

QRPGuys Noise Bridge User Guide

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K7QO

December 9, 2016

Abstract

This document provides a simple guide for the K7QO noise bridge and guidelines for its use and prevention of damage to the circuit.

1 Introduction

White noise, which is defined as noise with constant power spectrum, is useful for measuring and testing wide-band communication circuits. Commercially available white noise generators are usually very expensive. The design of the noise generator is an inexpensive method that produces white noise up to several hundred MHz.

This white noise generator is based on the avalanche noise generated by a zener breakdown phenomenon. It is created when a PN junction is operated in the reverse breakdown mode. The avalanche noise is very similar to shot noise, but much more intense and has a nearly flat frequency spectrum (white).

If you look at the schematic diagram, you will see R1 sets the operating point in the avalanche mode for the zener diode D2. This causes the white noise spectrum to be generated at a low level. Three stages of RF amplification follow to generate a noise level high enough for easy use. Most noise generators use two levels of amplification, but three stages of amplification provide a larger amplitude.

The noise signal is fed to a trifilar wound toroid transformer. Two windings, B and C, form a bridge output that is fed to the 51 ohm dummy load and to the antenna. Since the receiver is at the center node, the noise in the receiver will be loudest when there is an

impedance imbalance between the 51 ohm load and the impedance of the antenna. If the antenna impedance is 51 ohms, then the noise signal generated across the 51 ohm resistor and the antenna will exactly cancel each other and nothing will be heard in the receiver. The louder the noise level heard in the receiver the greater the impedance difference.

If you are using an antenna coupler, then tune for minimum noise level to get the minimum SWR.

The capacitors C5 and C6 provide DC isolation in case there are DC voltages present on the receiver or antenna terminals. This prevents high current levels that could result in damage to the bridge.

Schematic:

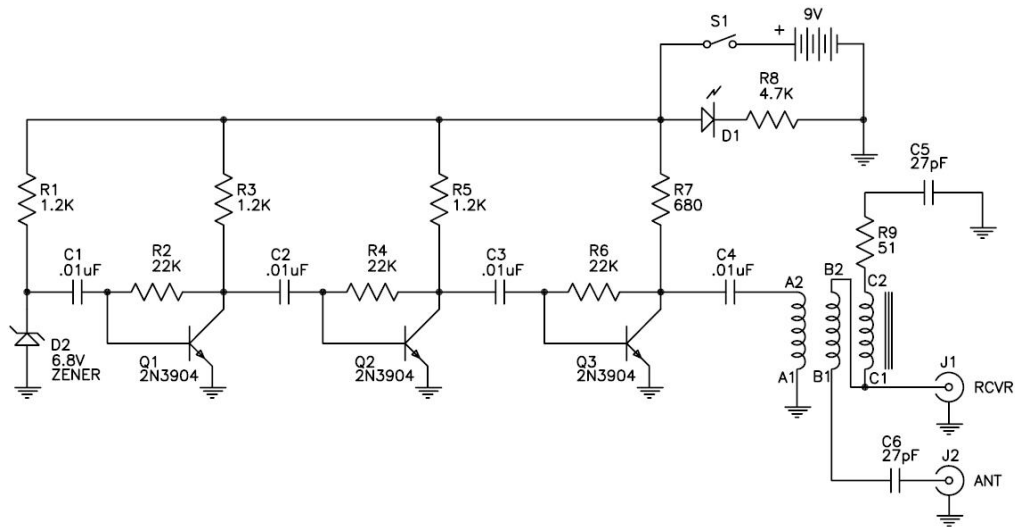


Figure 1: K7QO Noise Bridge Schematic.

2 Useage

Use of the noise bridge is very simple. Just attach a receiver to the BNC connector labeled receiver and connect your antenna tuner/coupler to the antenna terminal. Then turn on the noise bridge and receiver and tune the coupler for minimum noise for the band of operation.

IMPORTANT. Please remove keyer and/or paddle from the transmitter before hooking up everything. Do not transmit ANY power at all into the noise bridge. You will most likely destroy the 51 ohm resistor, the power LED and one or more transistors. There is no telling how many noise bridges have been destroyed in this manner. You have been warned. If you do do this, please let me know how many parts you had to replace.

Another use for the noise bridge is for the alignment of the receiver. Typically you hook up a newly built receiver and feed it a signal or connect to an antenna and find a signal and tune the front end for maximum signal strength. You can do the same thing using the noise bridge without an antenna connected and tune for maximum noise level in the receiver.

With the receiver and noise bridge connected together and no antenna. If you have an audio spectrum program on your PC, with the audio output from the receiver into the program you can get a response curve giving you some idea of the bandwidth of the receiver filters.

We hope you enjoy the noise bridge and find numerous uses for it in your shack and on your workbench. Thanks for your support.

3 RF Levels by Ham Band

For an expected noise signal level by ham bands for HF frequencies the following measurements were made.

The measurements were made using a TenTec Corsair I with a calibrated S-meter. This was achieved by using a Wavetek 3010 RF signal generator with an output level of $50\mu\text{V}$ RMS on each band. The $50\mu\text{V}$ signal was fed directly into the antenna terminal of the receiver and the meter response was read and is shown below.

The measurements were double checked with an old Elecraft XG-1 signal generator at 7.040MHz and an exact match of an S9 signal reading was obtained.

Measurements were also made on the 80m, 40m, 30m and 20m bands using an old NorCal S9 signal generator and again S9 readings were obtained.

The 2.8KHz SSB filter was used for these measurements in the SSB receive mode. A different filter bandwidth will result in different results, so be careful in reporting your results for different receivers. These results are to be used as relative values and not to be meant as values to be expected in all cases.

1.8MHz	+15dB/S9
3.5MHz	+15dB/S9
7.0MHz	+12dB/S9
10.0MHz	+12dB/S9
14.0MHz	+11dB/S9
18.0MHz	+10dB/S9
21.0MHz	+8dB/S9
24.5MHz	+5dB/S9
28.0MHz	+5dB/S9