a copper cold water pipe.
2. For convenience, a short length of audio cable with pre-wired RCA plug is adequate for making antenna and ground connections. (RF coaxial cable is not essential for this application).
3. A "banana plug" may also be plugged into the antenna jack but will not

provide a ground connection.

4. If an indoor antenna is necessary, simply make it as long as possible and as high up from concrete floors as you can.
5. When installing any outdoor antenna, BE VERY CAREFUL not to let your antenna wire come in contact with electric power lines.
6. Any antenna wire for shortwave listening may run horizontally, vertically or some both ways, or at an angle!
7. If you have a roof-mounted TV antenna, its feedline will make a great antenna for your SR2.
8. Some existing objects such as; metal downspouts, gutters, windows, door screens, or attic insulation foil can serve as antennas!

If you are completely restricted to indoor antennas, you will enjoy the extra boost of the Ramsey Active Antenna Kit, model AA-7. Its built-in whip antenna can also be boosted by your simple indoor wire antenna, and the AA-7 may be used with any receiver or even a VHF scanner. It's easy to build and a nice companion for your SR2. If you need more construction details on antennas, check the book mentioned on page 6, or any introductory HAM radio book, or the Radio Shack book on Antennas (No. 62-1083).

❒ 75. Decide what frequency range you would like to receive and select the values for C15 and C16 from the chart. A suggested configuration would be C15 = 47 pF and C16 = 100 pF. This will give you complete coverage from 6 to 11 MHz by adjusting T3 in or out. This is a very active section of the Shortwave Band and will provide you with hours of listening enjoyment any time of the day. Select and install C15 and C16.

INITIAL TESTING AND ADJUSTMENT

Before turning on your receiver, please double check the following:

❒ correct orientation of all IC's.
❒ correct orientation of flat side of all transistors.
❒ correct orientation of the diodes.
❒ correct polarity of all electrolytic capacitors.

❒ 1. Connect a speaker or earphones and antenna.

❒ 2. Install a fresh 9-volt alkaline battery.

❒ 3. Set both potentiometer controls to their middle positions.

❒ 4. Turn ON the receiver.

After adjusting the volume to a pleasant level, you should hear some shortwave stations by turning the Tune Control, no matter how any of the adjustable coils happen to be set.
While listening to any kind of station, whether broadcast or Teletype, etc., use a small screwdriver to adjust the slugs in transformers T1 and T2 for the best-sounding reception.

The Tuning Control covers varying segments of the bands selected by adjustment of oscillator coil T3. Adjustment of T3 anywhere between the full In

C16 = .001	**T3 Slug In**	**T3 Slug Out**
C15 = None	6.5—13.0 MHz	9.0—18.3 MHz
C15 = 47 pF	5.1—7.9 MHz	7.1—10.7 MHz
C15 = 100 pF	4.3—5.3 MHz	6.0—8.3 MHz

C16 = 100 pF	**T3 Slug In**	**T3 Slug Out**
C15 = None	8.4—14.2 MHz	11.5—19.5 MHz
C15 = 47 pF	6.0—8.1 MHz	8.5—11.0 MHz
C15 = 100 pF	4.9—6.3 MHz	6.7—8.4 MHz

position to the full Out position will give the user full range between the minimum and maximum frequency coverage set by C15 and C16.

Both T1 and T2 must be adjusted with a non-metallic alignment tool such as is used in radio-TV service. If you do not have one, a suitable tool can be made by patiently sanding a screwdriver-like blade on the end of a wooden match stick, kabob skewer or small plastic crochet needle. Again, please be aware that a metal screwdriver blade will drastically increase the coil inductance and make adjustment quite difficult. T1 and T2 are simply adjusted for strongest reception of any signal range that is tuned in.

