MFJ-208 VHF SWR Analyzer

Thank you for purchasing the MFJ-208 VHF SWR Analyzer. The MFJ-208 gives you a direct readout of your antenna's SWR without the need for formulas or indirect readings. The MFJ-208 can also be used to adjust a tuner to match your antenna without the need for transmitting. The frequency coverage for the MFJ-208 is from approximately 142 MHz to 156 MHz.

The MFJ-208 requires the MFJ-1312 power supply adapter (optional) or a nine-volt transistor battery.

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* NOTE: If you use a battery with the MFJ-208, use
*   an ALKALINE nine-volt battery.
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To install a battery, remove the screws holding on the cover. Insert the battery into the battery holder. Tuck the battery snap wires out of the way so they do not interfere with the tuning capacitor rotation. Re-install the cover and screws. The dial calibration is only approximate and is for reference only. A frequency counter can be connected to the FREQ. OUT jack (RCA phono) to get a more accurate reading of the frequency. As an alternative to a frequency counter, you can zero beat the output with an VHF receiver. See APPENDIX A.

USING THE MFJ-208 VHF SWR ANALYZER

Your MFJ-208 VHF SWR Analyzer has many uses. It can be used to find the resonant frequency of your antenna, to find the SWR of your antenna at a particular frequency, find the frequency at which your antenna has the lowest SWR. You can also use the SWR Analyzer to adjust your antenna to a low SWR and to adjust an antenna tuner (MFJ-921 or MFJ-920) to match the transmitter to the line.

Measurement of the antenna's SWR is done right at the input to the transmission line. There is no need to climb the tower and measure the SWR at the antenna. Using the chart in Figure 3, and knowing the line loss for your transmission line and the SWR at the line input, you can determine the SWR at the antenna, regardless of line length
or line loss.

I. **Measure the antenna's SWR at a particular frequency.**

1. To check the SWR of your antenna, connect the antenna with a PL-259 connector to the ANTENNA connector on the MFJ-208.

NOTE: If you are using coax as your feedline, connect the coax directly to the UHF connector marked ANTENNA. If you are using an open-wire feedline, wire the feedline to a PL-259 connector, then attach it to the ANTENNA connector of the MFJ-208.

2. Push the power button to ON. The LED should light. 3. Adjust the frequency dial of the SWR ANALYZER to read the frequency at which you want to check the SWR.
4. Read the SWR from the meter. This is the SWR at the INPUT TO THE TRANSMISSION line looking toward the load (antenna). To determine the SWR at the antenna, use Figure 3 in APPENDIX D.

5. Using steps 1 through 5, you can make a plot of SWR versus FREQUENCY for your antenna. Just plot the SWR at many different frequencies. APPENDIX B has an SWR vs. FREQUENCY chart. We suggest you make photocopies of this chart so you can use it for several antennas.

II. Find the frequency at which the antenna has the lowest SWR.

1. Connect the antenna to the MFJ-208 as in step I.
2. Push the power button to ON.
3. Adjust the TUNE control throughout its range until the SWR meter reads its lowest value. Read the frequency on the tuning dial. Read the SWR on the meter.

III. **Adjust the antenna** for 1:1 SWR.

1. Turn the frequency TUNE knob until the pointer is on the freq at which you want to tune the antenna.

NOTE: For accuracy, use a frequency counter attached to the COUNTER output on the SWR ANALYZER or zero-beat against the receiver.

2. Read the SWR on the meter. If the meter reads other than 1:1 SWR, adjust the antenna until the antenna reads 1:1 SWR (or lowest value obtainable).

NOTE: The MFJ-208 can tell you whether the antenna elements are too short or too long. If you find the antenna's resonant frequency is too low, then the elements are too long. If the resonant frequency is higher than you want, then the elements are too short.

If you are adjusting an antenna for the first time, it is recommended you start with elements a little too long, then shorten to resonance. Again, the SWR for your particular antenna may never get as low as 1:1. Adjust for the lowest reading.

IV. Using the MFJ-208 to adjust an antenna tuner.

1. Connect the antenna to the antenna tuner connector marked ANTENNA, then connect the tuner connector marked TRANSMITTER to the MFJ-208 connector marked ANTENNA.
2. Push the power to the ON position.
3. Set the frequency dial to the desired operating frequency. Adjust the tuner's controls until the meter on the MFJ-208 indicates 1:1 SWR (nulls).
4. Disconnect the MFJ-208 completely and connect the tuner to the transmitter.
5. Push the power switch to the OFF position when you are finished checking the SWR.

