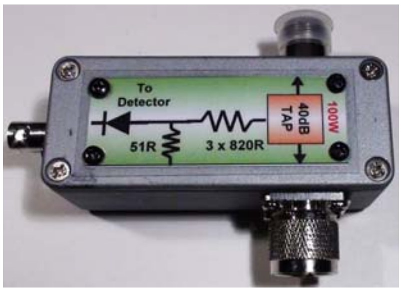


VK3AQZKITS

TAP40 KIT

Introduction and description.

The maximum power the RFPM1 power meter can handle is +16dBm, or 40mW.

However, there are times when a radio amateur may need to measure higher power levels. Handheld transceivers, HF rigs, linears, etc. all generate considerably more than 40mW.

The RFPM1 can be used to measure higher power levels with the use of attenuators.

For example, a 100W signal can be reduced to 10mW by use of a 40dB attenuator.

However, the attenuator input section must be capable of dissipating 100W.

High power attenuators, capable of working up to 500MHz do exist but they are expensive and require mounting in a substantial heat sink.

Other methods of reducing signal levels, is to use resistive taps, coupling loops, ferrite transformers, etc.

A low cost but quite effective solution is the use of a "T" tap resistive divider attenuator. However an external dummy load capable of handling the full power is required to be connected to the "through" section of the tap.

Most radio amateurs will already own a dummy load to suit their equipment.

The article "Simple RF Power Measurement" by W. Hayward and R. Larkin, published in QST, June 2001, contains a simple design capable of working upto 500MHz, flat within a fraction of a dB, if the unit is constructed exactly as per the details in the article. See reference 1.

The 40dB tap consists of a resistive voltage divider with the series arm containing 3 off, 820 Ω 1/2W carbon film resistors (=2460 Ω), and a shunt arm consisting of a 51 Ω resistor in parallel with the 50 Ω resistance in the RFPM1 probe connected across it (=25.25 Ω).

The total resistance of this combination is 2482.25 Ω and is in parallel with the 50 Ω external dummy load.

The result is that the voltage feeding the probe is very close to 1/100th that coming from the transmitter, or -40dB.

NOTE: A voltage drop to 1/10th equals a reduction of 20dB and 1/100th equals a further 20dB. This voltage drop of 40dB results in a power drop of 1/10,000th which is also a 40dB drop in power. So 100W is reduced to 10mW.

Due to the high resistance value of the series arm, the current will be low (around 28mA RMS). So the power rating of the resistors need only be ½W.
A 100W signal across 50 Ω has a peak to peak voltage of 197 volts. So the 3 off 820 Ω resistors will need to with stand around 66 volts peak to peak each.

If the tap is required to handle more than 100 W it may be necessary to increase the wattage of the 820 Ω resistors to 1W or 2W, or more.

The 40dB Tap is housed in a Hammond 1590A diecast metal box.
Type N connectors are used for the pass through connectors in order to maintain the UHF response. If UHF performance is not required, then SO239 or BNC connectors can be used.

The feed to the power meter can be a BNC connector. SO239 or N connectors can be used but they are slightly too big for the case at the bottom end resulting in the mounting screw nuts not clearing the internal pillars fully. The kit will come with a BNC female connector for the detector feed.

The pass through connection is a flat piece of metal or PCB material 38x25.4mm soldered between the connectors. These dimensions are chosen so as to maintain a 50 Ω transmission line through the box.

In order to obtain a flat response up to 500MHz, a small gimmick capacitor is placed alongside the first 820 Ω resistor. This capacitor consists of a 15.2mm long #22 AWG insulated wire.
However, exact adjustment of this UHF boost capacitor, would require a laboratory grade instrument. Following the this design to the letter does provide a very good result.

The tap can be constructed in many ways, with a variety of enclosures, connectors and parts.

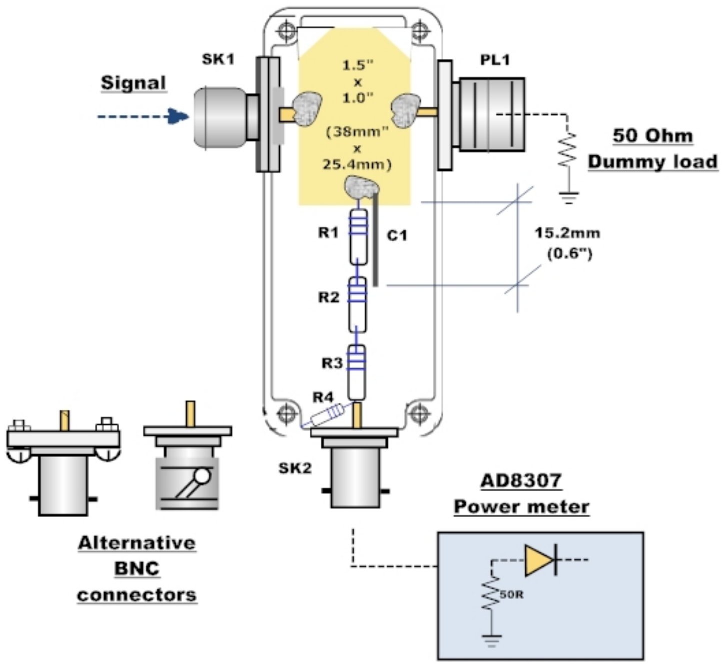
However, unless you have excellent test equipment, it is advisable to follow the original design.
If the tap is only to be used at HF, then you can build a tap to suit parts you may already have.

Please refer to the original article for more details.