If you are without any kind of testing or frequency reference equipment whatsoever, the easiest way to start enjoying your SR2 is, with the Tune control set at its midpoint, slowly tune T3 with your alignment tool as though it were a tuning dial. Stop when you come into the middle of a group or cluster of foreign broadcast stations. Try tuning around these stations with the Tune control. If you like what you hear, readjust both T1 and T2 for best

reception. Eventually, you will get a clue as to what general frequency band you are hearing, because many stations periodically announce their frequencies, particularly at sign-on and sign-off times.

If you like precision, use a frequency counter or calibrated receiver to find the SR2's strong oscillator signal, remembering that there is a 455 KHz IF difference (above or below) between the local oscillator frequency and the broadcast signal you are hearing.

TROUBLESHOOTING TIPS

If you experience difficulty, think of your SR2 in its several sections or stages: oscillator-mixer, IF audio and AGC, and final audio output (LM386). The first step in case of problems is to make sure that the tunable oscillator is working, which can be done by listening for its signal on another receiver. After the oscillator circuit is confirmed working, standard signal tracing procedures should isolate any problem, which will be either an incorrectly-installed part, a defective part or a bad solder connection. Correct orientation or polarity of all diodes, transistors, electrolytic capacitors and ICs is essential.

PROBLEM: Strong shortwave broadcast audible throughout tuning range
SOLUTION: This can occur if your antenna is "too good" or if the RF Gain control is turned up too high. The high sensitivity of the front end is designed for simple antennas, with most reception quite satisfactory with only 25 feet or so of wire.

PROBLEM: Local AM radio station audible throughout tuning range
SOLUTION: Whether this will even happen depends on how close you are to a local AM station. It is very important that all component leads be as short as possible, since just a bit of wire can help D1 and the several stages of audio amplification give you a free, unwanted "classic crystal radio". A grounded metal case for the SR2 is one possible solution.

THE RAMSEY ELECTRONICS CASE, KNOB & HARDWARE OPTION

Your finished receiver can be installed in a variety of enclosures of your own design and choosing. You might be planning to combine several Ramsey circuit kit boards in a single enclosure. Use of the inexpensive and attractive Ramsey case and knob kit will give your unit that finished look and increase its resale value. These sturdy black instrument cases are supplied with neatly lettered front and rear panels, knobs, rubber feet and mounting screws.

OTHER ENCLOSURE RECOMMENDATIONS

While we believe that the Ramsey enclosure and knob option is a fine value for finishing off your Ramsey receiver or transmitter, we are happy to give you a couple of additional suggestions and our reasons for them. If your first goal is economy and rugged portability, you will find that the circuit board can be mounted nicely in a standard VHS videotape storage box, which also gives room for a speaker, or earphone storage, and even a roll of antenna wire. The controls are easily mounted at one end of such a box. It may be necessary to cut away the molded posts which secure the tape cassette itself. These storage boxes come in several styles, so pick one which looks truly practical as a project enclosure.

To accomplish RF shielding, the most economical metal enclosure nicely suited for Ramsey kit boards is Radio Shack No. 270-253A. This metal utility cabinet can accommodate both a receiver and our AA-7 Active Antenna, plus speaker, with room for various refinements you might like to add, such as power supply or larger battery pack, etc.

A TUNING DIAL?

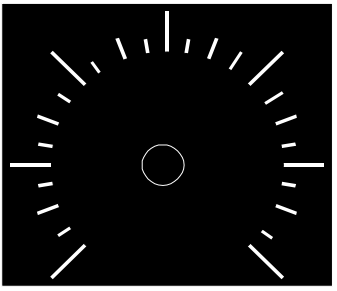
If you use your own enclosure and knobs, you will probably plan some sort of dial markings. If you finish your receiver with the Ramsey custom case and knob kit, you may wish to copy one of the following designs to make a logging scale:

