- **Instant TR switching with 1 to 100 watts RF**
- **Compact and easy to install**
- **Operates on 12 - 14 VDC**
- **Matches Ramsey RF Amps and Preamps**
- **Convenient size for mounting within 1 1/2" PVC pipe - ideal for mast mounted preamps**

RADIO FREQUENCY SWITCH

If you need a convenient way of bypassing or enabling an RF preamp or amplifier when you key your rig, then this is the way to go! The RFS-1 can be configured to switch in or out either a receive preamp or transmit power amp. Also has the ability to feed DC power directly up the transmission line, making it great for mast mounted preamps and amps. A very versatile transmit/receive switch for almost all RF switching purposes.

ramsey

Kit No. RFS1

INTRODUCTION TO THE RFS1

The RFS1 has been designed to work in conjunction with external RF preamps or RF power amplifiers to detect when the connected radio has been keyed, thereby bypassing a delicate preamp or enabling a booster amplifier. It can be used in a range of RF powers ranging from 1 to 100 watts. An inverter is supplied so that the relay can be opened when the radio is keyed to bypass a preamp without sending power to it. Without the inverter the relay is closed upon keying to allow a booster amplifier to be in circuit.

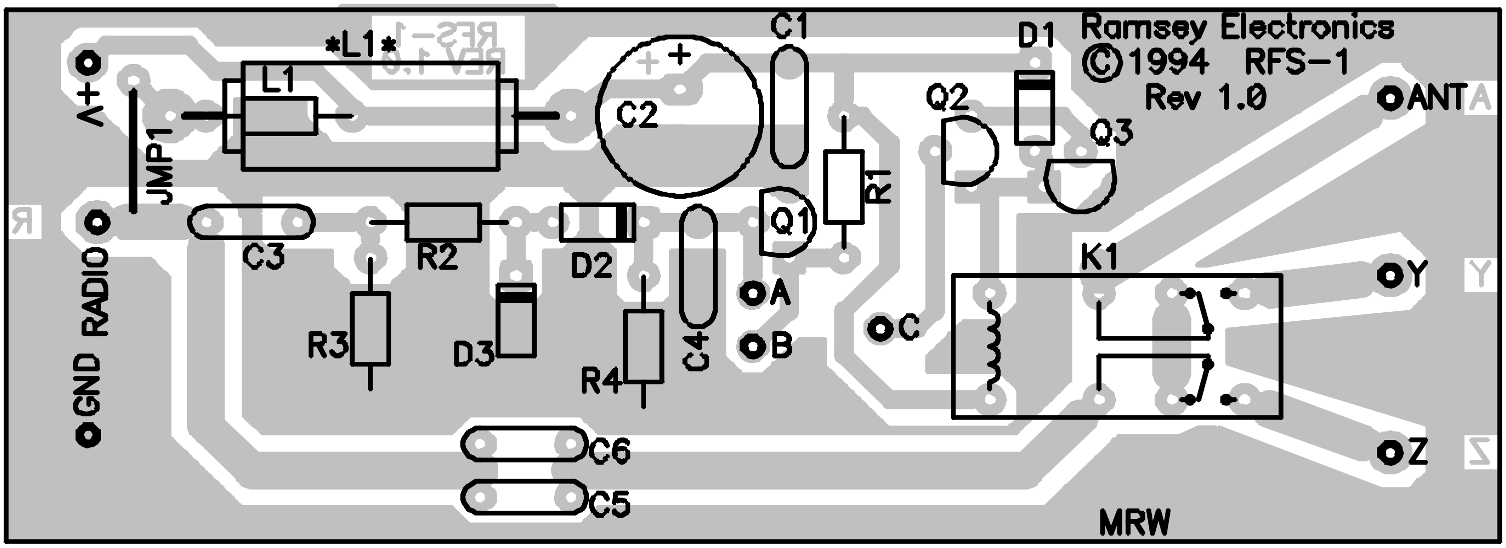
RFS1 PARTS LIST

- ❐ 1 10ρF ceramic capacitor (marked 10 or 10K) (C3)
- ❐ 4 .01μF ceramic capacitors (marked .01, 10nF, or 103) (C1,C4,C5,C6)
- ❐ 1 100μF to 220μF electrolytic capacitor (C2)
- ❐ 4 10K Ω resistors [brown-black-orange] (R1,R2*,R3,R4)
- ❐ 1 1K Ω resistor [brown-black-red] (R2*)
- ❐ 1 100 Ω resistor [brown-black-brown] (R2*)
- ❐ 3 1N4148 diodes (D1,D2,D3)
- ❐ 3 2N3904 NPN transistors (Q1,Q2,Q3)
- ❐ 1 12 Volt DPDT relay (K1)
- ❐ 1 RFS circuit board
- ❐ 1 2.2mH coil, green body [red-red-gold-black] (L1)

***NOTE:** To determine the value of R2 for your application, see Assembly step 4.

RFS1 PC BOARD ASSEMBLY

As you can see there isn’t very much to do in this project, but be careful! Don’t rush and improperly mount a part or leave long lead lengths on components. As all good RF technicians and experimenters know, parts must be mounted flush to the PC board - not only for mechanical strength and looks, but also to prevent radiation problems by long lead lengths acting as small antennas. Just follow the assembly instructions carefully and take your time. Before you know it you will be satisfied and have a working project!



