Ham Radio

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MYTHS AND MISINTERPRETATIONS

We radio amateurs sometimes toss around facts, figures, numbers, and parameters without giving much thought to what they mean. As a result, some plain old-fashioned nonsense creeps into our daily language. This month we will devote this column to looking at a couple of myths, or semi-myths, frequently found in amateur-radio (as well as CB) circles.

Signal Strength Reports. Most of our receivers are equipped with S meters to indicate the strength of the received signal. The S meter (Fig. 1) allegedly measures input-signal strength in a rigorously defined manner. The truth, however, is that receiver manufacturers can't even decide on what constitutes the correct definition of an "S unit." Note how the S meter is calibrated. The lower two-thirds or so of the meter is calibrated in the nearly arbitrary "S units." The S scale is logarithmic. The upper one-third of the meter face is calibrated in decibels (dB), so it, too, is logarithmic.

Now let's consider what some of those S units are supposed to mean. Table 1 shows the subjective meanings given to the signal-strength portion in the standard amateur-radio RST (readability, strength, tone) scale for CW, or RS system in voice modes. Note that "S9" corresponds to a subjective determination of an *extremely strong signal*. Hold that thought for a moment (S9 = extremely strong).

Recently I heard a guy on 20 meters tell a DX station that he was "60 dB over S9." Wonderful report (most amateur receivers only go up to +40 dB/S9). If you work out the arithmetic for voltage decibels—dB = 20 log (V1/V2)—we find that 60 dB is a ratio of 1000:1. In other words, a report of 60 dB over S9 means that other station was one-thousand times louder than an extremely strong signal!

Perhaps what he really meant was power decibels...which means that the other guy was a real "blazing blowtorch:" 60 dB over S9 means 1,000,000 times as much signal power at the receiver's antenna terminals as an S9 signal. Surely, such a signal qualifies as a long-range death ray! The Pentagon should take note.

So what is an S9 signal? According to some manufacturers, an S9 signal is a 50-μV signal across the 50-ohm input. Others require a 100-μV signal across a 50-ohm input to make the meter deflect to S9. In other words, there is at least a 2:1 ratio between voltage levels that supposedly qualify as S9.

The S unit is traditionally given the subjective definition of being the minimum signal-level change that an appreciable number of standard, grade-A average listeners can perceive...whatever that means, or whoever that person is. As a result, the usual definition makes each S unit worth a 6-dB change in voltage level, or a 3-dB change in power level (which is the same thing mathematically). A 3-dB power change has a ratio of 2:1. In other words, if you double the RF-output power from your rig, the S meter at a distant station will increase one S unit.

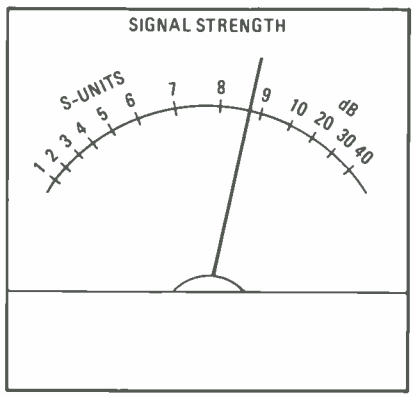

Fig. 1. Most receivers are equipped with S meters to indicate the strength of the received signal.

So, why is that important? What difference does it make to know what it takes to blast an S meter one digit higher? The answer is simple: it tells us what to expect if we increase power.

How Much Station Power? Most of us are enamored of high-power linear amplifiers for boosting our signal. In nearly 30 years of hamming, I've owned a one-kilowatt linear amplifier only in the last five or so years. Yet I only occasionally suffered from power levels that were too low. Even today I run "barefoot" more often than not, which is in accordance with the FCC requirement to use the minimum power required to do the job.

High power brings problems that must be considered. For example, you can expect an increased probability of TVI (television-interference) and BCI (broadcast-interference) problems. Antenna tuners must be the more costly heavy-duty types. Also, little annoying anomalies, such as RF "bites" on the microphone due to poor grounding or "RF in the shack," are more severe with a kilowatt. So where's the benefit?

TABLE 1—DEFINITIONS OF S-UNITS

S1	Faint signals, barely perceptible
S2	Very weak signals
S3	Weak signals
S4	Fair signals
S5	Fairly good signals
S6	Good signals
S7	Moderately strong signals
S8	Strong signals
S9	Extremely strong signals

Linear amplifiers come in three basic power levels (all of which are called "kilowatt" in advertisements): 600-watt CW, 1000 watts, and 1500 watts. Let's see if running a power amplifier is worth it in your case, and which power level is best for you.

Assume that you have a 250-watt HF transceiver. A 600-watt linear (also called "1200-watts PEP") is little more than 2:1 increase, so it is about 3 dB. That means that a station at the other end will just about hear an S-unit change. If you were S6 before, you might be S7 now. But if you bought a 1000-watt linear, then there would be a two S unit change. And that begins to be worthwhile.

Now consider what happens if you own a 100-watt transceiver (or one of

(Continued on page 101)

(Continued from page 92)

those 60-watt solid-state "novice" transceivers). For those people, a 600-watt linear is a 6:1 change, which is a gain of nearly 8 dB—almost three S units. For that person, the 600-watt lightweight linear is a good bet, and keeps TVI at minimal levels. The 1000-watt linear yields a 10:1 increase, representing 10 dB (more than three S units) Such a change is surely worthwhile.

Power is not everything in amateur-radio communications. Increasing power enables you to communicate in marginal situations. But it also brings other problems. If you have only enough money to sink into either a good antenna or a linear power amplifier (and no way to own both), then sink the money into the antenna system. Such an investment pays rich dividends. If you get an optimized three-element beam antenna, the forward gain will be around 8 dB, which is the same as buying a linear amplifier that increases power by about sixfold.

But power increase is not the main reason why an amateur needs a good beam antenna for marginal communications. The main reason involves reception! The directivity of a beam allows you to notch out interfering signals from certain directions. On the east coast, we are overwhelmed with W6 stations when chasing European and African DX.

Placing the notch on the back of the beam facing the west reduces the problem considerably. Even if the main lobe of the beam is not directly on the DX station, they'll still hear you loud and clear. Take advantage of the beam-steering capability of the antenna to null out the competition...and the DX is yours.

By the way, remember the days when CB'ers "souped-up" their 5-watt rigs to "get out better?" A typical modification boosted the power to an *illegal* 7 watts. That change wasn't even a single S unit! Not only that, they typically did not modify the modulator, so the percentage of modulation went down as well.

Sadly, we've come to the end of the space allotted to us for this month, but be sure to "tune in" next time. In the meantime, if you have any tips, comments or suggestions for this column, write to *Ham Radio,* **Popular Electronics**, 500-B Bi-County Blvd., Farmingdale, NY 11735. ■