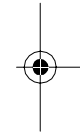


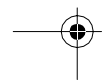
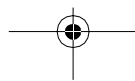
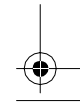
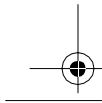
Cat. No. 21-533
OWNER'S MANUAL

Please read before using this equipment.

**CB/Ham Field-Strength
SWR Meter**



RadioShack®



INTRODUCTION

Your RadioShack CB/Ham Field-Strength SWR Meter helps you tune your CB or amateur radio system for the best performance.

CB and amateur radio systems work best when the antenna system's impedance matches the transmitter's output impedance as closely as possible. The meter's standing wave ratio (SWR) function helps you trim your antenna to the precise length you need for the maximum transmitted power.

The meter's field strength function helps you position your antenna for the best coverage and determine the effectiveness of changes you make to your antenna, antenna cable, and transmitter.

Carefully read all of these instructions to get the best use from this meter.

Warning: You can use this meter to make measurements on equipment that uses high voltages. Carefully observe all safety precautions provided with the equipment you are testing.

Note: You need a separate 50-ohm coaxial cable (such as RG-58U) with a PL-259 connector connected to both ends (such as Cat. No. 278-968, not supplied), long enough to reach from your radio's antenna jack to the back of the meter.

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CONTENTS

| | |
|---|-----------|
| Measuring SWR | 4 |
| Connecting the Meter | 4 |
| Calibrating the Meter/Measuring SWR | 5 |
| Interpreting SWR Readings | 8 |
| Improving SWR | 9 |
| Measuring Field Strength | 10 |
| Preparing the Antenna Site | 11 |
| Calibrating the Meter/Measuring Field Strength | 13 |
| Using Field Strength Readings to Tune Your Radio and Antenna | 17 |
| Care and Maintenance | 19 |
| Schematic Diagram | 21 |
| Specifications | 22 |

MEASURING SWR

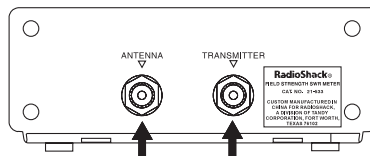
Measuring SWR shows you how much of your radio's transmit power is reflected from the antenna back into the antenna cable, generating heat and wasting power. With this information, you can adjust the length of your antenna or antenna cable so your antenna and radio combination can produce the maximum power they are capable of producing.

For more information about measuring SWR, see the *ARRL Handbook*, available at your local library.

CONNECTING THE METER

To connect this meter to your CB or amateur radio and your antenna, you need RG-58U coaxial cable (not supplied) with a PL-259 connector on both ends (such as RadioShack Cat. No. 278-968). The cable must reach from the back of the meter to your radio's antenna jack.

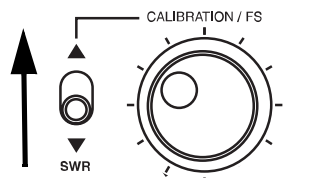
Follow these steps to connect the meter to your radio and antenna.



1. Turn off your radio. Then disconnect the antenna from the radio and plug it into **ANTENNA** on the back of the meter.
2. Plug the coaxial cable into the radio's antenna jack and into **TRANSMITTER** on the back of the meter.

CALIBRATING THE METER/ MEASURING SWR

1. Set **CALIBRATION/FS/SWR** on the front of the meter to **CALIBRATION/FS**.



2. Turn on your radio. Then select a channel or frequency on your transmitter and hold down its transmit key. Do *not* speak into the microphone.

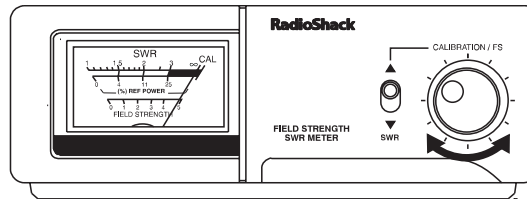
Notes:

- An SWR reading will be different for different frequencies (channels). If you transmit on one channel more often than any other, select that channel. If you trans-

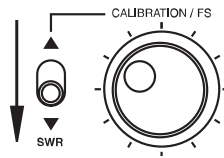
mit on several channels, choose a frequency in the middle of the range of channels you use. (For example, if you transmit on all 40 CB channels, choose Channel 20, because it is midway between Channel 1 and Channel 40.)