ASSEMBLY OF THE RFS1

❐ 1. Orient the circuit board as shown in the parts layout diagram.

❐ 2. Install C3, the 10ρF ceramic capacitor (marked 10 or 10K).

❐ 3. Install R3, a 10K resistor [brown-black-orange].

❐ 4. Installing R2: First, determine the power output of your RF transceiver. This is, of course, the power input to the RFS1. Then choose the appropriate value of R2 from the table below (all three resistors have been supplied in this kit).

TABLE FOR R2

Power to RFS1	Value of R2
less than 10W	100Ω
10 to 30W	1KΩ
30 to 100W	10KΩ

❐ 5. Install D3, one of the 1N4148 type diodes. Be sure to note the cathode (banded) end of the diode and its orientation on the layout diagram.

❐ 6. Install D2, another 1N4148 type diode. Again, observe correct orientation of the banded end.

❐ 7. Install R4, a 10K resistor [brown-black-orange].

❐ 8. Install C4, a .01µF ceramic capacitor (marked .01, 10nF, or 103).

❐ 9. Install C1, a .01µF ceramic capacitor (marked .01, 10nF or 103).

❐ 10. Install R1, a 10K resistor [brown-black-orange].

❐ 11. Install Q2, another 2N3904 type NPN transistor. Be sure to observe correct orientation.

❐ 12. Install D1, the last 1N4148 type diode. Be sure to observe orientation of the banded end.

❐ 13. Install Q3, the last transistor. Note again the orientation of the flat side.

❐ 14. Install K1, the DPDT RF relay. Note that this fits in only one way. Securely solder all connections.

❐ 15. Install C5, a .01µF ceramic capacitor (marked .01, 10nF, or 103).

❐ 16. Install C6, another .01µF ceramic capacitor (marked .01, 10nF, or 103).

❐ 17. Install the 2.2µH coil (resistor shaped body, green color) [red-red-gold-black].

❐ 18. Install C2, the 100µF to 200µF electrolytic capacitor. Make sure the positive side of the capacitor is mounted in the correct hole. In some cases only the negative lead is indi cated with a stripe down the body of the capacitor. Make sure to orient the capacitor cor rectly.

Now is where we get to make a few decisions about the final assembly of the RFS1. You will need to decide if it is to be used with an amplifier or with a preamp, and whether or not you want to feed the DC power up the transmission line.

