



Coaxial 50 Ω Dummy Load for Transmitter testing and RF experiments

Brief Description

Many thanks for purchasing this dummy load, it has been designed to provide a 50 Ω impedance to a radio transmitter to allow off air tests and experiments.

Constructed of high quality PCB material and using 20 x 1KΩ 3 Watt Metal or Carbon Film resistors the load displays the following SWR parameters:

MultiSWR		MultiSWR	
3895 kHz	1.01	3895 kHz	1.01
7000 kHz	1.02	7000 kHz	1.02
10000 kHz	1.03	10000 kHz	1.02
14200 kHz	1.03	14200 kHz	1.03
28500 kHz	1.07	50000 kHz	1.15
(CAL) Press [1] for help.		(CAL) Press [1] for help.	
MultiSWR		MultiSWR	
3895 kHz	1.01	3895 kHz	1.01
7000 kHz	1.02	7000 kHz	1.02
10000 kHz	1.02	10000 kHz	1.03
14200 kHz	1.03	14200 kHz	1.03
70000 kHz	1.22	145000 kHz	1.60
(CAL) Press [1] for help.		(CAL) Press [1] for help.	



Coaxial Load SWR
measured with AA-230 Zoom

As can be seen the load presents a very useful match to 70MHz and a usable match to frequencies of 145MHz.



The dummy load is air cooled and capable of absorbing RF energy of 40-60 Watts continuously for 1 minute, and up to 100 Watts for a few seconds. **See Appendix B for more details on this topic.**

Information is provided in appendix A on how to mount this load in a jar or can of mineral oil for use at longer times at 100 Watts.

Connection to the dummy load is via a high quality SO-239 UHF jack mounted on the PCB. The SO-239 UHF Jack shows a frequency roll off at 500 MHz

The entire load is constructed as a small cylinder that is approx. 2.5" diameter and ¾" thick.

How to use your new Dummy Load

CAUTION: THE LOAD COMPONENTS ARE EXPOSED; TOUCHING THEM WHILE IN USE CAN CAUSE BOTH HEAT AND/OR RF BURNS.

The dummy load is designed to provide a constant load to your radio transmitter, impedance matched to the transmitter output at 50Ω. Connection to the transmitter is via a 50Ω coax cable terminated in a SO-239 connector for the dummy load and a connector suitable for the antenna port on your radio.

The dummy load can also, like an antenna, be used as the termination point for a power meter or SWR meter to provide a balanced load to the transmitter. The dummy load should always be the last part of the transmission line, just as the antenna would be.

As with all tests (on air) or off air with a load, always start by using low output levels of RF. After establishing that no issues exist higher power levels can be used. We suggest using 10-25 Watts as a starting level.





Technical Details

Why a coaxial dummy load?

- Dummy loads are used in radio frequency (RF) testing to provide a safe, non-transmitting load at various frequencies and power levels. This ensures that equipment being tested, tuned or calibrated is done so in a safe way.
- A coaxial load is one that has the load component(s) mounted so that they present uniform impedance and low capacitance/inductance over as wide a range of frequencies as is possible.
- Coaxial load configurations generally show a uniform impedance up to 50 MHz, with a slow 'decay' in impedance as frequency increases, non-coax loads are generally good to around 30 MHz and above that show some more random impedance issues.
- Coaxial loads generally present a lower SWR compared to non coaxial loads at higher frequencies.





Appendix A

Guidance on mounting the coaxial load in a jar or can of mineral oil

This short guide gives some ideas/guidance on how to mount the coaxial dummy load in a jar of oil for increased power handling. These ideas have been tested by Electro-Resales, however, they are not 'hard and fast' rules and can be modified to suit your needs/materials.

Materials/tools needed;

1. 1 pint wide mouth mason jar or 1 quart metal paint can
2. Cutting template (see end of this document for a 1:1 printable template)
3. $\frac{3}{4}$ " Forstner bit (use an old or cheap bit)
4. $\frac{5}{32}$ " metal drill bit
5. 2 x 1.25" 4/40 bolts
6. 2 x 4/40 nuts

Using the cutting template mark out on the lid of the jar/can the positions for the larger central hole and the two $\frac{5}{32}$ " bolt holes. The template is 1:1 for the load, do not scale it when printing.



