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SWR Meters & Readings Explained

An SWR meter is an important yet simple and easy to use bit of kit.

This section of the site will show you how to use one correctly and tell you what to do to improve your readings if necessary.

Getting the SWR right is crucial not just for getting decent range but also because a high SWR reading can damage your CB.

All our CB's have a years guarantee but this ***does not*** cover the output transistor (the bit that can be damaged) as it's down to you to install it right, and get a low SWR.

Using an SWR meter allows you to check the readings and make any adjustments necessary, making sure you don't have any problems like this!

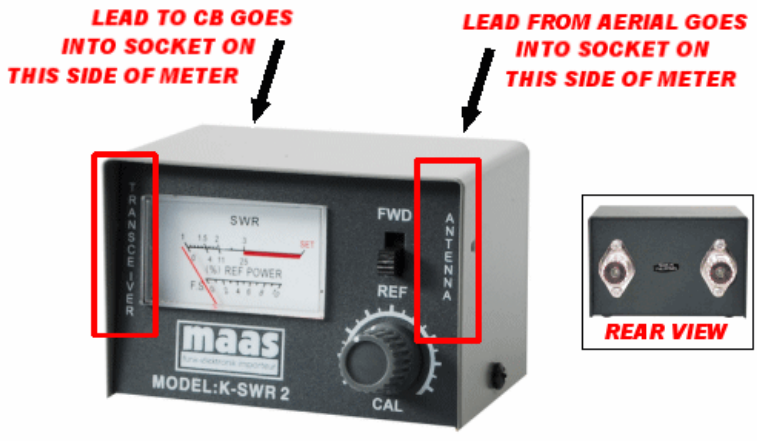
In most cases, if an aerial and mount has been installed correctly and in a suitable place, it should just be a matter of connecting the meter, taking a couple of readings, seeing that the SWR is within limits, and the job is done.

If anything is unclear or you have any questions, please feel free to get in touch by email or phone.

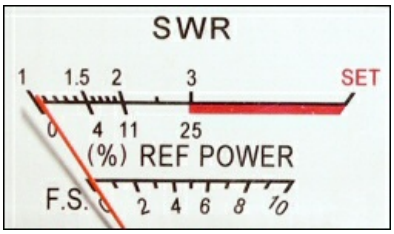
What is an SWR meter

An SWR meter will show you whether your aerial is correctly tuned (the right length) and if you have a good enough ground plane/earth connection on the mount.

It is connected inline between the CB and the aerial with a short connecting lead (often called a patch lead).



On the meter you will have a calibration control knob, and a switch with two settings. One may be marked FWD, DIR, or CAL and the other marked REF. These stand for forward power (to the aerial) and reflected power (back from the aerial).



The reading actually shows you how much power is being reflected back from the aerial - obviously the less reflected back, the better.

Looking at the meter face, the top line is the SWR reading - you can see that any reading above 3 is "in the red" and considered a risk to the CB - you should be able to get it under this without too many problems.

Under the actual SWR reading is the percentage of reflected power - i.e. 25% of your power being reflected back is just in the red.

Below this is the FS reading - you don't have to worry about this - it stands for field strength and is not a facility used when setting up a standard legal CB.

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How to take SWR readings

All SWR measurements should be taken with the vehicle in an open area, at least 20 feet from buildings and never inside a garage or carport. The vehicles' doors and bonnet should be closed.

There are meters that only measure SWR, and ones that measure SWR and output power too, but we will deal with the SWR functions here and all SWR meters measure SWR in the same way :

Firstly, go to channel 20 on the UK band.

Put the switch to FWD and transmit. While transmitting, turn the knob so that the needle swings over to the far right of the scale. You will probably see the word SET or a red mark at the end of the scale - make the needle line up with this.

Once this is done, and while still transmitting, switch over to REF and the needle should drop down to give you a nice low reading.

If the needle hardly moves when you switch over or does not come out of the red portion of the scale - STOP transmitting - you have a problem, probably with the groundplane connection.

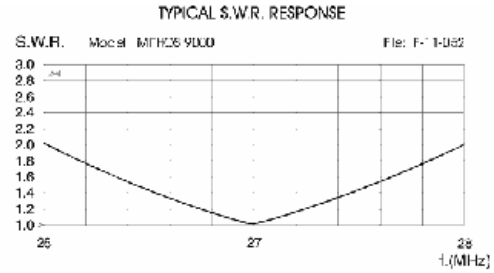
What the readings tell you

- A reading of below 1.5 is ideal
- A reading between 1.5 and 2 is ok, and nothing to be worried about
- A reading between 2 and 2.5 will usually be reduceable with adjustment to the aerials length
- A reading between 2.5 and 3 usually indicates that the aerial is being affected by something around it, or that the groundplane is present but maybe not big enough
- A reading in the red part of the SWR meters' scale means that the SWR is high enough to possibly damage the set and usually indicates an insuffcient ground plane/earth connection, or a short or open circuit in either the cable, plugs or mount.