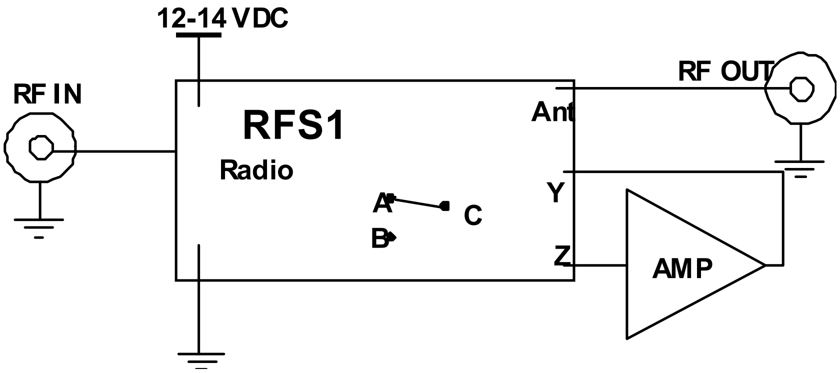
IF YOU'RE USING THE RFS1 TO SWITCH A RECEIVE PREAMP

- ❒ 19a. Install a jumper from holes B to C on the PC board. Use a piece of leftover clipped-off component lead for this.
- ❒ b. Install Q1, a 2N3904 type transistor. Make sure its flat side has the same orientation on the layout.

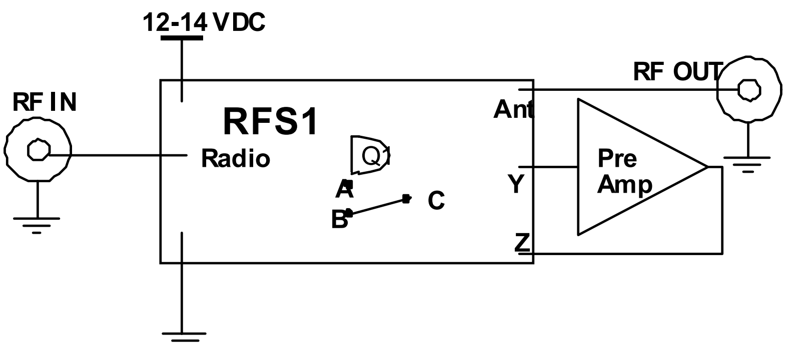
IF YOU'RE USING AN AMPLIFIER

- ❒ 19. Install a jumper from holes A to C on the PC board. Use a piece of left over clipped-off component lead for this. Transistor Q1 is not used.
- ❒ 20. If you wish to send DC power up the transmission line to power the RFS1, install JMP1 using a scrap piece of clipped-off component lead; if not then leave this jumper out.
- ❒ 21. Now is a good time to check solder joints and part orientations for proper installation. Check for cold solder joints or solder bridges.

To Connect an Amplifier :



To Connect a Preamplifier :



Follow these simple diagrams to connect your RFS1 to a preamp or amplifier. Use coax only and make sure the shield conductor on the coax and center conductor are as short as possible when soldered together.

FREQUENCY CONCERNS OF L1

If you are planning on powering your RFS1 through the transmission line instead of the power leads, notice that the value of L1 is going to be frequency dependent. Its purpose is to channel DC from the transmission line into the circuit, but block the RF from coming into the power. A coil has a certain resistance to RF called reactance. The larger the value of the coil, the more reactance it has at a particular frequency. The less frequency there is, the less reactance there is. So if you are working with HF, the coil provided will not be large enough in value.

What we are looking for is a coil with a reactance value larger than 1K ohms. To solve for this part value the formula is a relatively simple plug and chug. Put the value for your coil in "L" and frequency in "F". Remember to take the numerical values of your extensions into account such as Mega = 1 million and micro = .000001. The formula is as follows:

$$X = 2 * 3.14 * L * F$$

For example, to find the reactance of the supplied coil in the two meter band, plug in the numbers as follows:

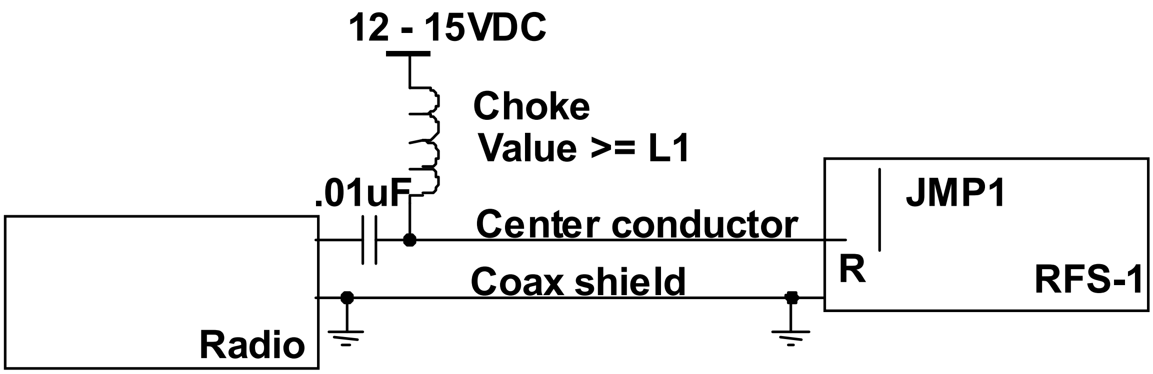
$$2 * 3.14 * .0000022 * 146520000 = 2025 \text{ ohms}$$

