

# HAMster Training School

## LESSON #4:

# SWR

## — THE MYSTERY METER —

ON THE AIR

GOOD  
ANTENNA =  
HAPPY HAMSTER



HAM  
OPERATOR

*It's not a hobby...  
it's a lifestyle!*



Hey... what  
the heck is  
SWR?!  
My radio  
says 3.5...  
is that bad?!

ROOKIE

Relax, kid...  
you didn't  
break  
anything...  
\*yet. 😊

ELMER



HAM NOTES



CQ  
CAFFEINE

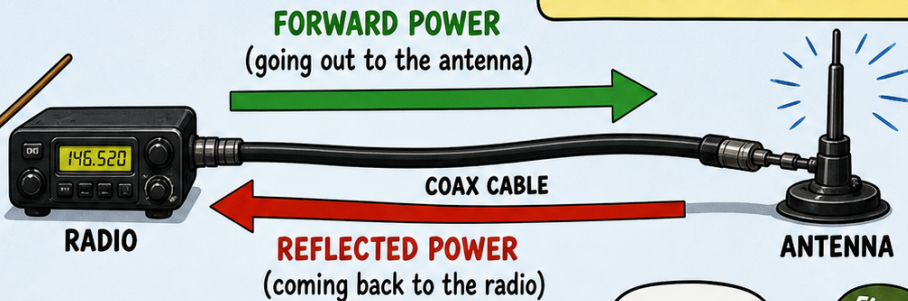
ELMER  
EXTRA LICENSED  
LOTS OF MISTAKES  
SURVIVED

# WHAT IS SWR?

SWR is a measure of how well your antenna system is matched.

SWR stands for **Standing Wave Ratio**...

In simple terms... it tells you how much of the signal your radio sends **out** to the antenna...  
...and how much comes **back**.



So... some power goes out... and some comes back?

**FORWARD POWER:** The power your radio sends toward the antenna.

**REFLECTED POWER:** The power that doesn't get absorbed by the antenna and bounces (back) toward your radio.



Exactly! The lower the reflection, the better!

★ **SWR = HOW WELL YOUR ANTENNA SYSTEM IS WORKING TO GET YOUR SIGNAL OUT INSTEAD OF BOUNCING BACK.**



# THE GARDEN HOSE EXAMPLE

Think of your antenna system like a garden hose!



When everything is matched and working correctly...

**GOOD ANTENNA = SMOOTH FLOW**

✓ Water flows efficiently where it should.

✓ Most of your power goes **OUT** to do its job.

**LOW SWR (1:1 to 1.5:1) = GREAT!**



But when something is wrong...

**BAD ANTENNA = KINKED HOSE**

Pressure builds up and water comes back and sprays everywhere!

✗ Water doesn't get where it's supposed to.

✗ A lot of it comes back instead.

**HIGH SWR (3:1 and up) = PROBLEM!**

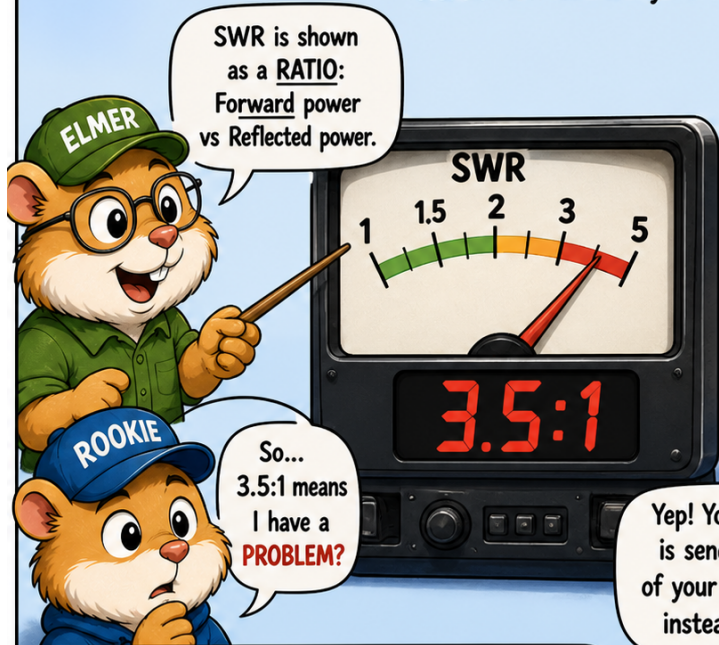
★ **SAME IDEA:** Your radio sends power out through the coax to the antenna. When things are matched (**smooth hose**), power goes out. When things are not matched (**kinked hose**), power comes back (reflected) — causing **HIGH SWR**.

SWR is your antenna system telling you how happy (or not) it is!



# UNDERSTANDING THE NUMBERS

Here's how to read your SWR meter...



SWR is shown as a **RATIO**: Forward power vs Reflected power.

So... 3.5:1 means I have a **PROBLEM?**

Yep! Your antenna is sending most of your power back instead of out.

Lower the SWR, and your radio will work better and go farther!