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* CAUTION: Never transmit through the MFJ-208. Take the *
* MFJ-208 completely out of line before transmit- *
* ting! Damage to your MFJ-208 may result if it *
* is left in line. *
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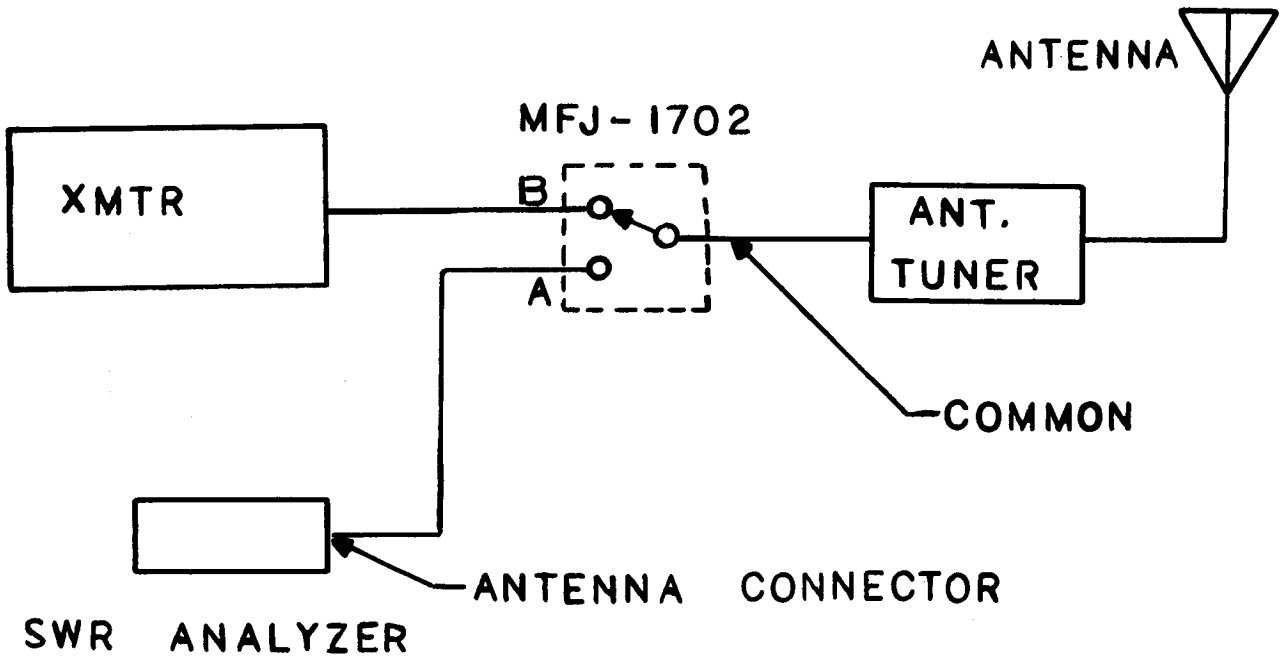
We recommend using the MFJ-1702 coax switch as in the diagram below:

WARNING: NEVER TRANSMIT WHILE THE MFJ-1702 COAX SWITCH IS SWITCHED



TO A if the XMTR is connected to B.

Damage to your radio can occur.

TRANSMIT ONLY WHEN THE COAX SWITCH IS SWITCHED TO THE CONNECTOR TO WHICH THE XMTR IS CONNECTED.

If the XMTR input is on B, then transmit only when the coax switch **is in** position B.

If the XMTR input is on A input, transmit only when the coax switch **is in** position **A.**

The center conductor of the UNSELECTED position is grounded, so transmitting into B while the switch is thrown to **A will** cause you to be transmitting into a dead short to ground.

NOTE: MFJ ENTERPRISES,INC. will NOT **be liable for any** damage to your radio or other equipment due to improper connection or use of the MFJ-1702 **coax** switch.

APPENDIX A

HOW TO ZERO-BEAT THE MFJ-208 AGAINST THE RECEIVER

The FREQ. OUT port on the MFJ-208 has a sine wave output which can be used to accurately check the frequency at which the MFJ-208 is working.

To zero-beat the 208 against the receiver, loosely couple a wire from the RCA jack (Free. Out) to the antenna connector on your radio.

First, try a small length of wire from the FREQ. OUT connector of the SWR ANALYZER. Just leave it dangling free, not touching the ANTENNA input of the receiver. Place the far end of the wire near the receiver input but do not connect to the input unless you simply cannot hear the signal at all in the receiver. The output of the SWR ANALYZER is high (typically 0 dB). **Damage to some radios may occur with a direct connection, so you assume all risk involved in making a direct connection to your radio.**

Turn the radio on and tune to the frequency in question. For example, if you want to check your 2 meter Yagi on 146 MHz, set the radio for 146.000 MHz. Turn the audio down because the signal coming out of the MFJ-208 is pretty strong.

