



Race Radios

SATURATION/NOISE POLLUTION

Introduction: An Analogy

You and I are alone in Staples Center at opposite ends of the auditorium. We can talk to each other in a normal tone of voice.

Now more people enter the auditorium and start talking. For you and I to continue our conversation, we either have to shout, or move closer together.

Now the auditorium is full and the Los Angeles Lakers tie the game. If we're more than a few rows apart, we can't hear each other unless we yell.

The Lakers win the championship. Pandemonium breaks out and saturation occurs. We can't hear each other from more than a few feet apart.

In this analogy, voice equals frequency. Some voices are bass, some alto, and some soprano; but none are exactly the same. Shouting is power output. Hearing is the quality of the receiver's sensitivity and selectivity, and moving closer together is range. Remember – frequency, power, receiver sensitivity and selectivity, and range.

FREQUENCY SATURATION AND LOSS OF RANGE: THE LONG VERSION

Part I. Interference

There are many factors contributing to lack of range besides faulty installation or improperly mounted and tuned antenna.

- A. **Co-channel Interference.** This comes from other users on your own channel, even if you can't hear them clearly or they're "in the dirt". They lessen your range compared to a clear channel.
- B. **Willful or Unintentional Interference.** This is where someone keys up on top of your signal, either willfully or inadvertently, by not monitoring before transmitting.
- C. **Adjacent Channel Interference.** Channels that are next to yours bleeding over – particularly when they are running between bands. For example, you are on 151.925. The next frequency down is 151.910 and the next frequency up is 151.940. If someone is illegally running on 151.920 or 151.930, they can produce adjacent channel interference, particularly if their modulation is set too high. The 15 kilohertz between channels is a protection against adjacent channel interference. Amplifiers are the biggest problem with regard to bleedover.
- D. **Intermodulation Interference.** This is where two or more frequencies combine to form a frequency product that spatters your frequency. This is the worst kind of interference as it is extremely hard to track down. Noise pollution, or even saturation, occurs when your receiver becomes choked with unwanted signal and is lessening your range considerably.

Part II. Frequency

Dirty transmitters that produce spatter on other frequencies cause noise pollution and contribute to saturation. All transmitters should be looked at with a spectrum analyzer to make sure they are clean. However, spectrum analyzers are very expensive and not every radio shop has one, let alone the two-steppers who have no service equipment.

Now put a cheap \$200.00 amplifier on a cheap radio and create a radio-jamming device that can take out a half mile of pit communications. This is noise pollution at its worst. This is one of the problems that you can do something about, as amplifiers are illegal in SCORE's rule book: CR52.

Part III. Receivers

What constitutes a good receiver? First let's talk about a great receiver – one that can be used in communications sites on mountaintops with an antenna farm on towers and many radios operating within a single building. Would any radio used in off-road, even with proper external filters work under these conditions? Only the Kenwood TK790 – PCI's Power Source Radio. There may be exceptions to this, but extremely few.

Now if we don't pay \$1250.00 to \$3000.00 for a great receiver, where do we draw the line? Let's say we draw it at \$350.00, and say that anything under that price is missing a whole lot of parts. Unfortunately, most of these are receiver parts – receiver crystal filters and filtration at all the intermediary frequencies.

You get what you pay for, and here we can directly correlate *cheap = lost range*.

I acquired a trade-in of an ICOM V8000 amateur band radio that had been expanded to work in the commercial band. Its performance on the Weatherman relay in helping any team on any frequency was pitiful. Most of the time, because of noise pollution, I couldn't hear replies directed to me and had to ask the team to switch to the Weatherman frequency. At times the signal strength bar graph was full strength but no signal could be heard. I couldn't even open the squelch.

I personally took apart and examined two ICOM radios. One was the amateur band radio that had been illegally expanded to work in the commercial band – the model V8000. It had a one-sided printed circuit board. The other ICOM was a commercial band model IC121. It had a double-sided PC board and almost twice the number of parts, mostly the more expensive receiver parts that include the filtering of all the intermediary frequencies prior to your final output frequency. These components are required for sensitivity and selectivity so the radio can distinguish between wanted and unwanted signals.

One of those radios sells for \$189.00 and the other for \$359.00. The \$189.00 radio is FCC type accepted under part 15 of the rules, i.e. the **amateur** band. Its manufacturer's tag specifically states, **"This device must accept any interference received, including interference that might cause undesired operation"**. The \$359.00 one is type accepted in the commercial band where a much higher performance is required.