What you need to do next is to take readings on channels 1 and 40 and make a note of them. (You will need to switch back over to FWD and fine tune the calibration on each of these channels.)

If your readings are LOWER on channel 1 than they are on 40, then your aerial needs to be shortened. (In most cases, this is what you are likely to find.)

If your readings are LOWER on channel 40 than they are on 1, then your aerial needs to be lengthened (by loosening the grub screw and pulling some of the whip out of the coil).



A meter with a built in antenna matcher may help you reduce the readings if you can get it out of the red to start with - but you'll need to make sure you don't accidentally adjust the controls after you have set it up. Mark the settings and lock them by sticking tape over them (or similar) to prevent them moving.

SWR tuning to cover all 80 UK legal channels

As the majority of CB use in the UK still happens on the UK band, the procedure above will allow you to tune the aerial for best coverage on that band, however if you want to check the aerials' SWR across both EU and UK bands, the principle is the same as for tuning to one band, but - you should use channel 20 on the EU band instead of channel 1 UK band, and channel 20 of the UK band instead of channel 40. If possible try to get these to read the same if you will be using both bands equally.

The EU band is lower in frequency than the UK band - the lower the frequency, the longer its wavelength (which translates to length of aerial). This means that a better reading on the EU band means the aerial is too long. The same is true if the SWR is better on the UK band than on the EU band - the aerial is too short. However, if the readings are below 2.0 on all channels, there shouldn't be much need for finer adjustment.

Incidentally, there is an unused gap the size of 20 channels between the two bands so if you do get the readings on 20EU and 20UK the same, the "resonant frequency" (the channel where the SWR would be perfect) will be between the bands.

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IN SUMMARY :

- If the reading is lower on EU band , or channel 01, shorten the aerial, (slide the whip in or cut it)
- If the reading is lower on UK band, or channel 40, lengthen the aerial (slide the whip out)

Generally, the smaller an aerial is, the fewer channels it will give a good SWR over so if you have a small aerial and can't get the reading low across all 80 channels, you may have to decide which band you will use the most, and fine tune it for that band.

Should you keep the SWR meter inline?

When there was a CB licence (abolished in 2006), they recommended that SWR meters should only be used to check your antenna system, and then removed to minimise any chance of interference. I feel that this is more relevant to base stations causing TV interference than it is to people in vehicles, so I recommend having one inline permanently - if you have the space for it, and especially if your cable is outside the vehicle and could potentially get snagged on branches etc.

The advantage with this is that if anything in the aerial system becomes damaged, or your ground connection goes bad, you will know about it much quicker than you would if you had to wait until you got home to check your SWR. This could prevent you damaging your set.

The metal case of the basic SWR meter we sell can be easily removed by undoing 2 screws. This can then be drilled through and mounted flush on a surface, and the meter put back together again - an ideal way of saving space, and securing it inside or outside a cubby box for example.

How to avoid a high SWR in the first place

There are a few important things you need to know when installing the aerial and mount which should prevent you from having an SWR problem :

- All mounts apart from magnetic mounts will usually need a metal-to-metal ground/earth connection. This doesnt need to be a "back to battery" earth, just a connection to a large enough piece of metal to act as a groud for the aerial. The roof or roofrack, bonnet, chassis, etc will normally do it, but the larger the better.
- Aerials shouldnt have metal too close to them (apart from whatever they're mounted on) - ideally they should be sited well away from anything that might interfere. You cannot mount an aerial on a Defender's back bumper, and run it up the back of the vehicle, for example.
  If the aerial is being affected by things around it, the usual effect is that the readings will indicate that the aerial is too long, so you may still be able to get a good SWR by shortening it.
  In particular it's the coil of an aerial (they'll all have one of one kind or another) that needs to be kept away from metal objects.
- Plugs and connectors are crucial - if you're buying new from us this shouldnt be a problem, but if you are reading this because you are trying to cure a high swr in an already installed system, then you should make sure there are no shorts in the cable or plugs. The outer braid of the cable makes connection with the outer of the plug, which in turn makes connection with the mount, and there gets routed to ground, under the aerial. The inner core of the cable goes to the inside of the plug, which feeds the actual aerial itself - this should be electrically isolated from the braid/earth.

