

## Separate Transmit/Receive Antenna Switching Phil Salas – AD5X

### Introduction

Sometimes it can be beneficial to use separate antennas for transmitting and receiving. As an example, a vertical antenna can be a great radiator on 160 and 80 meters, but it may also be a very noisy receiving antenna. So maybe the low-noise characteristics of a magnetic loop antenna or a beverage antenna may be desirable for receiving. Many higher-end transceivers have a separate antenna connector for a receive-only antenna. But my IC-706MKIIG, like many low-to-moderate priced transceivers, does not. However, it is not difficult to provide separate T/R antenna switching externally.

### Design Consideration

The T/R antenna switch uses a relay for antenna switching, under control of the amplifier interface available on most transceivers. Since lead lengths and their associated inductances are very forgiving at frequencies below 30 MHz, the important thing becomes the current rating of the relay contacts and the relay switching time, as it is important for the relay to fully energize before your transmitter puts out power. The heart of this unit is the Omron 3-amp SPDT relay called out in the parts list (Table 1). This relay has a specified maximum switching time of 5ms (3ms typical) so it is fully QSK compatible. The relay is so fast, however, if your transceiver continues to output RF AFTER the amp-key line goes high then you may hot-switch when you un-key if operating QSK. This shouldn't happen, but some ICOM radios do this (the IC-706MKIIG and IC-7000 – and maybe others). So unless you know for sure, operate your ICOM radio using semi-break-in on CW.

### The Circuit

Figure 1 is the schematic of the antenna switch. The input pin numbers correspond to the accessory connector pins on my IC-706MKIIG. The relay driver interface is high impedance (so it will work with the HSEND output of my IC-706MKIIG) and works with any transceiver that has a saturated transistor or relay that goes to ground for enabling an external amplifier. On the IC-706MKIIG/7000, the HSEND output is a bi-directional output that should only drive a high impedance load, and should not be pulled up above 8-volts. For all other transceivers just connect the +8V point to a +13.8V input as shown by the dashed line on the schematic. The LED shows when the TX antenna has been selected. You can add a SPST switch in series with the either the +8 or +13.8V inputs to disable the switch when desired. I found it just as easy to unplug the interface cable to the transceiver when the separate antenna switching is not needed. I used SO-239 connectors for the RF interfaces, and a Molex 4-pin miniature connector for the control signals. All circuitry is wired on two terminal strips. The relay and LED are mounted by hot-gluing them to the bottom of the aluminum box. Photos A and B show the inside and outside of the transmit/receive antenna switch.

### Conclusion

If you have a separate receive antenna and your transceiver doesn't have a separate receive-only antenna connector, this switch will inexpensively solve this problem.

Table 1: Parts List

QTY	Description	Source	Price ea.
1	2.7x2.2x1.6" AL box	Mouser 546-1411BU	\$3.30
1	SPDT 3-amp relay	Mouser 653-G6E-134P-DC12	\$3.25
1	4-pin Molex plug	Mouser 538-030-06-2043	\$0.77
1	4-pin Molex socket	Mouser 538-03-06-1044	\$0.77
4	0.062 F contacts	Mouser 538-02-06-1103	\$0.19
4	0.062 M contacts	Mouser 538-02-06-2103	\$0.19
2	Terminal Strip	Mouser 158-1005	\$0.55
3	SO-239 connectors	All Electronics SO-239	\$1.00
1	2N2222A transistor	All Electronics 2N2222A	2/\$1.00
1	2N3906 transistor	All Electronics 2N3906	5/\$0.75
1	Ultrabright red LED	All Electronics LED-94	\$0.75
1	10K resistor	All Electronics 10K-1/4	5/\$0.50
3	1K resistor	All Electronics 1K-1/4	5/\$0.50
1	1N4001 diode	All Electronics 1N4001	15/\$1.00

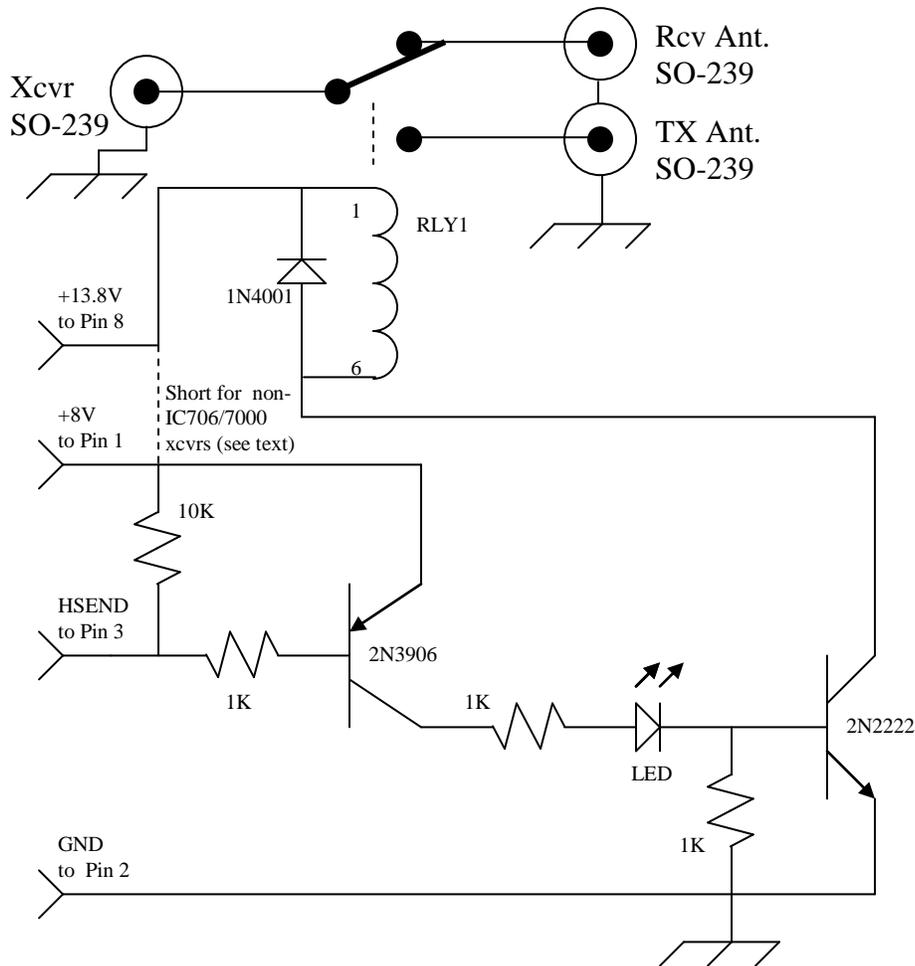


Figure 1: Schematic - Separate transmit/receive antenna switch

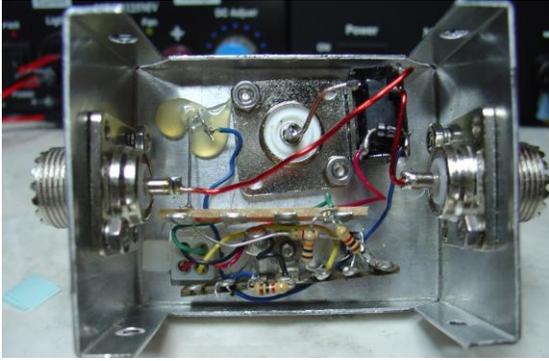


Photo A: Inside Wiring



Photo B: External view