VE3PSZ Receiver Multicoupler V3 – Tom Seeger February 2025

There are several HF multicouplers available on the market today. The following paper describes a simple, high performance LF-HF active multicoupler that also includes overload protection and bias-tee. Unlike most other multicouplers, with this design there is no need to terminate unused ports as there is essentially no interaction between ports. Figure 1 shows an example of the PCB inside a small aluminum Hammond box. Blank PCB's, or completely built and tested units are available from me. Contact me for price and availability at: thomas.b.seeger@gmail.com

Circuit Description
Figure 2 shows the schematic of the multicoupler.
The antenna is connected to J1. R13 is there to bleed off snow, wind and rain generated static electricity. D1 is a transient voltage suppression diode to reduce the likelihood of damage from nearby transmitters or lightning transients. R1 sets the input impedance to 50Ω. U1 is a high speed, ultra-low noise operational amplifier. The (+) input is set at 1/2 supply via R1 from R3 and R5. R4 and R6 provide negative feed back with a gain of 2. Since the signal output goes through 50Ω resistors to the 50Ω feed line and receiver, the signal gain of 2 is effectively halved, setting the overall gain back to unity. Receiver protection can be enabled by shorting JP-2. This will limit the output signal to about +6 dBm, but some distortion may occur just below that. U2 is a low noise, low drop out 10V regulator. Power to the circuit is provided at J2 and is reverse polarity protected by D4. The internal bias-tee can be enabled by shorting JP-1. F1 is a self resetting fuse in the event that the bias-tee load is shorted. Current consumption is under 50mA plus any load on the bias-tee. Full performance is achieved with supplies as low as 10V but should not exceed 18V. Note that the bias-tee voltage is not regulated and will depend on the dc power supply voltage. A bias-tee load of greater than about 170mA will cause the re-settable fuse to trip. Removing power or load for 15 seconds will reset it.
Be careful to never transmit directly into an input or output port as this <u>will</u> damage the multicoupler.

Specifications:

Input / Output impedance:	50Ω
Gain:	0 dB (with 50Ω loads)
Frequency Response:	+/-3 dB from 20 kHz to 90 MHz (-40dBm test level)
Port-Port Isolation:	Greater than 50dB @ 1MHz. Greater than 30dB @ 25 MHz.
IMD @ 0 dBm, 4 loads:	1 MHz +81 dBm OIP2, 7 MHz +62 dBm OIP3, 2 MHz +41 dBm OIP3, 5 MHz +37 dBm OIP3
Compression P1dB:	+20 dBm @ 1MHz, 1 port loaded.
	+14 dBm @ 1MHz, with all 4 ports loaded with 50Ω.
	+6 dBm with receiver overload protection jumper installed.
Noise:	16 dB
Power Supply:	12 Vdc @ 50 mA (plus bias current if used).
PCB Dimensions:	1.25 inches x 2.2 inches (31.7 mm x 55.9 mm).