So we find the coil has a reactance of about 2K ohms in the two meter band. Rearranging the formula so we can find the value of a coil that has a reactance of 1K ohms at any frequency:

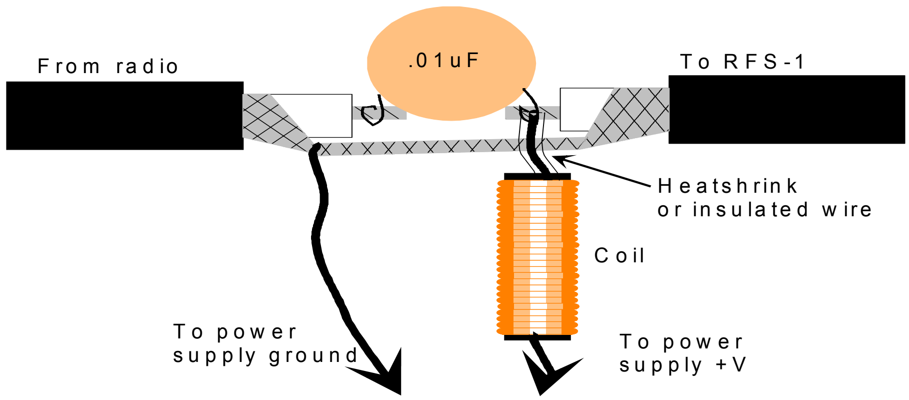
$$L = 1000 / (2 * 3.14 * F)$$

where F is the frequency you will be operating on. Use this value of coil for both at the power source and as L1 in the RFS1. Note the diagram for jumper setting and parts placement for feeding the power up the transmission line. The coil near the radio end of the coax should be mounted as close as possible to the connections on the coax to prevent unwanted radiation.

Block diagram :

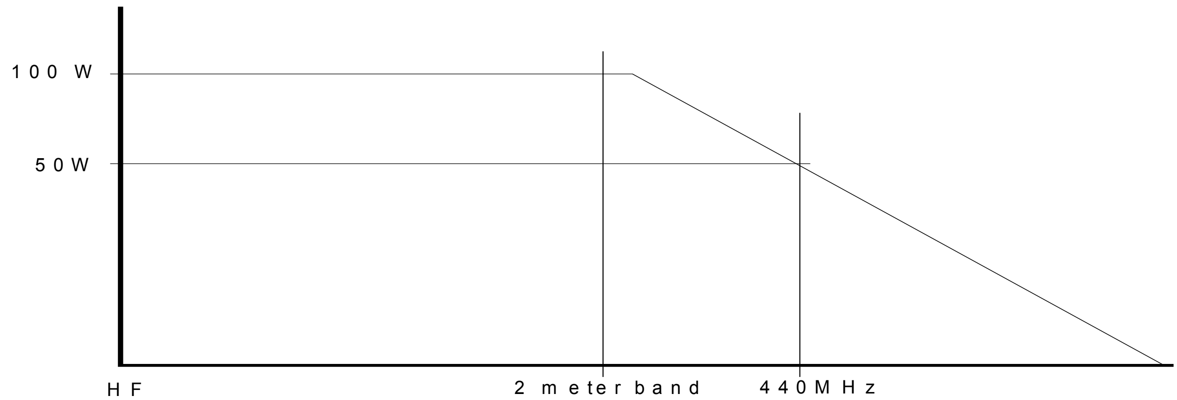


Hook up of coil near radio :



OPERATING NOTES:

