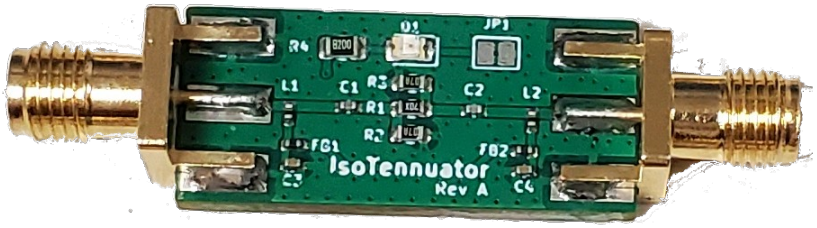
IsoTennuator Attenuator and UnBias Tee for the GNSS Unfiltered Splitter ("GUS") Assembly and Operation Manual

IsoTennuator – Revision A
Revised: 30 August 2023



Introduction

The IsoTennuator is an RF attenuator that incorporates a DC bypass path so it can be used with DC voltage present on the coaxial cable, as when a GNSS receiver is powering its antenna. The UnBias Tee is a DC block that includes LEDs to indicate presence of DC voltage. The GUS Accessory Kit includes 3 IsoTennuator boards – one each with 3 dB, 8 dB, and 15 dB attenuation – and one UnBias Tee board.

The main purpose of the IsoTennuator is to compensate for the gain of an in-line amplifier. For example, the LNA in the GUS antenna splitter has about 8 dB gain from input to each of the outputs. Sometimes that amplification results in too much signal for the receiver being used. Adding an 8 dB IsoTennuator at the antenna input compensates for the LNA gain.

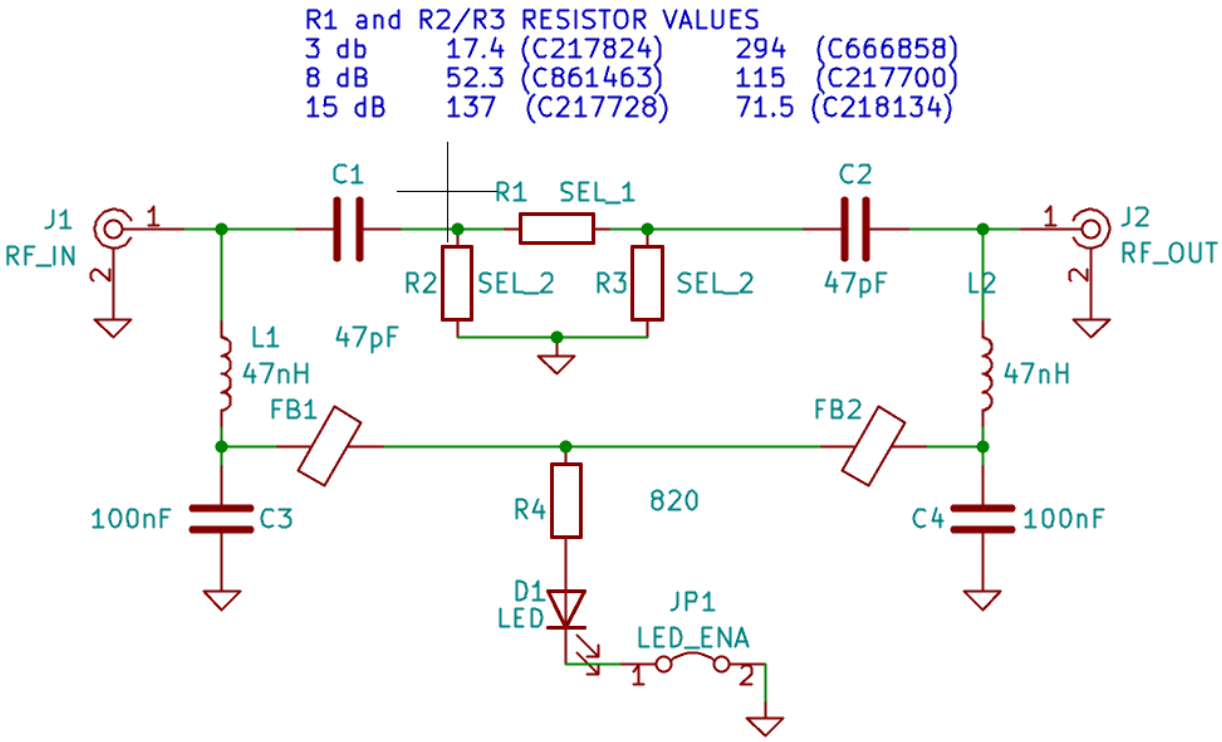
You can't use a standard attenuator for this application, because its resistors provide a DC path to ground which will draw power from the source, resulting in wasted power as well as a loss of voltage delivered to the antenna. The traditional way around this is to put a DC power injector ("bias tee") on either side of the attenuator to break the DC path but allow the RF signal to go through the attenuator. That's kind of messy, so the IsoTennuator combines those three elements on one small circuit board with SMA connectors.