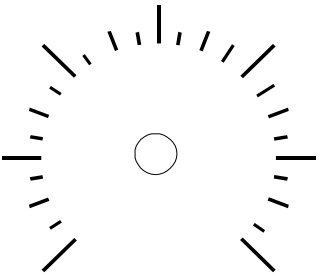
SAMPLE SHORTWAVE LOGGINGS

Freq (MHz)	Country	Notes/Contributor
4.30	PERU	ballads, huaynos, brief annmt, TC partial ID, tnx
4.31	DIEGO GA	oldies, good sig
4.38	PERU	long talk, rel talk, choir, poor
4.40	BOLIVIA	romantic vocals, poor
4.72	S VIETNAM	VT pop tunes, YL anncr, instl mx
4.72	MYANMAR	soft vocals, ID, nx
4.78	GUATEMALA	ID, nx
4.78	MALI	FR Spice Girls, Afr pop
4.82	BOTSWANA	lang church svc, choir
4.82	HONDURAS	cmtry mx
4.97	UGANDA	tribal singing, SH talk, ID during nx
5.04	PERU	pop mx, ID, phone talk
5.50	ETHIOPIA	flute mx, annmts, nx
5.67	PERU	Magnificent 7 song, poss ID
5.76	GUAM AFN	sports pgm, PSAs
6.01	MEXICO	Mexico City in SP 1005, U.S. oldies and SP tunes
6.02	UZBEKISTAN	mx pgm, ID's, tlk on scientific forum
7.11	THAILAND	patriotic sounding songs, Asian rock mx,
7.12	ITALY	ID, mailing QTH, tlk on drug use, mx
7.12	ITALY	nx in EG re Columbus 2000 project, ID
8.45	CHINA	V of Russia relay , “Moscow Mailbag”, nx of Russia,
9.02	IRAN	nx re OPEC, ID, fqy, sked,
9.34	ISRAEL	Kol Israel HB 2142, discussion, US oldies
9.90	BULGARIA	Sofia in RS 1840, tlk, regional mx, ID
9.90	EGYPT	EG version of AR poem, chants, ID, garbled audio
9.90	RUSSIA	Deut Welle relay Irkutsk, nx, stocks, QTH, ID
9.92	GERMANY	Croatian R relay, UK investm'ts
11.60	SLOVAKIA	AWR V of Hope relay ID, relig nx
12.00	UNITED AE	AR mx, into EG 0330, nx
13.64	MADAGASCAR	R Canada Int
13.65	CANADA	"Maple Leaf Mailbag
15.14	OMAN	nx of earthquake in PNG causing tidal wave and local damage, MIR space station being closed down, ID, mx, feature on banking in Oman
16.00	AUSTRALIA	VNG Time Station, full ID’s, Only 5 kw!
17.49	MADAGASCAR	IBC Tamil relay, ID, mostly nx and tlks, exc
17.67	NEW ZEALAND	nx on N Ireland, ID, "Goon Show"
17.67	NEW ZEALAND	classical mx, "In Touch with NZ" featuring oldies
17.67	NEW ZEALAND	nx, Olympic update, ID's
17.68	CHILE	relig pop & inspirational mx, ID's, promos

SAMPLE SHORTWAVE LOGGINGS Con't

Freq (MHz)	Country	Notes/Contributor
18.96	SWEDEN	"Sweden Today", special on Nobel prizes
18.96	SWEDEN	"Sweden Today", article on burden of military spending on developing countries
18.96	SWEDEN	Cinema Africa Film Fest being held in Stockholm
18.98	USA	relig mx, sermon, ID





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 $18.00, 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 $36.00 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.

SR2 Shortwave Receiver
Quick Reference Page Guide

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

TOTAL SOLDER POINTS
166

ESTIMATED ASSEMBLY TIME

Beginner ..... 5.0 hrs
Intermediate..... 3.0 hrs
Advanced..... 2.0 hrs

Manual Price Only: $5.00
Ramsey Publication No. MSR2
Assembly and Instruction manual for:
RAMSEY MODEL NO. SR2
SHORTWAVE RADIO KIT

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