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Royce Electronics Corporation
You and Your Antenna Paper

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ROYCE ELECTRONICS CORPORATION

YOU AND YOUR ANTENNA

Three main components comprise a typical Citizensband installation. They are: your transceiver, an antenna, and the coaxial cable which connects the antenna to the transceiver. It is important that all three pieces are installed correctly to give the best possible range and reliable performance. We hope this pamphlet will be helpful for you to realize the maximum performance of your installation.

ANTENNA

For several reasons, it is impossible to exactly PRE-TUNE an antenna at the factory. A general range of tuning is done which may suffice, but for best performance, an antenna should be tuned after it is installed.

Most antennas have some form of tuning capability. Usually, this involves the whip section sliding into a coil, spring, or metal section. This allows the antenna to be adjusted to the exact frequency desired. All Royce antennas are the "broad band" type. When adjusted for Channel 20, they will perform well from Channels 1-40. An untuned antenna robs you of range and could cause, after a period of time, substantial deterioration of the performance of an RF output transistor. We cannot stress enough the importance of tuning your antenna. The measure of an antenna's performance is its "SWR" (standing wave ratio).

"COAX" CABLE

Coax cable is used in all Citizensband installations. This cable transfers the power from your transceiver to the antenna. The output of your transceiver is 50-52 ohms. Your antenna is designed to be 50-52 ohms. For this reason, RG58/U or RG8/U cable is used because it also is 52 ohms and matches the antenna to the unit. The frequency of the antenna is very important in this area because a mis-tuned antenna can disrupt the system balance. If this balance is disrupted, standing waves are generated on the coaxial cable, which results in a loss of power in your transceiver.

UNDERSTANDING SWR (Standing Wave Ratio)

In theory, your transceiver has a 50 ohm output and your antenna is 50 ohms. If a 50 ohm cable (such as RG58/U or RG8/U) is used, all the power from your transceiver will be transmitted via the coaxial cable and radiated by the antenna. Under these conditions, the SWR (standing wave ratio) of your antenna system would be 1:1. In practice, the antenna must be 50 ohms and tuned to the exact channel. This condition seldom exists and standing waves are set up on the cable. This SWR robs you of power and likewise range. While 1:1 is not always possible to attain, you should tune your antenna system so the SWR does not exceed 1.5 to 1 or at maximum 2 to 1. Here are some examples of the power losses for various SWR ratios:

<u>SWR</u>		<u>Power Losses</u>
1:1	=	0
1.3:1	=	2%
1.5:1	=	3%
1.7:1	=	6%
2:1	=	11%
3:1	=	25%
4:1	=	38%
5:1	=	48%
6:1	=	55%
10:1	=	70%

TUNING YOUR ANTENNA

For optimum performance, an SWR meter should be used to tune the antenna. However, since this meter may cost from \$15.00 to \$30.00, not everyone may want to invest in its purchase. If possible, borrow one. If you are unable to borrow one, the RF output meter on your transceiver can be used as a GUIDE to antenna tuning. While it is not 100% accurate, it is generally better than no tuning at all. Always tune your antenna in an open area. Wires, metal and copper tubing if nearby can effect the tuning. Never tune an antenna inside a garage, under a metal car port, next to a metal truck, etc.

A. USING YOUR TRANSCEIVER OUTPUT METER AS A TUNING GUIDE

After installing your antenna system, place the whip halfway into its receptacle and turn your transceiver to Channel 20. Depress the switch on your transceiver microphone, and make note of the reading on your RF output meter. Loosen the adjustable whip section and move it 1/8 to 1/4 inch down. Again depress the transmit switch, if the reading is the same or lower continue moving the whip down 1/4 inch at a time until the LOWEST reading is obtained on your transceiver RF meter. If the reading was higher, move the whip up 1/4 to 1/2 inch the first time and 1/8 to 1/4 inch thereafter until the LOWEST reading is obtained on the RF meter. That's right.....