I now use two PCI Power Source Kenwoods - model TK790 – 160 channel radios to cover the frequencies being used in off-road racing.

Part IV. Stuck Mikes

If your push-to-talk switch is the least bit sticky or stays pushed at times, or if your coil cord is old and stretched, buy a new mike. They are cheap compared to someone's life or limb that could be lost because your transmitter was stuck in the "on" position.

Proper mike hang-up brackets should be used at all times. If you don't have one, hang the mike over the ash try. NEVER lay it on your lap, armrest, or on the seat or floor. No one wants to be a Richard Cranium! Realize that the

Weatherman channel is extremely busy, so if you don't hear anything on your radio, you could be stuck in transmit mode. Watch your 'busy' and 'transmit' lights. That's what they're for.

If you want to be absolutely sure to not stick on a transmitter, then open your squelch and enjoy the sound of the ocean while expanding your receiver's range by a whole lot.

If you are a spectator or leave your kids unattended, unplug your mike.

If you're a 'skitzo' with personality disorders and like to play on the radio – while your good side is in control make the decision to leave your mike at home.

Part V. Score Rule CR52

CR52 - Radio Equipment: No radio equipment in any race vehicle or support vehicle is permitted to transmit on any frequency allotted to the amateur radio band, public service band, marine band, aircraft band, and any frequency that the FCC considers illegal. All radio equipment must transmit and receive on frequencies that the equipment was designed for. No outboard linear amplifiers with an output over 25 watts. An outboard linear amplifier is a device attached between the radio and the antenna that boosts the power of the radio. Rule GL8 in its entirety is included in this rule.

Part VI. Satellite Phone Use

Satellite phone communications have also become saturated during races. A satellite phone orbiting gateway can handle only a very limited number of calls at the same time. As with your radio transmitter, think before pushing the 'send' button. On race day, use the satellite phone for **essential race-related calls only!** A chase truck at pit 8 doesn't need to know if the race vehicle went through checkpoints one, two, or three. And, please, no personal calls during race time.

Part VII. Back to the Analogy – What Have We Learned?

Now imagine that the Baja 1000 is a very expanded Staples Center. Remember:

- Frequency = individual voice
- Power = shouting to be heard
- Hearing = receiver sensitivity and selectivity
- Range = moving closer together to be heard.

Frequency: On your pre-run, make sure your frequency is a clean one. During the race, avoid any non-essential transmissions. If your transmission isn't acknowledged, transmit your message and repeat it after a few minutes.

Power: Know your transmitter is clean (no spurious frequencies). Make sure your installation is correct.

- Check that you have adequate 10 or 12 gauge wire to the positive and negative terminals of the battery.
- Your antenna should be mounted with a proper ground plane and with no metal interference above the bottom of the antenna.

Do not use an amplifier!

- It's against the rules.
- It causes your receiver to be less sensitive by 5% to 50%.
- Amplifiers are the worst offenders with regard to noise pollution.

Receiver Sensitivity and Selectivity: Expanded amateur band radios do not have the selectivity of hearing on the intended frequency. They are prone to all types of interference and, during a race, are putting you and your team to a big disadvantage when compared to a commercial band radio. To be more frank, they are crippling the overall race communications.

Range: To maximize your range, pay attention to these factors:

- Be sure your equipment is properly installed.
- Choose the best location to transmit from or hear from while waiting. Avoid canyons and low spots.
- Use a gain antenna,
- Have your vehicle running to supply the proper voltage to your radio when transmitting.

USING THE WEATHERMAN RELAY

When using Weatherman to expand your range, make sure you are on a legal frequency. I will not relay on between-band frequencies.

Remember the principles of good communication: who, why, where, what, and when.

- **Who:** The first words you speak should be the car number you're referring to, then your vehicle number if different, then your name. "1625, chase 3, Jimmy".
- **Why:** Clearly and briefly state why you're calling Weatherman. "I need a relay" or "Our car is stuck".
- **Where:** Identify where you need assistance or the location (frequency) of the person you need to contact. "To 1625, Chase 1, Bob," or "Race mile 52.5 (or GPS coordinates)".
- **What:** State specifically what you need. "I need two tires," or "I need a tow strap."
- **When:** The answer to this should be "Right now". If it isn't urgent and necessary, you shouldn't be calling Weatherman.

If you have questions, e-mail me at weatherman@pciraceradios.com and I will post your question and its answer on "THE WEATHERMAN SPEAKS".