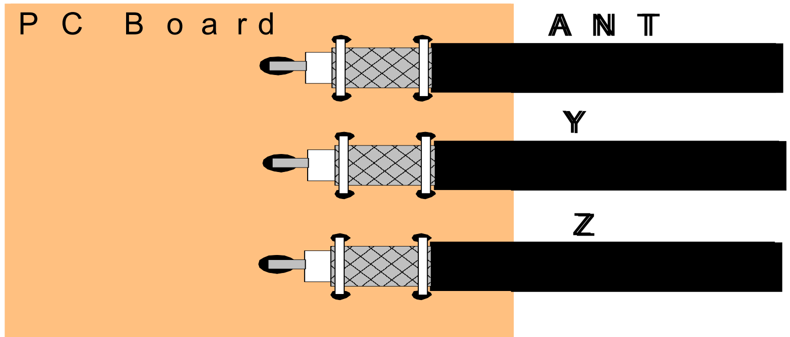
1. If the relay chatters, it is a sign of high SWR, which you will wish to resolve anyway by antenna system or amplifier output adjustments.
2. If the relay action is “sloppy”, there is insufficient RF to drive the RFS1 circuit. This may occur when using a “low power” HT setting.
3. The RFS1 will handle a range of powers depending on frequency. The following graph depicts the approximate maximum power you should use to operate the RFS1 to prevent overheating or other problems.



INSTALLATION NOTES

If you haven't noticed, the RFS1 has been designed in a way so that it fits well inside of 1 1/2 inch PVC pipe. You can fit it into an existing enclosure, or use a piece of 1 1/2 inch PVC plus two endcaps and some sealant to make a weather tight enclosure. Make sure all grounding connections are as short as possible and all coax shields are grounded as well. Use miniature RG-174 for best results.

Notice the four small holes around where each coax piece is to be mounted. The center conductor of the coax is soldered into the labeled hole, and the four small holes are where you may use pieces of scrap component lead to "strap down" the coax to the board. If you are planning on mounting the RFS1 within a PVC pipe make sure and thread the coax pieces



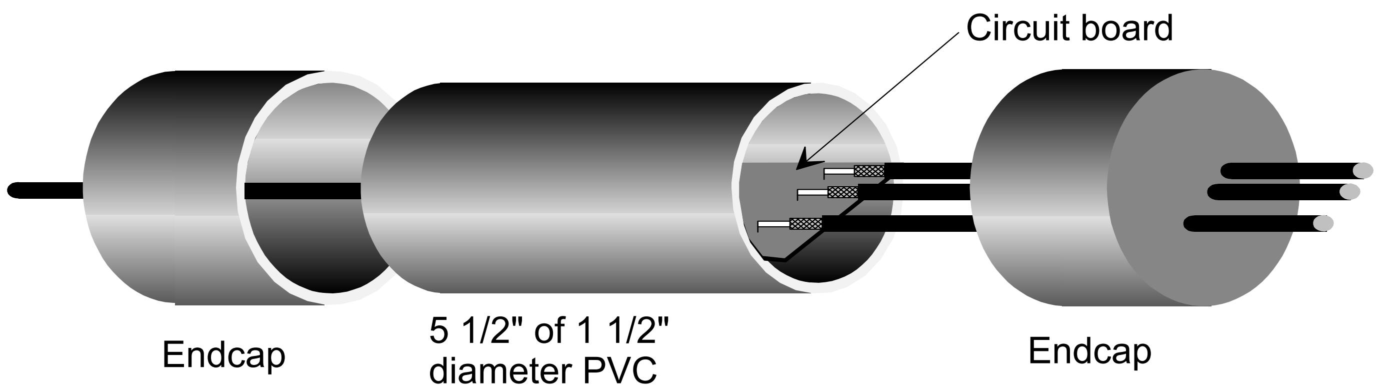
through the holes in the endcaps before soldering them to the board, especially if the wires are very long! Read the next section on PVC mounting also.

