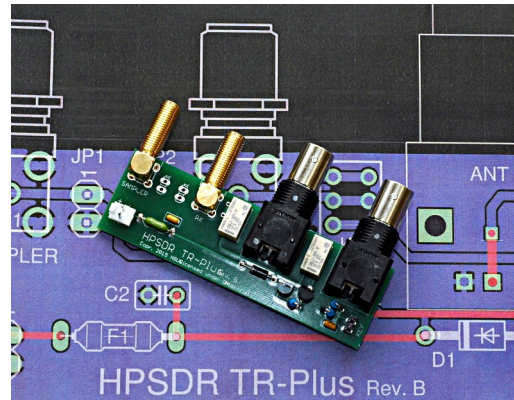


# TR-Plus T/R Switch Assembly and Operation Manual

Revised: 7 February 2015

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## Introduction

The TAPR TR-Plus is a transmit/receive (“T/R”) switch that connects a receiver and transmitter to a common antenna. In addition to that basic functionality, it also allows an external coupler to feed a sample of the transmitted signal back to the receiver. This capability is required to use the “Pure Signal” adaptive distortion available in the PowerSDR Software. Pure Signal uses this sample to digitally pre-distort the transmitted signal to compensate for non-linearity in the amplifier system. It can reduce intermodulation (“IMD”) products by 10dB or more.

The TR-Plus is provided as a kit. The circuit board is 3.25 inches wide, and 1 inch high. All parts are through-hole.

## Circuit Description

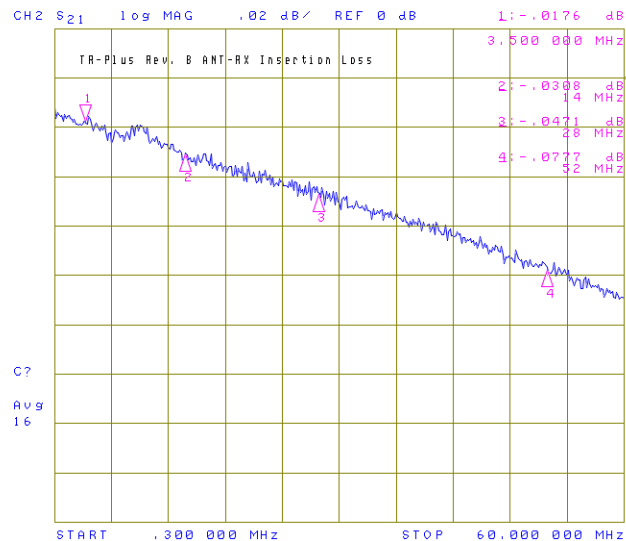
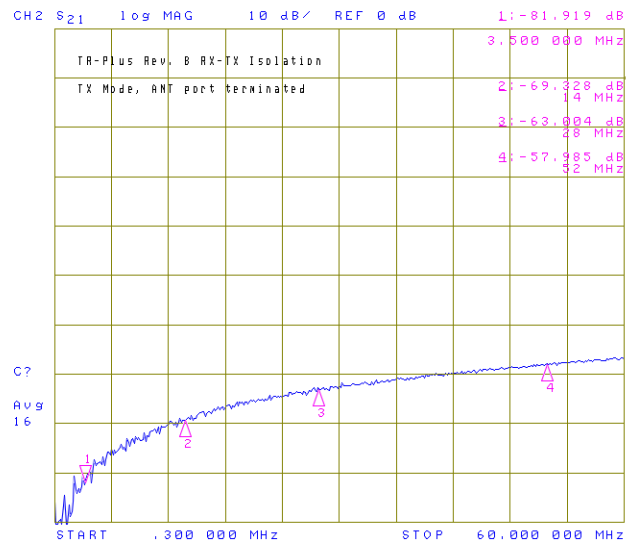
The TR-Plus circuit is very simple. Two relays are switched by a pair of transistors. On receive, the RECEIVE SMA connector is routed to the ANTENNA BNC connector. On transmit, the TRANSMIT BNC connector is routed to the ANTENNA BNC connector, and the SAMPLE SMA connector is routed to the RECEIVE SMA connector.