Below is a drawing of the tap. R1 to R3 = 820 Ω 1/2W 5% carbon film resistors. R4 = 51 Ω 1% metal film resistor. Unfortunately, precision carbon film resistors are not readily available so 5%, 820 Ω resistors are used instead. The 820 Ω resistors used in the prototype were selected to add up to within 20 Ω of the nominal value of 2460 Ω with a digital multimeter. This is within 1% of the required value. With these values, the attenuation was very close to 40dB and quite satisfactory.

The TAP40 kit will have preselected resistors in order to achieve the 1% of the nominal values.

40dB TAP



Kit contents and tools.

Before starting to assemble the kit, check that all the components have been supplied.

Refer to the “Component list” for details.

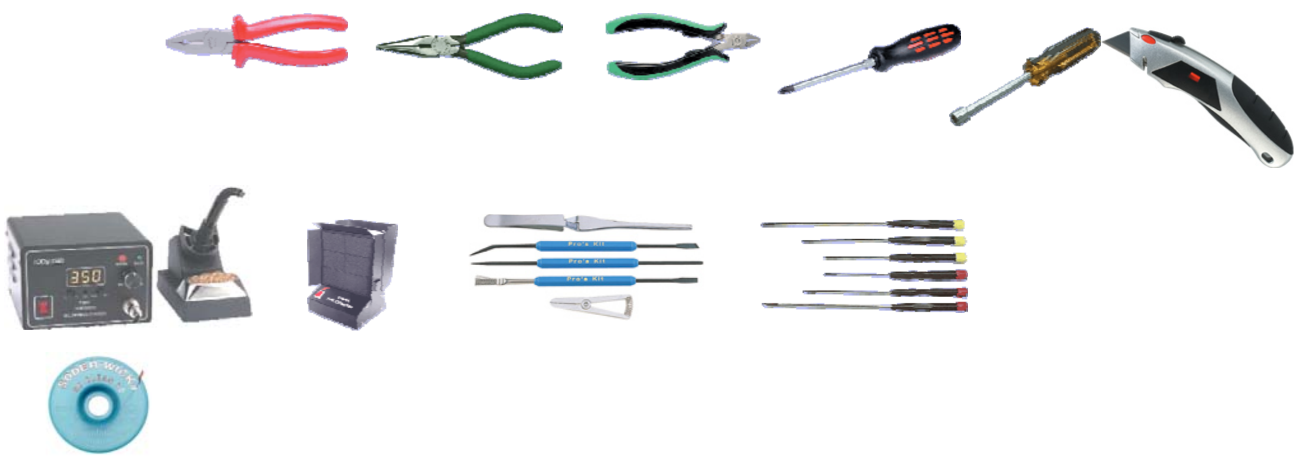
Assuming all the components are there, and correct, you can commence the assembly process.

You will need the following tools:

A soldering iron with normal tips, a pair of fine tipped side cutters, small and medium sets of pliers, a set of cross head and flat blade screwdrivers of various sizes, a 3mm nut driver, an alignment tool set with a small flat blade for trimpots. A small open ended spanner with an opening of 12mm may be needed if the BNC connector supplied is a chassis nut fixing type. However, small flange connector will be the preferred type.

A 12 V PC fan running from a battery or plug pack maybe suitable for blowing away fumes if the soldering rate is low enough.

Tools



Test equipment

Assembly.

1. Fit the connectors into the case. The BNC connector may be a small flange type fixed with 3mm x 10mm bolts or a 12mm nut depending on supply. The case will be supplied to suit.

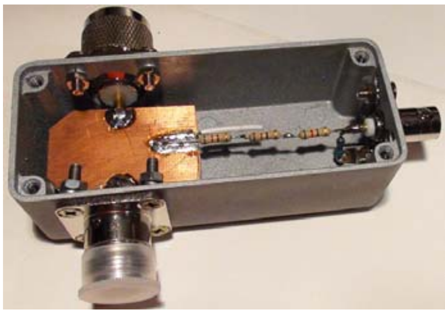
2. Solder the pass through plate between the input and output pass through connectors.

3. Solder in the 3off 820 Ω resistors. Trim the leads short. Fit the 51 Ω resistor across the detector connector.

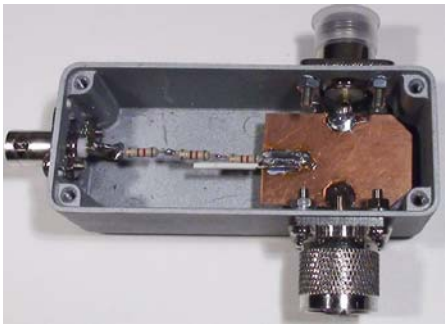
4. Fit the gimmick capacitor using a short piece of #22AWG insulated wire as per the diagram. A length of around 20mm can be used. Strip back around 4.8mm and solder to the plate right next to the first 820 Ω resistor. You should have 15.2mm of insulated wire resting alongside the body of the resistor.

5. Fit the label to the lid.

6. Attach 4 off rubber feet to the base.



That completes the construction of the tap.



References:

1. W. Hayward, W7ZOI, and R. Larkin, W7PUA, "Simple RF Power Measurement," QST, June 2001, pp 38-43.

First issue 9/3/2014
Updated: Nil

==

VK3AQZKITS

30 Regency Drive, Wonthaggi, Victoria,
AUSTRALIA, 3995
Tel: +61 03 5674 4743
Fax: as above
Email: vk3aqzkits@dodo.com.au
Web: www.vk3aqzkits.com