The center hole is for the SO-239 connector to pass through, the hole diameter is $\frac{3}{4}$ " and while several methods exist to make this opening we have found that using a Forstner bit at slow speed (preferably in a drill press) gives the best result. The lid metal is very thin so a slow drill speed and backing material is needed to get the best/cleanest result.



Caution: The can & lid material is thin and can cause harm to the user if precautions are not taken when drilling, cutting or otherwise working this material. Be careful!

After making the central hole, drill the two smaller holes for the 4/40 bolts to pass through. Using 2 x 4/40 1.25" bolts feed these through the bottom holes in the load so they pass out of the corresponding holes in the SO-239 connector. Using the bolts, align the lid onto the load. Use the nuts to finger tighten them onto the bolts to hold the assembly in place. Do not overtighten these nuts; finger tight plus about ½ turn with a wrench or pliers will suffice.



Lid plus load assembly mounted and bolted in place.

Side view of the same image as above





Fill the jar or can with mineral oil, do not overfill and remember that the load will displace its own volume so less is more (Archimedes and his bath are your guide). We have found that when using a mason jar filling to the freezer volume line works well.

When the jar is filled, carefully fit the load + lid assembly and lock in place with the ring. Oil will leak around the openings; this is expected and any excess or leaks can be removed with a tissue.

Shown here is an example of a finished load in a jar of oil.

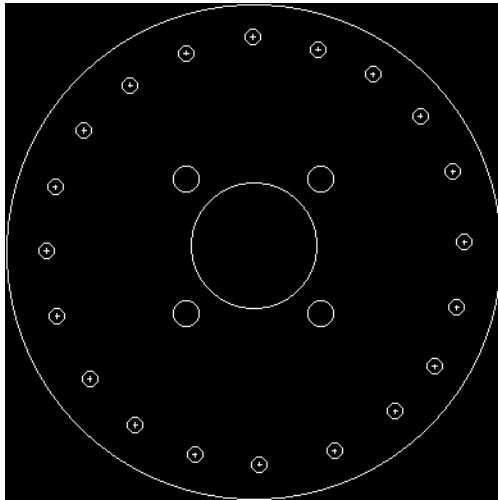
Test the load with an antenna analyzer or VNA to ensure it has not shorted to the lid or similar, before putting to use.





Cutting Template

The template is 1:1, do not scale when printing to ensure it matches the load dimensions.