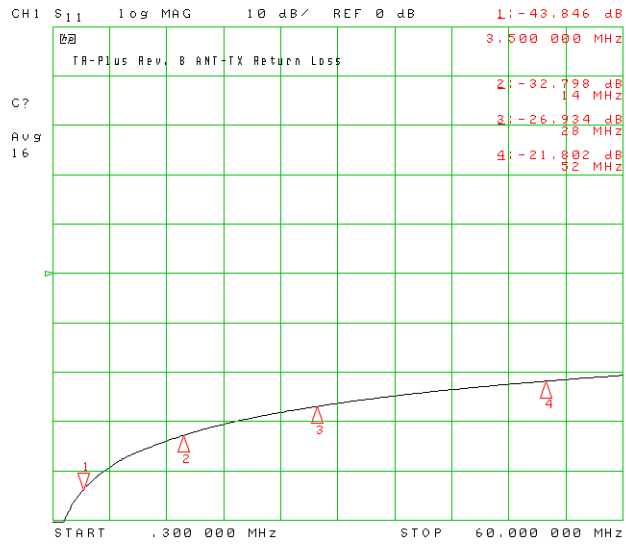
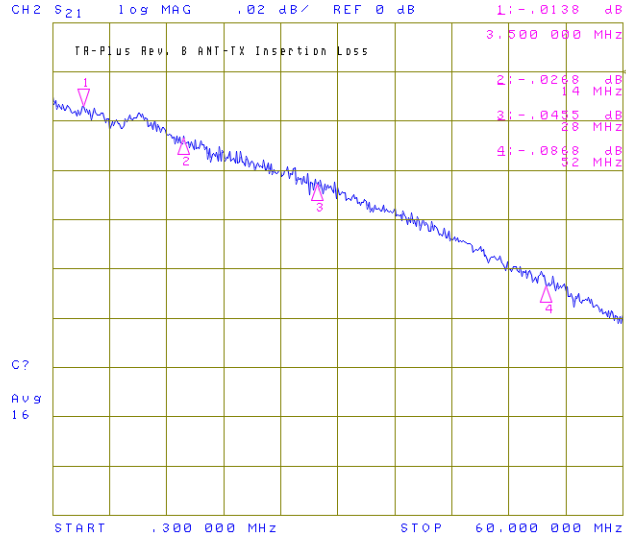
The board requires 12V DC input at JP4, and keying is activated by shorting pin 1 of JP3 to ground.

JP1 and JP2 are optional and are not normally fitted. They are useful if you wish to use coax connectors that are not mounted directly to the board. These 0.1 inch spaced pads provide for an easier hook-up than trying to solder to the SMA connector pads. (The signal pads for the BNC connectors are already on 0.1 inch spacing, so you may mount a header directly to them.)

# Typical Performance

Below are network analyzer plots of the TR-Plus from 0.3 to 60 MHz. For Pure Signal purposes, the most important criterion of the switch is the isolation it provides between the transmitter signal and the receiver input. This plot shows that isolation, which is at least 60dB through 10M; this is adequate for 100W operation. At 6M the crosstalk level increases, but should still be usable. Other important criteria for an antenna switch are its insertion loss and return loss (VSWR).





# Preparation

The TR-Plus kit includes the printed circuit board and a bag containing components. Check the envelope against the parts inventory below. If anything is missing, contact the TAPR office.

Refer to the layout diagram for clarification of parts placement. All references to up, down, left, and right assume that you are looking at the PCB with the "TR-Plus" text and copyright notice right-side up as you look at the board. All components are mounted on the top of the PC board.

Check your soldering iron to be sure the tip is in good condition. The tip should be the small conical tip type and must be clean. If you can't remember when you last replaced the tip, now would be a good time to do so.

All parts should be mounted as nearly flush to the board surface as practical without stressing the lead.

## Parts Inventory

OK?	Qty	Value	Part
	2	0.1uF	C1, C2
	1	1N4004	D1
	1	0.5A PICO FUSE	F1
	2	BNC jack and hardware	J1, J2
	1	2-pin Molex header	JP1
	1	2-pin Molex connector	--
	2	Molex crimp pins	--
	1	2-pin header	JP3
	1	2-pin connector	--
	2	Crimp pins	--
	2	Omron G6J-2P-Y-DC12 relay	K1, K2
	2	10K	R2, R3
	1	47K	R1
	2	SMA jack and hardware	X1, X2

## Assembly

Assembly of the TR-12 should be straight-forward. It's easiest to mount the flattest parts first. An order like this seems to work well: F1, D1, C1, C2, Q1, Q2, R1, R2, R3, JP3, JP4, K1, K2, X1, X2, J1, J2. If you are installing the SMA connectors at X1 and X2, JP1 and JP2 should not be fitted.

When installing SMA connectors X1 and X2, note that the mounting holes on the board are quite a bit larger than the posts on the connectors. Take care when soldering to align the connector so that it is straight and level. It's best to solder one pin first and check alignment, correct if necessary, and then solder the remaining posts.