- If you use a CB that has sideband modes (SSB), do not select any of these modes. (Use only AM for SWR measurements).
- If you have an amateur radio, select the continuous wave (CW) or tuning mode to check the SWR.

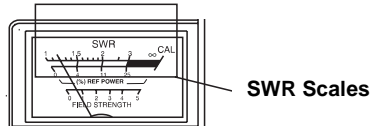
3. While you hold down the transmit key, rotate the meter's knob until the needle points to CAL.



4. Release the transmit key, then set **CALIBRATION/FS/SWR** to **SWR**.



5. Press the transmit key again, then read the SWR by noting the needle's position on the upper SWR scale. A meter reading of 1 on the upper scale is ideal.



The figure shown between the upper and lower scales on the meter (% REF POWER) indicates the percentage of power that is wasted through reflection of the signal from the antenna back into the antenna cable. For example, an SWR reading of 1.5 also means that 4% of your signal power is lost. However, 96% of the radio power is more than enough for almost all applications.

6. Repeat Steps 1–5 for each channel or frequency you want to get an SWR reading for.

Interpreting SWR Readings

An ideal SWR reading is 1.0, but this reading is usually possible only under laboratory conditions or with a dummy load. Actual antenna installations have higher readings. The information below will help you interpret the readings you get.

| SWR | Efficiency | Interpretation |
|------------|-------------|---|
| 1.0 to 1.5 | Excellent | The antenna cable and the antenna length match the transmitter's output requirements almost perfectly. |
| 1.5 to 2.0 | Very good | The antenna, the cable, and the transmitter operate very efficiently. |
| 2.0 to 3.0 | Acceptable | The antenna, the cable, and the transmitter operate with some loss. If possible, adjust your antenna or antenna mounting system to improve. |
| Above 3.0 | Inefficient | Adjust your antenna or antenna mounting system to improve efficiency. |

IMPROVING SWR

There are several ways to improve the SWR of your radio/antenna combination. Try these first.

- Be sure you are using the type of cable recommended for your equipment. If the manufacturer recommends a 50-ohm cable, do not substitute another type that has a different impedance.
- Confirm that you mounted your antenna according to the manufacturer's instructions. The angle and the base arrangement can affect the SWR reading.
- Adjust the length of your antenna according to the instructions provided by the manufacturer. A change of as little as $\frac{1}{8}$ inch can make a measurable difference.
- See your radio's and antenna's owner's manuals.

MEASURING FIELD STRENGTH

Your meter can measure the low levels of radio frequency (RF) generated by a radio transmitter. You can use these measurements to map the transmitting direction and coverage pattern of your antenna, or to compare your radio and antenna's efficiency before and after an adjustment. You do not need to connect the meter to the antenna or the radio to measure field strength.

It takes two people to measure field strength. For an accurate measurement, you will need to map the site around your antenna. Then, while someone presses the radio's transmit key, you will need to walk around the site around your antenna with the meter, marking the readings you see.

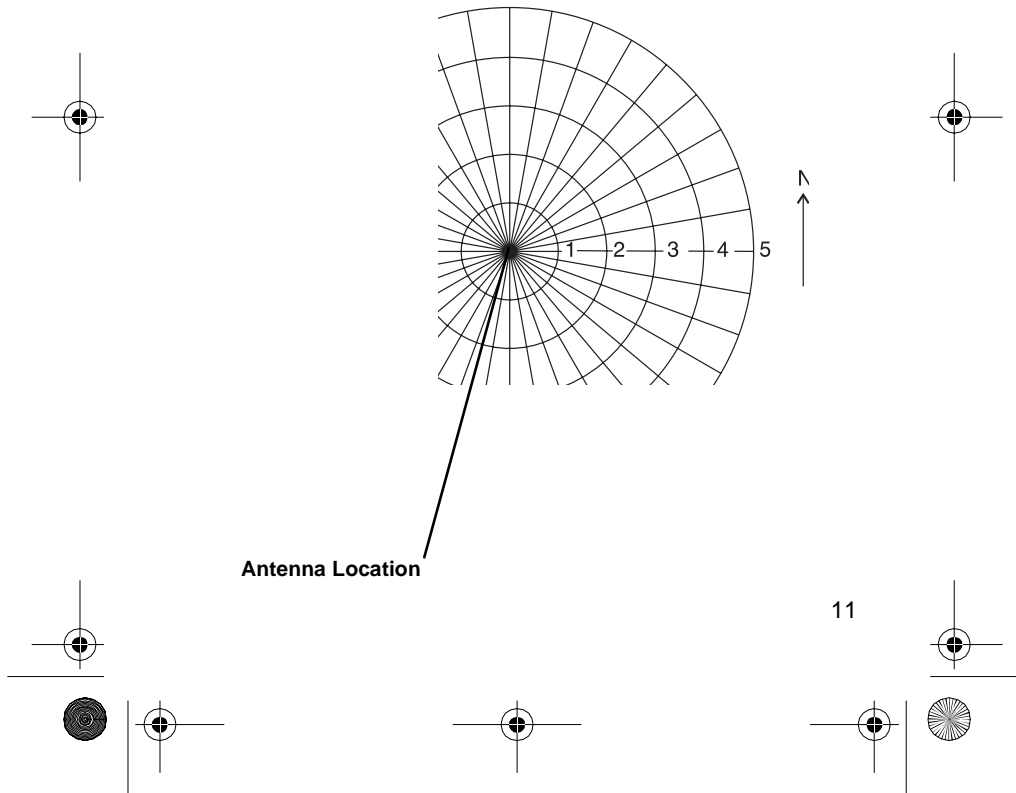
Hints:

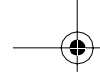
- In addition to the meter, we recommend you use the following items to help you measure field strength:
 - Several photocopies of the template on Page 11
 - 36 objects such as rocks or weighted pieces of paper
 - 25 feet of rope or strong cord
 - Calculator
 - Pencil
 - Compass
- Make sure there is at least 25 feet of open space in all directions around your antenna.

PREPARING THE ANTENNA SITE

Before you use the meter to measure field strength, you should mark the site around the antenna in a pattern that will help you make the measurement.

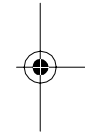
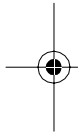
An easy way to do this is to map the area around your antenna using a template like this one.





The template shows an imaginary circle around an antenna. The spokes on the template represent imaginary straight lines measured from the center of the circle to 36 points spaced equally around the circle. Each straight line is 25 feet in length. The numbers on the template (1–5) are a guide to show you where to mark the field strength level the meter displays as you measure.

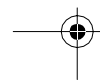
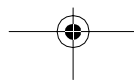
Hint: To help measure a circular path around the antenna, tie a slip knot in a 25-foot piece of rope or strong cord, slide the knot loosely around your antenna, then use the rope as a guide as you walk around the antenna.



Follow these steps to prepare the antenna site.

1. Starting at the antenna, use a compass to find due north. Then walk due north and stop about 15 to 25 feet away from the antenna.
2. Use an object such as a rock or a weighted piece of paper to mark where you are standing.
3. Walk around the antenna in a circle, using more objects to mark 35 more evenly spaced marks on the path.

Hint: You can quickly find the space to leave between each mark by using a calculator. Measure the diameter of the marked circle (from one side of the circle to the other). Then, divide the diameter by 11.46.



For example, for a 50-foot diameter circle:

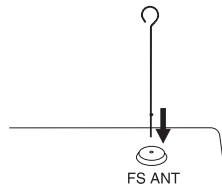
$$\frac{50 \text{ feet}}{11.46} = 4.363 \text{ Feet}$$

So, you would place a mark every 4.363 feet (4 feet, 3 inches).

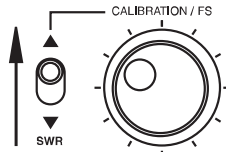
CALIBRATING THE METER/ MEASURING FIELD STRENGTH

Important: Be sure to follow any radio service regulations that limit the amount of time you can transmit without a break or station identification.

1. Remove the supplied short wire antenna attached to the bottom of the meter, then insert it into **FS ANT** on top of the meter.



2. Set **CALIBRATION/FS/SWR** to **CALIBRATION/FS**.



3. To calibrate the meter, have your helper select a channel or frequency on your transmitter and hold down its transmit key. Tell the helper *not* to speak into the microphone.

Then, while the helper holds down the transmit key, walk around inside the marks you made using the steps in "Preparing the Antenna Site" on Page 11, covering as much area inside the circle as you can. As you walk, watch the meter's needle. If it moves to the right of 5 on the **FIELD STRENGTH** scale, rotate the knob on the front of the meter until the needle lines up with 5 on the scale.