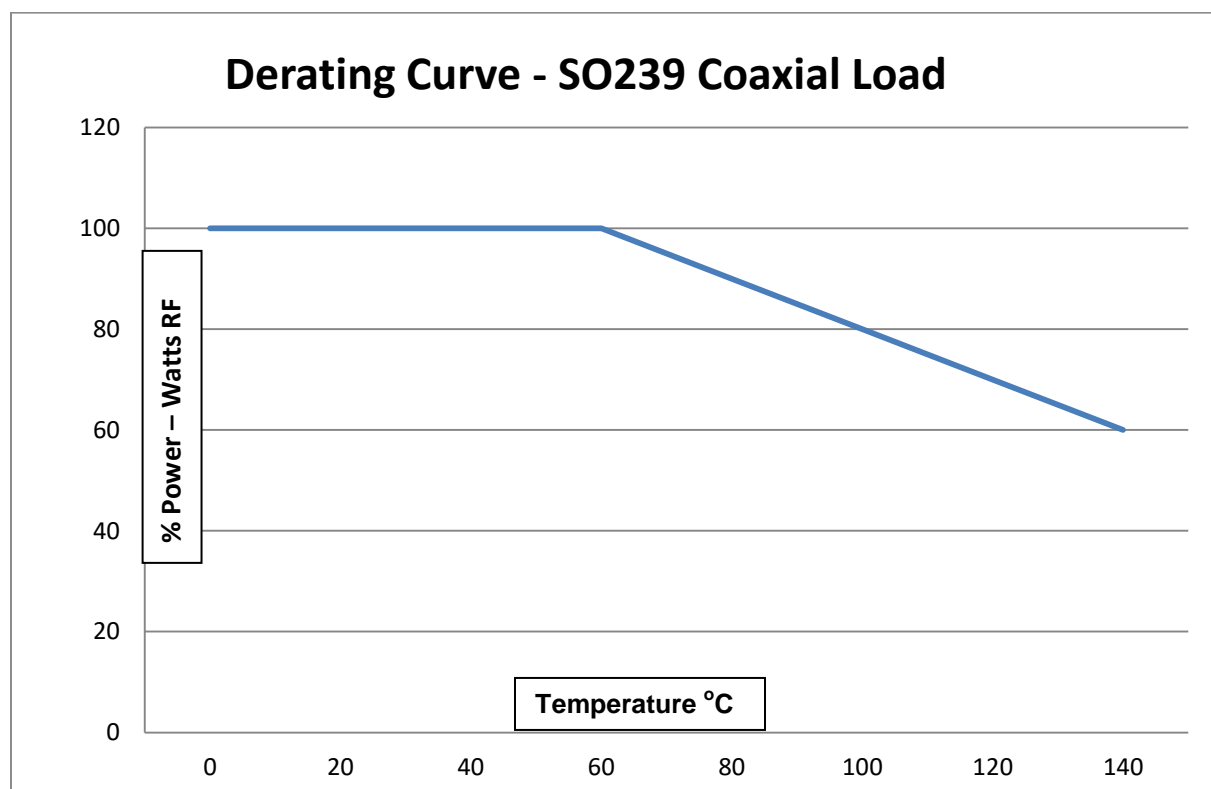


Appendix B – Additional Technical data

The following data is for your information and is based on information provided by the manufacturer of the resistors, and our own testing.

As described in this document the load is designed for use in free air (air cooling by convection) at power levels of 40-60 watts 100% duty cycle. Under these conditions the load will not overheat and full power absorption should be possible.

As resistors heat up in use their usable power absorption decreases, to understand how this load responds to heat, the following derating curve is provided, showing power decrease as temperature rises, and temperature is shown in °C in this chart.



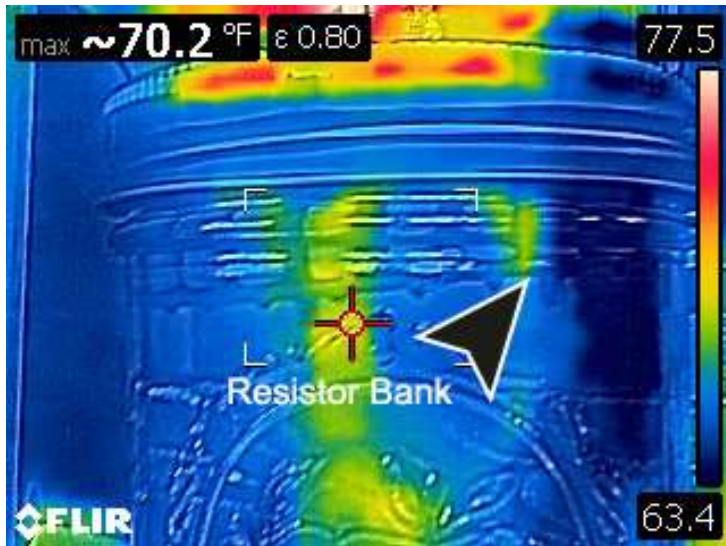


We have driven the load at 50 Watts power 100% duty cycle for 2 minutes and using a thermal imaging camera determined that the temperature rise in free air is 43°C ~110 °F

This image is of the load driven under these conditions;



We mounted a load into a jar of mineral oil as described in this document and at 100 Watts RF 100% duty cycle the temperature rise was measured at 22°C or 70°F, over a period of 2 minutes. This image shows that test;





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The small Print

DISCLAIMER

Any person who constructs or works on electronic equipment may be exposed to hazards, including physical injury, the risk of electric shock or electrocution.. These hazards can result in health problems, injury, or death. Only qualified persons who understand and are willing to bear these risks themselves should attempt the construction of electronic equipment. By purchasing this item, the buyer acknowledges these risks.

There is a risk of electric shock, electrocution, burns, or fires that is inherent in the construction and use of electronic equipment. By purchasing this item, the buyer acknowledges these risks.

IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE including, but not limited to, property damage, personal injury, death or legal expenses. Buyer's recovery from Seller for any claim shall not exceed the purchase price paid by Buyer for the goods, irrespective of the nature of the claim, whether in warrant, contract or otherwise. By purchasing this item, BUYER AGREES TO INDEMNIFY, DEFEND AND HOLD SELLER HARMLESS FROM ANY CLAIMS BROUGHT BY ANY PARTY REGARDING ITEMS SUPPLIED BY SELLER AND INCORPORATED INTO THE BUYER'S PRODUCT.



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