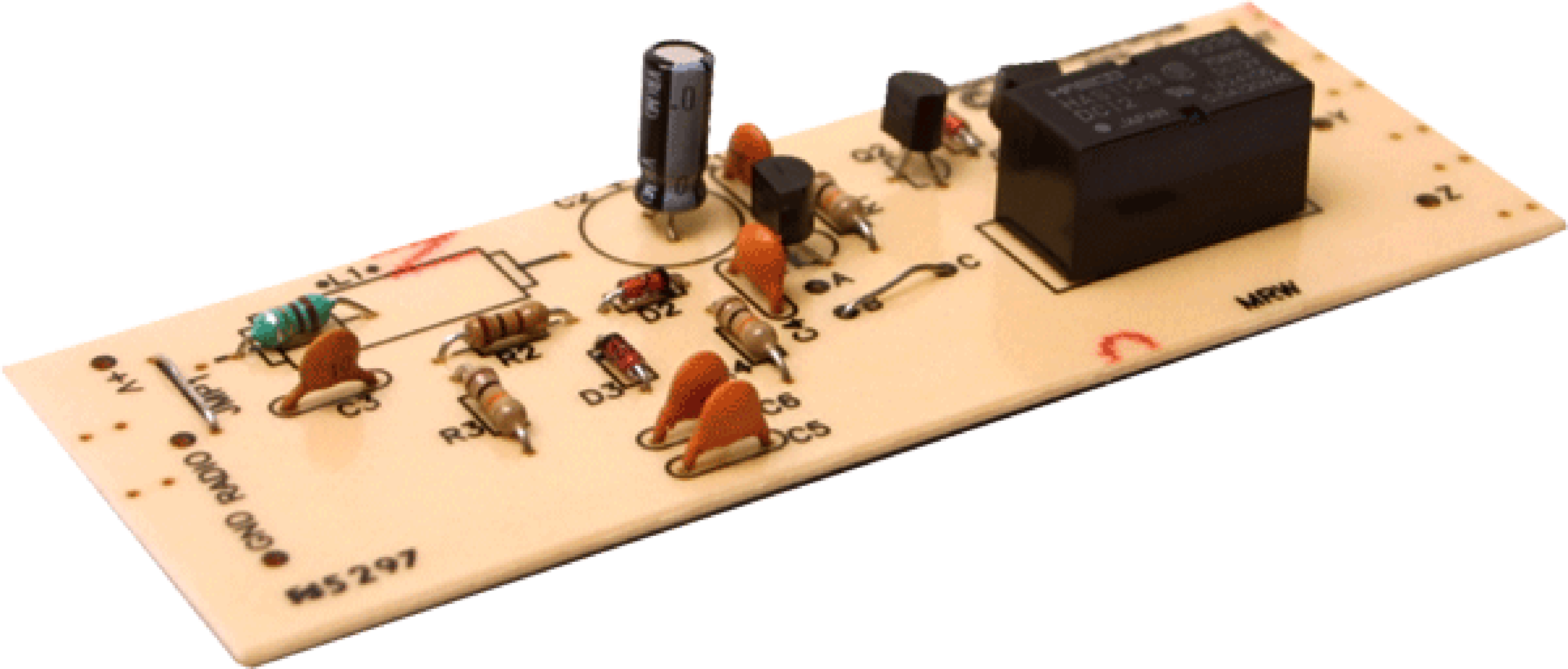
Once you have strapped down the coax to the board with the jumper wire, solder the jumper wire to the braid of the coax on top for a nice, mechanically solid solder joint. Don’t overheat when you’re soldering; you don't want the braid to melt through to the center conductor and short out a cable.

When you've got everything together, test out your wiring with a multimeter to make sure none of the coax pieces are shorted, and double check all of your parts placements, especially if you are feeding the power up the transmission line.

HINTS FOR PVC MOUNTING

Locate the parts indicated in the diagram in your local plumbing supply or hardware store. Cut a 5 1/2 inch piece of PVC pipe and set it aside. Drill the appropriate holes in the endcaps to thread the wires through, making sure the holes are only one size up in diameter from the wire diameter. After threading the wire through, place the circuit board in the pipe and then solder the wires to the board. If you forget to thread the wires, you'll have a long process of pulling wire through the holes. Don't use PVC glue to glue the pipes together since you'll never get them apart again. Instead, use silicon sealant or something water-tight like wax to seal up the remaining holes. When done, use pipe clamps to secure the RFS1 to a secure place.




R2
R3
D2
D3
C3
C5
C6
A
C
M5297