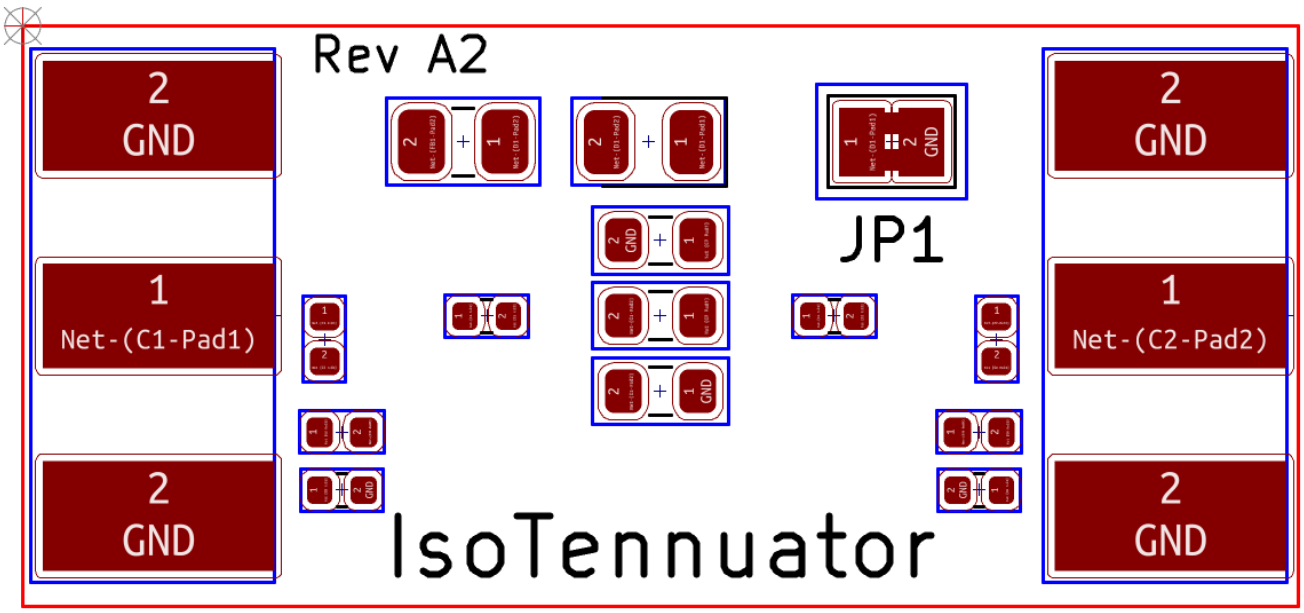
The UnBias Tee is a very simple board with SMA connectors that blocks DC but passes RF. It includes LEDs to indicate the presence of DC voltage on either port. It's useful if you want to prevent DC traveling upstream from a receiver or amplified splitter.

<u>IMPORTANT NOTE:</u> The IsoTennuator is *<u>not</u>* a precision device and shouldn't be used for measurements. The attenuation may be ±0.75 dB from nominal, and frequency response has not been checked outside the 1 – 2 GHz range.