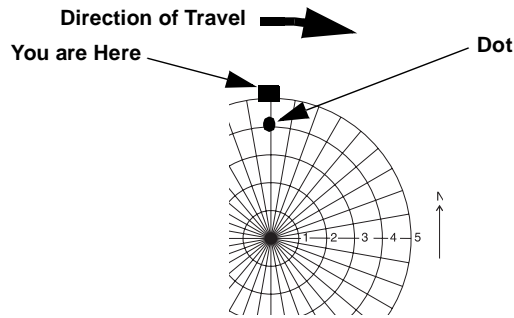
Notes:

- If you use a CB that has sideband modes (SSB), do not select any of these modes. (Use only AM for field strength measurements).

- If you have an amateur radio, select the continuous wave (CW) or tuning mode to check the field strength.
4. To measure field strength, as the helper continues to hold down the transmit key, move to the marked spot on the circle due north of the antenna, then watch the meter's needle.

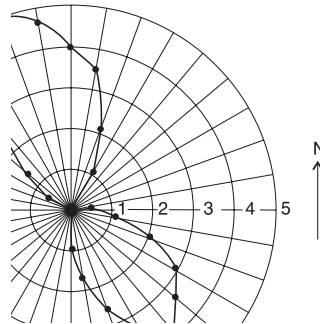
Note the reading on the FIELD STRENGTH scale and place a dot on the template on Page 11 corresponding to the reading at that point.

In this example, the needle shows a 4 on the FIELD STRENGTH scale. Place a dot where the spoke representing the path you walked from the center of the circle intersects the circle marked with a 4 on the template.



-
5. Move to each marked spot along the circular path then repeat Step 4 for each one, taking another reading and recording that reading on the template.

Here is an example of a completed template. It shows an antenna mounted on the rear bumper of an automobile that is parked facing north. The field strength readings form a two-lobed pattern when plotted, meaning the antenna's power is greatest at the front, weaker at the back, and almost nonexistent at the sides.



USING FIELD STRENGTH READINGS TO TUNE YOUR RADIO AND ANTENNA

You can use field strength measurements to monitor the effectiveness of changes you make to your radio and antenna *while* you make them. Changes you might make include:

- Installing a new antenna or antenna cable
- Adjusting the length of an antenna
- Changing the antenna mount on your vehicle
- Adjusting your radio's transmitter

You do not need to connect the meter to the antenna or the radio to measure field strength, but you will need two people. While someone presses the radio's transmit key, you will need to note the readings you see on the meter.

Important: Be sure to follow any radio service regulations that limit the amount of time you can transmit without a break or station identification.

1. Remove the supplied short wire antenna attached to the bottom of the meter, then insert it into **FS ANT** on top of the meter.
2. Set **CALIBRATION/FS/SWR** to **CALIBRATION/FS**.
3. To calibrate the meter, have your helper select a channel or frequency on your transmitter and hold down its transmit key. Tell the helper *not* to speak into the microphone.

Then, while the helper holds down the transmit key, walk around and adjust the meter's knob until the meter's needle moves to 3 on the FIELD STRENGTH scale.

Notes:

- If you use a CB that has sideband modes (SSB), do not select any of these modes. (Use only AM for field strength measurements).
- If you have an amateur radio, select the continuous wave (CW) or tuning mode to check the field strength.

4. Have the helper release the transmit key, then make a change to your radio or antenna (such as adjusting the antenna or transmitter or adding a new antenna).
5. When the change is completed, have the helper hold down the transmit key again while you watch the meter's needle.

If the field strength reading is higher, you have probably improved the power output and efficiency of your radio and antenna. If the field strength reading is lower, repeat Steps 4 and 5.

Note: If you move the physical location, or change the transmission direction, of your antenna, you might have to recalibrate the meter and measure the field strength again. See "Calibrating the Meter/Measuring Field Strength" on Page 13.

CARE AND MAINTENANCE

Your RadioShack CB/Ham Field-Strength SWR Meter is an example of superior design and craftsmanship. The following suggestions will help you care for your meter so you can enjoy it for years.



Keep the meter dry. If it gets wet, wipe it dry immediately. Liquids can contain minerals that can corrode the electronic circuits.