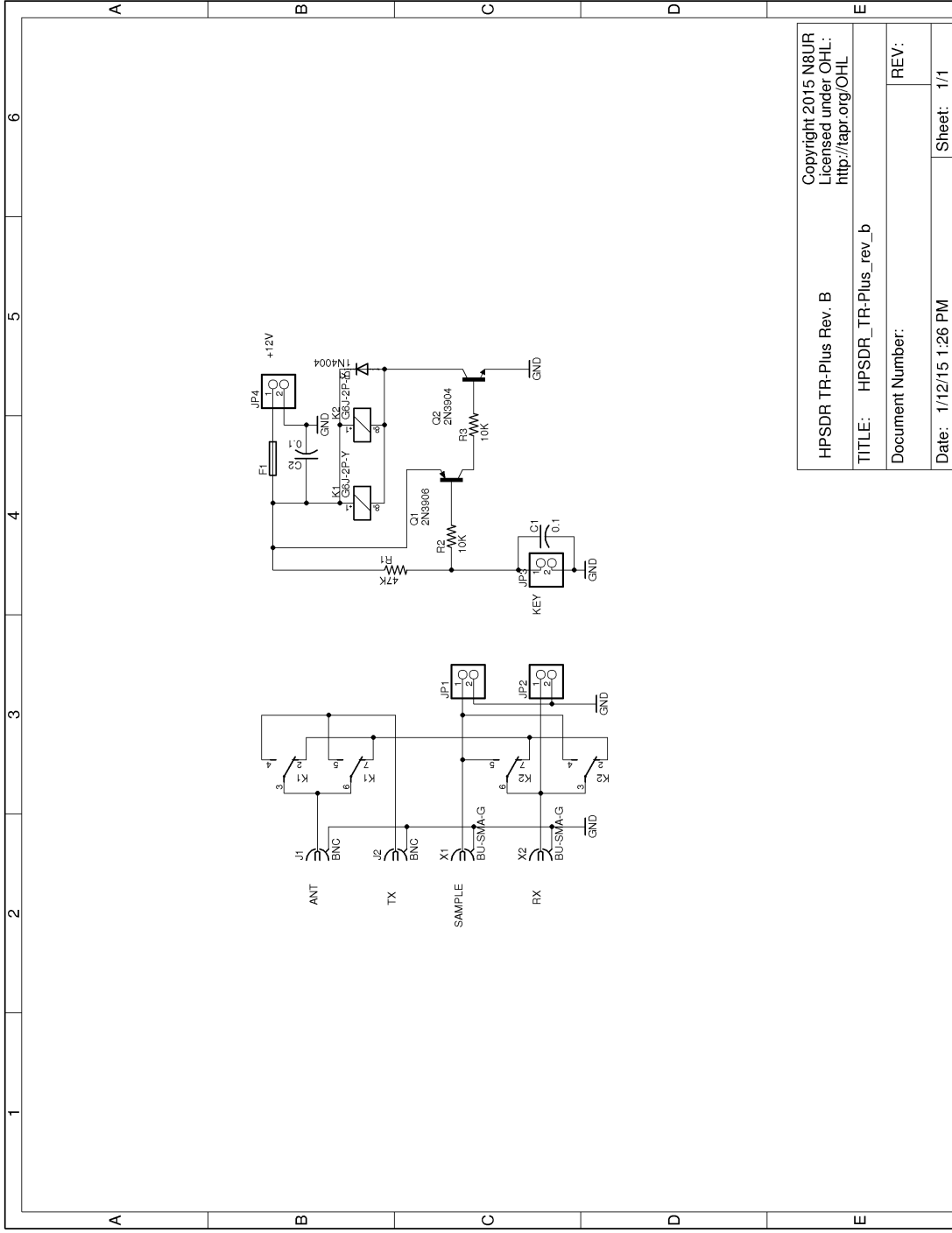
# Installation and Use

Apply 12 volts to the power input connector (JP4). Shorting pin 1 of the KEY connector (JP5) to ground will cause the relays to close.

JP1 and JP2 are normally **not** installed. They are intended to allow easy connection of a 0.10 inch spaced header if the SMA jacks are to be mounted off the board and hooked up with coax. The signal pins on the BNC jacks have standard spacing and a two-pin header may be directly installed instead of the BNCs.

If you wish to mount the TR-Plus in an enclosure, the 4 RF connectors are spaced 1.00 inches apart. The two BNC connectors have higher centers than the SMA connectors. The SMA connector hole center is nominally 4.65mm (0.183 inch) above the top of the PC board. The BNC connector hole center is nominally 8.59mm (0.338 inch) above the top of the board. So, a mounting panel should center the SMA holes 3.94mm (0.155 inch) **below** the BNC holes.

[ Someday there will be a mounting panel template here. ]



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HPSDR TR-Plus Rev. B

TITLE: HPSDR\_TR-Plus\_rev\_b

Document Number:

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Date: 1/12/15 1:26 PM

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