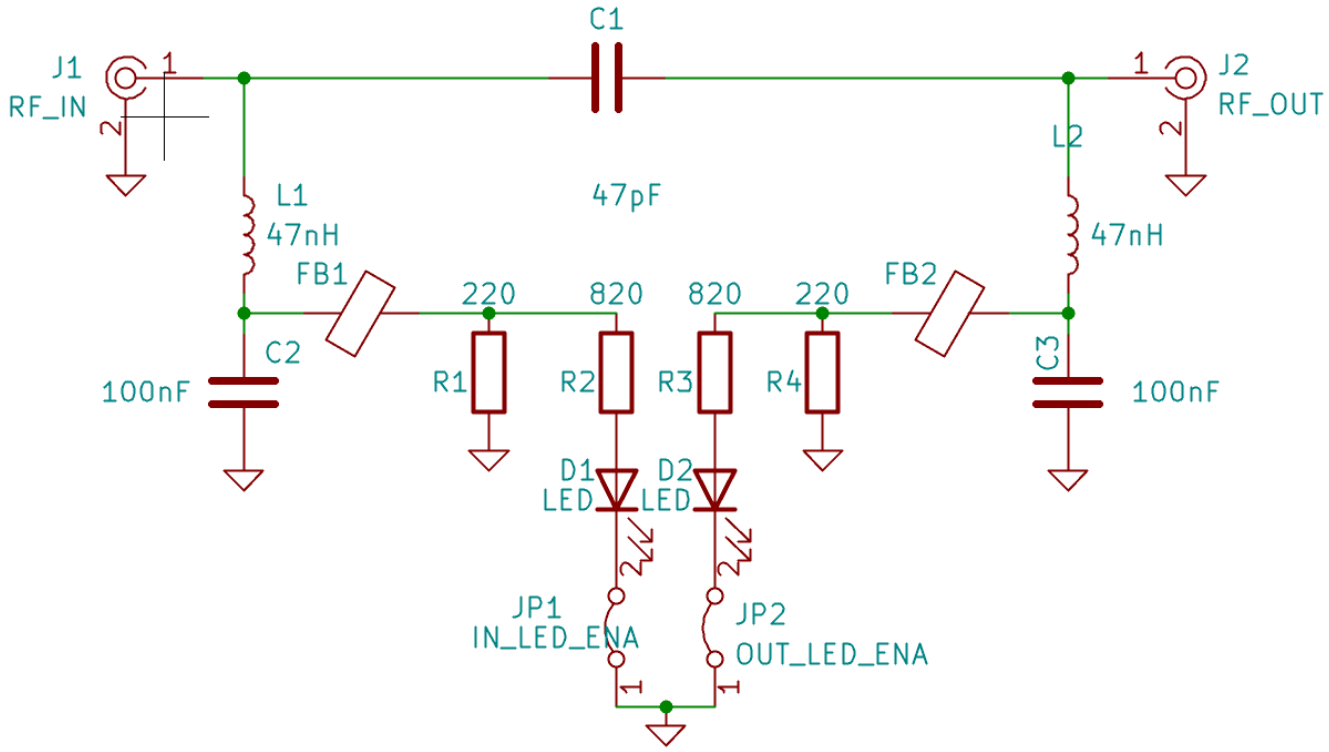
Circuit Description

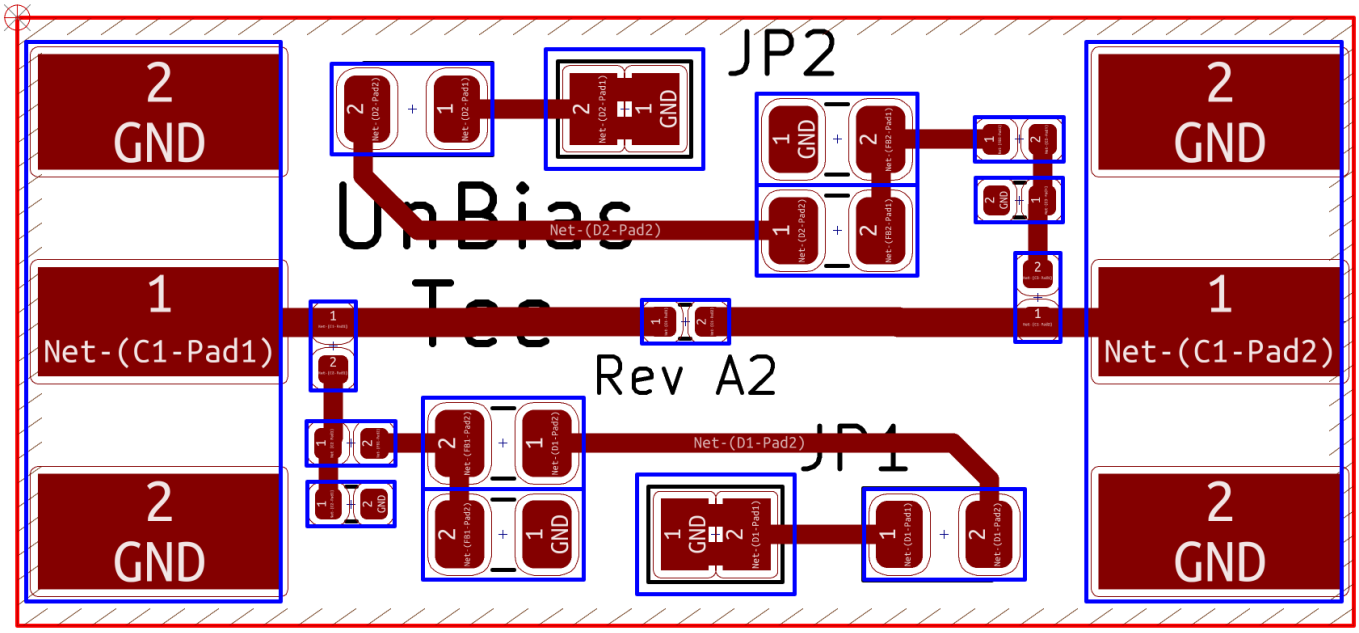
The IsoTennuator is very simple. It is a pi-configured attenuator protected from DC by C1 and C2. DC at J1 flows via L1, C3, FB1, FB2, C4, and L2 to J2. This path passes DC but blocks RF and is essentially two “bias tee” circuits connected back-to-back. LED D1 indicates that voltage is present. JP1 allows the LED to be disconnected to reduce current consumption.





The UnBias Tee is even simpler. It's simply a capacitor that blocks DC and passes RF. A bias tee on either side of the capacitor provides a DC load and lights an LED if voltage is present on that port. The 220 ohm resistors R1 and R4 mimic the DC load that an antenna would provide. This is to satisfy the antenna fault circuit in some receivers that expects to see current drawn from the antenna connector. Jumpers JP1 and JP2 may be used to disable the LEDs if desired to reduce power consumption.





Assembly

IsoTennuator and UnBias Tee assembly involves only soldering the two SMA connectors and optionally using a utility knife to cut the trace at JP1 (and JP2 for the UnBias Tee) to disable the LED(s).

The small size of the boards can make it challenging to keep the connectors in place while soldering. A clamp (I use a pair of pliers with rubber band putting pressure on the handles) or heat resistant tape can help keep the board in place. The connector bodies will become hot when soldering the ground pins; don't burn your fingers!

The kit includes a piece of ½ inch clear heatshrink tubing that can be cut to length and used to protect the circuit board after assembly.

Make sure you keep track of the attenuation of each board. Use an indelible marker to mark the appropriate value on the back of the board *before* adding the heatshrink..

The resistors are 0603 size (*i.e.*, tiny) and you'll need a good magnifier to read their values. An easier way to identify the boards may be to measure the resistance across R1 (the middle resistor).

Attenuation	**Center Resistor (R1)**	**Top and Bottom Resistor (R2/R3)**	**Measured Resistance**
3 dB	24X	46A	16.9 ohms
8 dB	70X	07A	42.8 ohms
15 dB	14A	83X	70.0 ohms

In the table, "Measured Resistance" is the ohmmeter value between both sides of the center resistor (R1).

The resistors have 1/10 watt ratings, so the IsoTennuator is a receive-only device and **should never be connected to a transmitter**.