Handle the meter gently and carefully. Dropping it can damage circuit boards and cases and can cause the meter to work improperly.



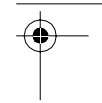
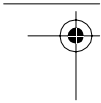
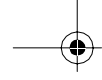
Use and store the meter only in normal temperature environments. Temperature extremes can shorten the life of electronic devices and distort or melt plastic parts.



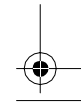
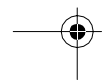
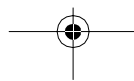
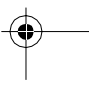
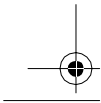
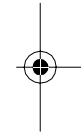
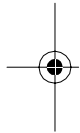
Keep the meter away from dust and dirt, which can cause premature wear of parts.

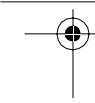


Wipe the meter with a damp cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the meter.



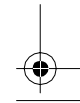
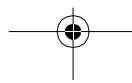
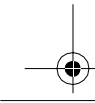
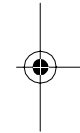
Modifying or tampering with your meter's internal components can cause a malfunction and might invalidate the meter's warranty and void your FCC authorization to operate it. If your meter is not operating as it should, take it to your local RadioShack store for assistance.





SCHEMATIC DIAGRAM

(illus - show schematic diagram of meter)



SPECIFICATIONS

| | |
|---------------------------|---|
| Measurable RF Power | 1–1000 Watts |
| SWR | 1–3 |
| Impedance | 50 Ohms |
| Frequency Range | 3–30 MHz |
| Dimensions (HWD) | 2 ⁹ / ₁₆ ¥ 6 ⁵ / ₁₆ × 3 ¹⁵ / ₁₆ Inches (65 ¥ 160 ¥ 100 mm) |
| Weight | 8 oz (226 g) |

Specifications are typical; individual units might vary. Specifications are subject to change and improvement without notice.

Limited Ninety-Day Warranty

This product is warranted by RadioShack against manufacturing defects in material and workmanship under normal use for ninety (90) days from the date of purchase from RadioShack company-owned stores and authorized RadioShack franchisees and dealers. EXCEPT AS PROVIDED HEREIN, RadioShack MAKES NO EXPRESS WARRANTIES AND ANY IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE DURATION OF THE WRITTEN LIMITED WARRANTIES CONTAINED HEREIN. EXCEPT AS PROVIDED HEREIN, RadioShack SHALL HAVE NO LIABILITY OR RESPONSIBILITY TO CUSTOMER OR ANY OTHER PERSON OR ENTITY WITH RESPECT TO ANY LIABILITY, LOSS OR DAMAGE CAUSED DIRECTLY OR INDIRECTLY BY USE OR PERFORMANCE OF THE PRODUCT OR ARISING OUT OF ANY BREACH OF THIS WARRANTY, INCLUDING, BUT NOT LIMITED TO, ANY DAMAGES RESULTING FROM INCONVENIENCE, LOSS OF TIME, DATA, PROPERTY, REVENUE, OR PROFIT OR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, EVEN IF RadioShack HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Some states do not allow the limitations on how long an implied warranty lasts or the exclusion of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

In the event of a product defect during the warranty period, take the product and the RadioShack sales receipt as proof of purchase date to any RadioShack store. RadioShack will, at its option, unless otherwise provided by law: (a) correct the defect by product repair without charge for parts and labor; (b) replace the product with one of the same or similar design; or (c) refund the purchase price. All replaced parts and products, and products on which a refund is made, become the property of RadioShack. New or reconditioned parts and products may be used in the performance of warranty service. Repaired or replaced parts and products are warranted for the remainder of the original warranty period. You will be charged for repair or replacement of the product made after the expiration of the warranty period. *(continued)*

(continued) This warranty does not cover: (a) damage or failure caused by or attributable to acts of God, abuse, accident, misuse, improper or abnormal usage, failure to follow instructions, improper installation or maintenance, alteration, lightning or other incidence of excess voltage or current; (b) any repairs other than those provided by a RadioShack Authorized Service Facility; (c) consumables such as fuses or batteries; (d) cosmetic damage; (e) transportation, shipping or insurance costs; or (f) costs of product removal, installation, set-up service adjustment or reinstallation.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

RadioShack Customer Relations, Dept. W, 100 Throckmorton St., Suite 600,
Fort Worth, TX 76102

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