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Figure 1 – Example of the PCB mounted in a Hammond 1590BFL box.
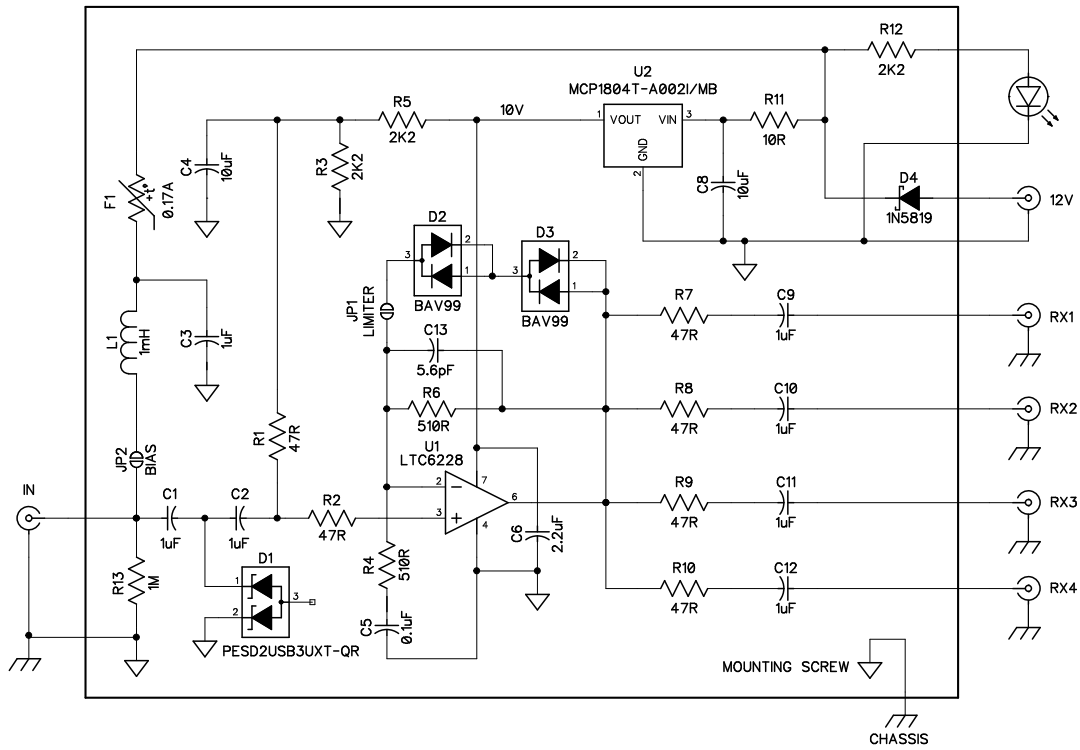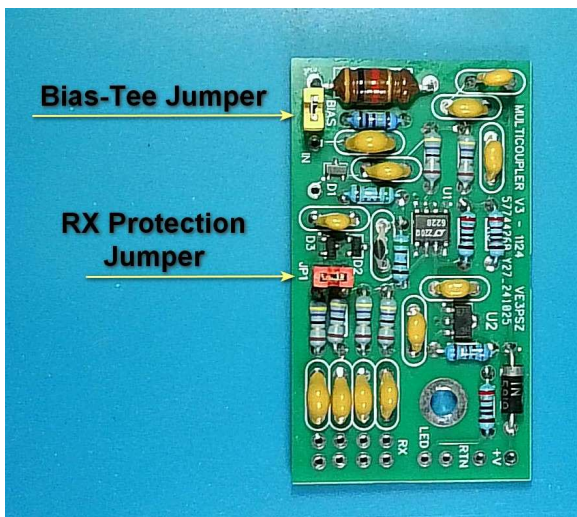
Figure 2 – Schematic

Figure 3 – PCB Jumper Locations

The **Bias-tee** is not enabled when shipped. To enable bias, reinsert the yellow jumper as shown.
The **RX protection** is enabled as shipped. Except for special circumstances, the red jumper should remain as shown.

Parts List:

Ref	Value	Type	Description	Mfg P/N
C1, C2, C3, C9, C10, C11, C12	1uF	50V	Ceramic	
C4, C8	10uF	50V	Ceramic	
C5, C7	0.1uF	50V	Ceramic	
C6	2.2uF	50V	Ceramic	
C13	5.6pF	50V	Ceramic	
D1	PESD2USB3UXT-QR		3V Transient Voltage Suppressor	Nexperia
D2, D3	BAV99		Dual Diode	
D4	1N5819		1A Schottky Rectifier	
F1	0.17A Fuse		Re-settable PPTC	Bourns MF-R017
L1	1mH		Inductor 0.20A	TDK B82144A2105J
R1, R2, R7, R8, R9, R10	47Ω	0.25W	Metal Film	
R3, R5, R12	2k2Ω	0.25W	Metal Film	
R4, R6	510Ω	0.25W	Metal Film	
R11	10Ω	0.25W	Metal Film	
R13	1M	0.25W	Metal Film	
U1	LTC6228IS8		Ultra Low Noise, Low Distortion amplifier	8-Pin SO-8 Package
U2	MCP1804T-A002I/MT		Low Dropout 10V Regulator	5-Pin SOT-89 Package

Note: Do not use electrolytic capacitors anywhere in this circuit, especially C6 or it may oscillate.