PREAMPS: WHAT THEY REALLY DO (AND WHAT MOST PEOPLE GET WRONG)

By Greg Lewis (N5XO)

Introduction – Let's Clear the Air First

If you've spent more than five minutes around VHF/UHF operators, you've heard it:

"Just add a preamp and you'll hear everything!"

That sounds great… but it's also one of the most misunderstood concepts in amateur radio.

A preamplifier (**pre-amp**) is not magic. It does not "pull signals out of thin air," and if used incorrectly, it can actually **make your station perform worse**.

Let's break this down in plain English so even a brand-new operator can understand it—and more importantly, so you don't waste money or cripple your station.

What Is a Preamp (Really)?

A **preamp** is a **low-noise amplifier (LNA)** designed to boost very weak signals **before they are degraded by system losses**.

That's it.

It does **NOT**:

- Increase antenna gain
- Improve propagation
- Fix a bad antenna
- Overcome poor station design

What it **DOES**:

- Raises weak signals *above the noise floor introduced by your feedline and receiver*

The Single Most Important Concept: SYSTEM NOISE

Every radio system has noise:

- Atmospheric noise (natural)
- Man-made noise (electronics, power lines)

- Receiver noise (your radio itself)
- Feedline loss (coax eating your signal)

On VHF and especially UHF and above, **feedline loss becomes a major problem**.

Example:

- 100 feet of coax at 432 MHz → easily **3–6 dB loss**
- That means your signal is cut **in half (or worse)** before it even reaches your radio

The REAL Purpose of a Preamp

The purpose of a preamp is **NOT** to make signals louder…

👉 It is to **compensate for feedline loss**

Placed correctly, a preamp:

1. Amplifies the weak signal **right at the antenna**
2. Sends a stronger signal down the coax
3. Prevents the coax from burying that signal in noise

WHY LOCATION IS EVERYTHING

❌ Wrong Place: In Your Shack

Putting a preamp next to your radio is almost useless.

By the time the signal reaches your shack:

- It has already gone through coax loss
- Noise has already been added
- Weak signals may already be gone forever

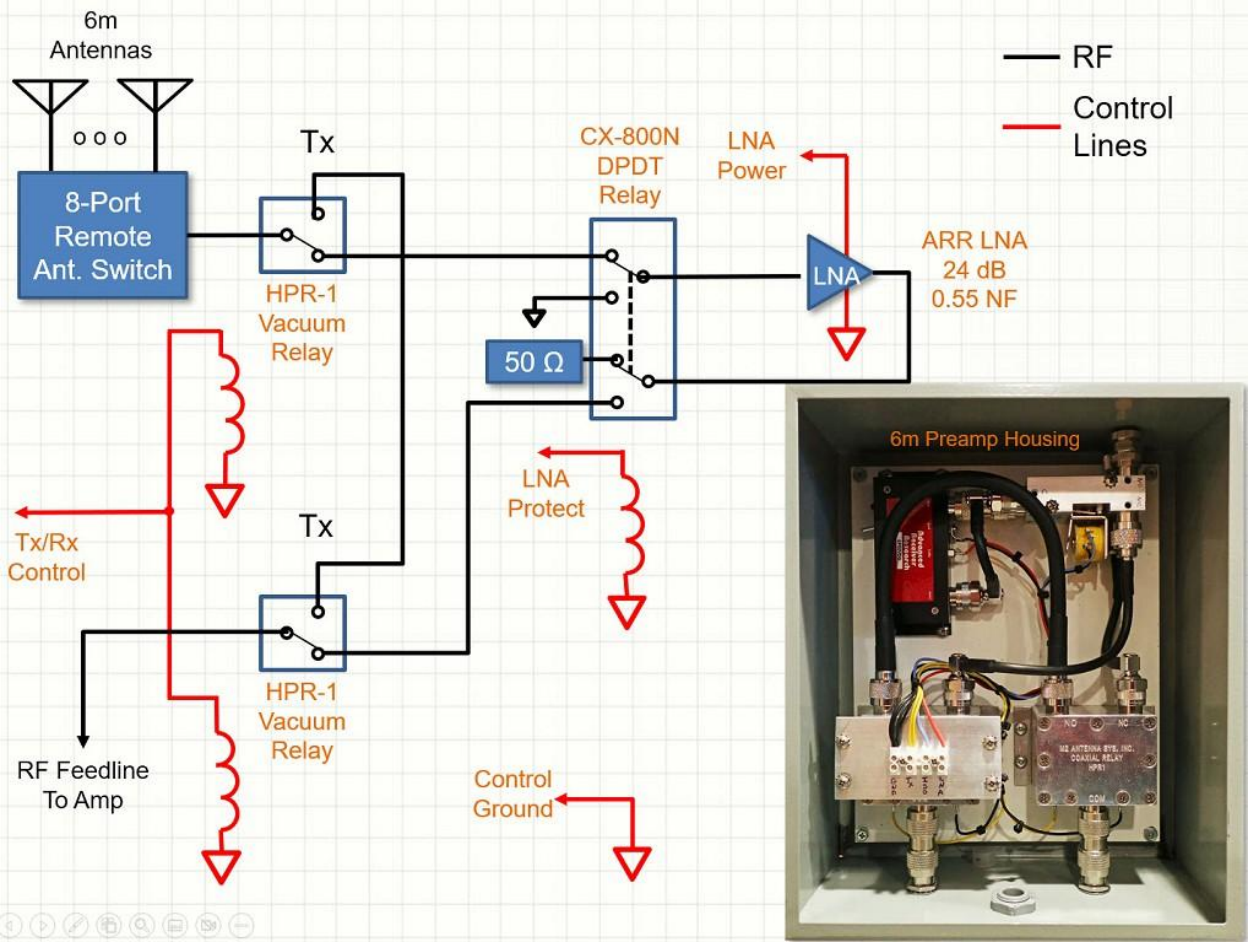
At that point, amplifying it is like:

Turning up the volume on a radio that's already full of static

You get **louder noise… not better signals**

✅ Correct Place: At the Antenna (Top of the Tower)


EME220
Rev1.3 ©
Mini-Kits
DESIGNED IN AUSTRALIA
GAIN
D3
IC2
C13
PWR
C14
D
C
B
A
L2
C3
LK1
C21
TX
39Ω-J
150Ω-J
OMRON
G2RL-2
12VDC
ANT
TRX
VHF PREAMP



7

This is where preamps belong. Period.

Mounted at the antenna:

- Signal is amplified **before loss occurs**
- System noise figure improves dramatically
- Weak signal performance actually improves

👉 This is not optional for serious weak-signal work—it's **fundamental physics**

Understanding Noise Figure (Without the Math Headache)

Every component adds noise.

A good preamp has a **very low noise figure** (NF), meaning:

- It adds very little noise while amplifying the signal

When placed at the antenna:

- The **preamp's low noise figure dominates the system**
- The receiver and coax matter much less

When placed in the shack:

- The coax loss dominates
- The preamp can't fix what's already lost

GAIN: MORE IS NOT BETTER

This is where a lot of people get into trouble.

❌ The Myth:

"If 10 dB is good, 25 dB must be amazing!"

✅ The Reality:

Too much gain causes:

- Receiver overload
- Intermodulation distortion (IMD)
- Desensitization (you hear *less*, not more)
- Increased noise floor

What Happens When Gain Is Too High?

Your receiver has limits.

If you push too much signal into it:

- Strong signals mix together
- Weak signals get buried
- The band sounds "busy"… but useless

👉 You'll think your station improved—until you try to copy a weak signal and realize it's gone

Ideal Preamp Gain

You want:

- Just enough gain to overcome feedline loss
- Not enough to overload the receiver

Typical targets:

- 10–20 dB for most VHF/UHF setups
- Match gain roughly to feedline loss

A Simple Real-World Example

Let's say:

- You have 4 dB coax loss at 432 MHz

Without Preamp:

- Weak signal = barely detectable
- Coax reduces it further → possibly gone

Preamp at Antenna (15 dB gain):

- Signal boosted before coax
- Coax reduces it slightly
- Net result = signal preserved and usable

Preamp in Shack:

- Signal already weakened by coax
- Noise already added
- Preamp boosts both equally → no improvement

Common Fallacies (Let's Bust Them)

❌ "A preamp will fix my bad antenna"

Nope. Garbage in = garbage out.

❌ "I'll just add more gain"

That usually makes things worse.

❌ "It works fine in my shack"

It might *seem* like it… until you compare it to a proper installation.

❌ "I don't need one on 2 meters"

Maybe… maybe not.

- Strong signal FM? Probably not needed
- Weak signal SSB/CW? Often very beneficial

When You SHOULD Use a Preamp

✔ Weak signal operation (SSB, CW, digital)
✔ Long coax runs
✔ UHF and above (432 MHz, 902 MHz, 1296 MHz, etc.)
✔ EME (Moonbounce) – absolutely critical
✔ Meteor scatter / troposcatter

When You Probably DON'T Need One

✖ Strong signal FM repeater work
✖ Short feedline runs
✖ High-noise urban environments (may make things worse)

Advanced Tip: Sequencing Matters

If you run a preamp:

- It **must be protected during transmit**

That means:

- Use a sequencer or built-in T/R switching
- Never let RF hit the preamp directly

Otherwise:

👉 You'll let the smoke out… permanently

Final Thoughts – Keep It Simple and Correct

A preamp is a **precision tool**, not a band-aid.

Used correctly:

- It can dramatically improve weak signal performance

Used incorrectly:

- It can completely ruin your receiver

The Golden Rules

- **Mount it at the antenna**
- **Use only enough gain**
- **Understand your system losses**
- **Don’t expect miracles—expect physics**

Closing

Weak signal operating is where the real magic of amateur radio happens—and understanding your receive system is half the battle.

A properly installed preamp doesn’t make you louder…

👉 It makes you **hear what others can’t**

And that’s where the fun begins.

— Greg N5XO