## SWR QUICK GUIDE

<b>1.0:1</b>	<b>PERFECT</b> ✓	All power goes out
<b>1.5:1</b>	<b>GREAT</b> 👍	Very little coming back
<b>2.0:1</b>	<b>OK</b> ⚠️	Some reflection
<b>3.0:1</b>	<b>PROBLEM</b> ⚡	Too much coming back!
<b>5.0:1+</b>	<b>STOP!</b> 🛑 Do not transmit	Can damage your radio

**KEY POINTS TO REMEMBER:**

- ✓ SWR is a ratio (out vs back).
- ✓ 1:1 is perfect — all power goes to the antenna.
- ✓ Higher numbers = more power coming back.
- ✓ Aim for **1.5:1** or lower for best results!

**MY GOAL:**

- ✓ Check SWR
- ✓ Adjust
- ✓ Get it under 1.5:1!

# WHAT CAUSES HIGH SWR?

Your SWR meter is trying to tell you something. Here are the most common culprits!



High SWR isn't random... it's your antenna system saying "Hey! Fix me!"

So there's a reason my radio is seeing that much reflection?

Yep! Check these one by one. You'll usually find the problem.

**1 ANTENNA TOO LONG OR SHORT**

If the antenna isn't the right length for the frequency, it won't be efficient and will cause high SWR.

**2 BAD OR DAMAGED COAX CABLE**

Cuts, cracks, or crushed coax can cause signal loss and reflection.

**3 LOOSE OR CORRODED CONNECTIONS**

Even a small amount of corrosion or a loose connector can cause big problems.

**4 WRONG FREQUENCY**

I'm set for 146.520...  
...but you're transmitting on 147.300!

Antennas are tuned for certain frequencies. Go too far away and SWR goes up.

**5 NO GROUND PLANE (MOBILE / HT)**

Mobile antennas need a good metal ground plane. Without it, SWR will be high.

**6 OTHER ISSUES**

- ✓ Water in coax
- ✓ Faulty antenna trap
- ✓ Broken wire inside
- ✓ Poorly installed antenna

There are always a few other gremlins that can sneak in. Keep investigating!

SWR is your friend! It's not trying to upset you... it's trying to help you build a better, more efficient station.

Find the cause... ifx the issue... lower the SWR!



**THAT'S THE GOAL!**

# WHY SWR MATTERS!

High SWR isn't just a number... it can cause real problems.

Ignoring high SWR is like ignoring a **smoke alarm**... it won't end well!

## 1. REDUCED POWER OUTPUT

More of your power is reflected back to the radio instead of going out to your antenna.



Less signal out = shorter range and weaker communication.

## 2. WASTED POWER & ENERGY

Reflected power is wasted... your radio works harder but does less.



Wasted power = heat  
Heat = stress on your radio.

## 3. POTENTIAL RADIO DAMAGE

Too much reflected power can damage or even destroy the final amplifier transistors in your radio.



High SWR + High Power = **Expensive Paperweight!**

**ROOKIE**

Yikes! I don't want to turn my radio into a toaster!

## THE BOTTOM LINE:

- ✓ Low SWR = more power out, less stress, better performance.
- ✓ High SWR = less power out, more heat, more wear, possible damage.
- ✓ Good SWR protects your radio and your wallet!
- ✓ Take a few minutes to check and tune... it's time well spent.

**ELMER**

Your radio will thank you... and so will your contacts!

REMEMBER:



TUNE IT RIGHT



PROTECT YOUR RADIO



GET BETTER SIGNALS



HAVE MORE FUN!

**LOW SWR = HAPPY HAM!**



# FIXING SWR - THE BASICS

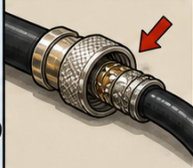
Measure, Adjust, Measure Again!

Good news! Fixing high SWR isn't magic... it's just a process!

**ELMER**

Follow these steps and you'll be golden!

## 1 CHECK CONNECTIONS



Inspect all connections from your radio to your antenna. Tighten anything loose.

Bad connections = high SWR!

## 2 MEASURE SWR



Check your current SWR on the frequency you plan to use.

Write it down so you know where you started.

## 3 ADJUST ANTENNA LENGTH



Make small changes. If your SWR is high:

- Shorten if too long
- Lengthen if too short

(Small moves make a BIG difference!)

## 4 RE-TEST SWR



Measure again on the same frequency. See if your SWR improved.

You're getting closer!

## 5 REPEAT UNTIL YOU'RE HAPPY



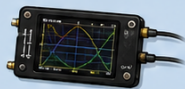
Keep adjusting and re-testing until you get the best SWR you can.

Aim for 1.5:1 or lower — that's excellent!

**ROOKIE**

Let's do this!

USEFUL TOOLS:



**NanoVNA**  
Great for fine tuning!



**SWR METER**  
Your best friend in the shack!



**ANTENNA TOOL**  
Makes adjustments easy and safe!

**PATIENCE = PERFECT SWR!**

Take your time and enjoy the process.

**ROOKIE**

Wow! So it's just a little bit at a time and keep checking!

**ELMER**

Exactly! Once it's dialed in, you'll have more range, better signals, and a happier radio.

I'm gonna tune this thing for **146.520!**

**ROOKIE**

Now you're thinking like a **HAMster!**

**ELMER**



**LOW SWR = HAPPY RADIO = BETTER SIGNAL**



★ **73!** ★  
KEEP ON HAMMING!