How to alter the length of a CB aerial

Some aerials have the ability for you to change the length by moving the whip in and out by a certain amount, and some aerials you simply cut short bits of the whip off.

Below are our most popular aerials and how to alter their length.

Springer/Stinger/Orbitor

All the aerials with an open coil spring have to be cut of you need to shorten them, but if you need to lengthen (if they are a bit too close to something metal, for example) you can undo the grubscrew and move the whip up by upto 30mm or so.

These aerials are supplied as being the correct length for an "ideal world" installation (what some suppliers rather misleadingly call 'pre-SWRd' or 'pre tuned') but location on the vehicle and of course ground plane can have a effect on SWR readings, but as long as these factors are ok, you shouldn't have to actually do anythig to these aerials to get a reasonable reading.

The smaller Springer aerials can need a little bit of fine tuning, usually shortening - you do this by taking readings to make double sure that it does need to be shorter (i.e. a better reading on channel 1 than on 40) and cut 10mm off the top of the aerial, and take more readings.

You're looking for readings on channel 1 and 40 that are about the same, and a nice low reading in the middle at channel 20.

If you cut too much off and find the readings going the other way (indicating it's too short) undo the grubscrew and pull the whip out by 10mm to get you back to the length you were at before you cut too much off!

Generally speaking, the larger an aerial is, the greater number of channels it will give a good reading over - this means that the large Springer aerials will normally give reasonable readings over both bands legal in the uk, whereas the small Springer may have to be set up to favour the band you will be using most.

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Valor 300 Short Rubber Aerial
This aerial has a simple SWR adjuster at the bottom of the aerial.

Over the years we have been importing this aerial, there have been two types of SWR adjustment to it...

Originally there was a single ring that you turn to adjust, then there was a version with two rings that you adjust together then twist against each other to lock, and now it looks like the next batch (due any day - July 2008) will be going back to the one ring.

Through our own experience of setting these aerials up, we've found that about 2-3 turns down from the top is a good place to start and will give a reasonable SWR for the majority of people, but if you need to make adjustments, you can simply twist the ring/s up to make the aerial appear shorter, down to make it appear longer.

On the two-ring model, once you have a good SWR reading, twist them against each other to lock them, and on the single ring version, use some threadlock, superglue or nail laquer to prevent the ring from moving over time through vibration.

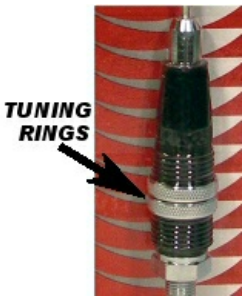
Sirio Mythos 9000
These aerials are made in Italy, so are about the right length for the European bands and below, but in the UK we normally want aerials the tune to the European band and above (the UK band is above the EU band).

This means that they are supplied to us slightly too long for most peoples uses.

We simply cut 30mm off the top of the whip which makes them give a better SWR on the UK band, but can stil be fine tuned further (usually shortened) to give a very low SWR across both bands - the Mythos 9000 is one of the most "wide banded" aerials available, so fine tuning it on the vehicle is deffinately worthwhile doing, to get the best from this aerial.

To reduce the length of this aerial, cut 10mm off the top of the aerial and recheck the SWR. As with the Springer aerials, if you go too far, you can undo the grubscrew to bring the whip up a bit to regain the amount you just cut off.

Solarcon Dial-A-Match
These aerials use a twin tuning ring system, much like the short rubber aerial.



You make adjustments by turning them (keeping them together) - when you have reached the ideal SWR twist them against each other to lock them against movement though vibration.

To make the aerial appear shorter, twist the rings up, to make it appear longer, move them down.

Thorobred Z27
This aerial has two coloured marks on the bottom of the whip, the lower Blue one is for the EU band, the upper one is for the UK band.

The aerial pictured opposite has the whip pushed into the coil so that half the coloured mark is visible above the coil - this is tuned for the EU band.

To tune specifically for the UK band, undo the grub screw and push the whip in so that half of the red mark is visible.

To tune the aerial for both EU and UK bands, put it to the middle of the two marks.

Related Links

More Info about ground planes for aerials
Basic SWR Meter
Basic SWR & Power Meter
Standard 50cm Connecting Lead
Large Springer Aerial
Small Springer Aerial
Large Orbitor Aerial
Small Orbitor Aerial
V300 Short Rubber Aerial

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FSB MEMBER

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