THE LOWEST READING. Your RF output meter is a voltage sensing device. It is installed in the RF output circuit and senses the voltage near the antenna terminal. In a perfectly tuned system all of the voltage is transferred from the output transistor and passed to the antenna. As an example, let's use the figure 10. If there is SWR on the line, the forward voltage is 10 and a reverse voltage appears (let's say it's 2). The meter circuit now sees 20 and shows a higher reading. You can see that because of the way most RF output meters work, the LOWER your RF output meter reads the better your antenna is tuned. Of course, if the meter reads less than 1/2 scale, it may indicate a problem in your set and should be checked. Similarly, an extremely high reading may indicate a problem in your antenna. An RF output meter can tell you much...especially if you know how to use it.

B. TUNING YOUR ANTENNA WITH AN SWR METER

Using an SWR meter is the most accurate way to tune an antenna.

Connect the SWR meter as close as possible to the back of the transceiver. Use a double

male connector or a very short piece of RG58/U with connectors on each end.

Place the adjustable whip halfway into its receptacle. Set your transceiver to Channel 20. Measure the SWR following instructions supplied with the meter. After the first measurement, move the whip down 1/8 to 1/4 inch and repeat ALL the steps again. If the SWR is lower, continue the process moving the whip down 1/8 to 1/4 inch at a time until the lowest reading is obtained. If the SWR is higher, raise the whip 1/4 to 1/2 inch the first time and 1/8 to 1/4 inch thereafter until the lowest SWR is obtained. Note, if the reading continues falling but you have reached farthest point down that you can go with the whip, the whip may be too long. To verify this, put the Channel Dial to Channel 1 and measure the SWR. Next, put the channel dial to Channel 40 and measure the SWR. IF THE SWR WAS LOWEST ON CHANNEL 1 AND HIGHEST ON 40 THE WHIP SECTION IS TOO LONG. Carefully cut 1/4 to 3/8 inch from the whip section and re-measure Channels 1, 20, and 40. If the SWR is still lowest on Channel 1 continue trimming the whip by removing 1/8 to 1/4 inch at a time until the lowest SWR is obtained on Channel 20. DO NOT GET OVERANXIOUS. YOU CANNOT REPLACE A SECTION ONCE IT IS CUT OFF. If you exceed slightly the best tuning for Channel 20, the whip may be raised 1/8 to 1/4 inch at a time to obtain the best SWR on Channel 20.

WARNING: DO NOT CUT THE WHIP USING THE "POWER OUTPUT METER TUNING METHOD". YOU MUST USE AN SWR METER TO ACCURATELY DETERMINE THE SWR.

Every six months or so, re-check the SWR. Car washes, rod grime, and chemicals can effect the mechanical connections of an antenna and corrode them. This corrosion can cause poor electrical connections and lead to high SWR. The correction of this problem is usually accomplished by cleaning of the metal connection parts with a wire brush.

HELPFUL HINTS

1. High SWR robs you of range and puts a strain on your output transistor.
ALWAYS TUNE A NEW ANTENNA.
2. Never tune your antenna in a closed area (garage, under a metal car port, etc.)
incorrect tuning may result.
3. MAKE SURE ALL MECHANICAL CONNECTIONS ARE TIGHT.
4. DON'T SMASH OR SHARPLY BEND THE COAX CABLE – it should remain generally
round to do its job properly.
5. TIGHTEN YOUR PL-259 CONNECTOR OCCASIONALLY – road vibration has a
tendency to loosen it which can cause output transistor problems.
6. PERIODICALY (every 6 months) re-check your SWR. Corrosion and road grime
may rod you of performance.
7. PERIODICALY check your coax cable for wear. A broken or loose wire could
cause RF output transistor failure.

This pamphlet was produced to help you understand the installation and maintenance of your antenna and cable feed system. Many field problems have been traced to problems such as the above. They can lead to eventual failure of the RF output transistor in your transceiver. Careful installation and maintenance can prevent these problems.

Royce  electronics corporation

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