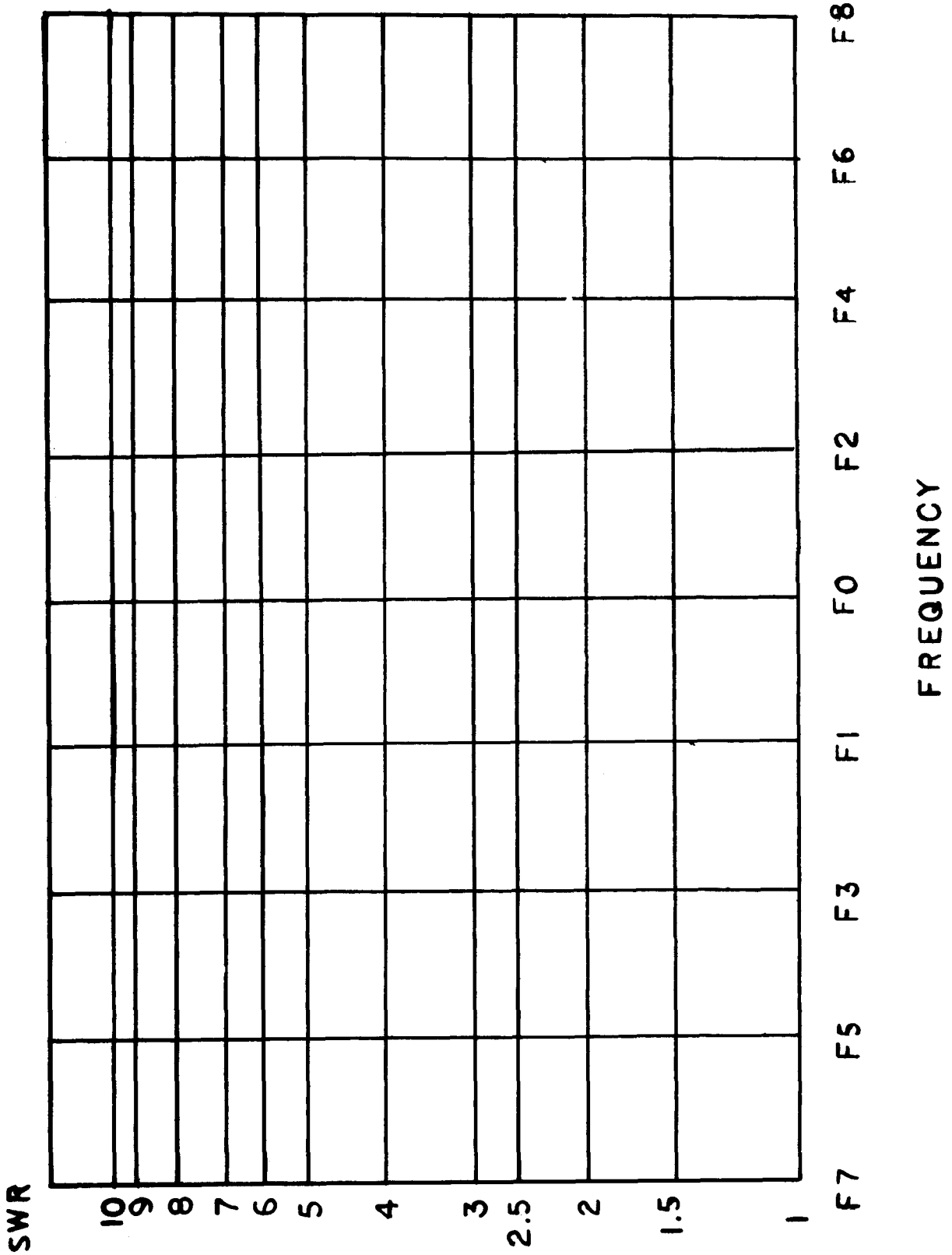
Adjust the TUNE dial on the MFJ-208 until you start hearing a tone in the radio's speaker. As you turn the TUNE dial, the frequency will start at a very high pitch, then decrease to zero pitch. Where the tone cannot be heard is the "zero beat". That means the radio frequency is set to the exact frequency of the MFJ-208.

Now make a note of where the dial is set to on the MFJ-208 so you can re-set the frequency if you accidentally bump the TUNE control.

You can now disconnect the radio and connect the antenna to the MFJ-208.

APPENDIX B

FREQUENCY/SWR PLOTTING CHART



APPENDIX C

Facts About Transmission Lines and Line Loss.

It is not necessary to connect the MFJ-208 to the antenna directly to determine its SWR. The MFJ-208 should be connected to the input to the transmission line. You do NOT have to know the length in wavelength of your transmission line, but you do need to know the number of feet (or meters) and the loss (in dB) for the length of the transmission line you are using. Using the SWR/Line loss chart below you can readily determine the SWR at the antenna. As you will see, the most important consideration for any antenna system is probably the loss in the transmission line. The less loss, the better. Two important points about transmission lines need to be understood:

1. On a LOSSLESS transmission line, the SWR read at the transmitter is the same as the SWR at the antenna. For any line with loss the SWR is greatest at the antenna and minimum at the transmitter.

2. Regardless of the losses in the transmission line, if the SWR at the transmitter is 1:1 (due to matching), then the SWR at the antenna is 1:1, but if there is ANY SWR at the input to the transmission line, there is a higher SWR at the antenna (assuming anything but a lossless line).
   Let's go through a practical example:

   Let's say you are using RG-8/U which has a loss of 2.3 dB at 146 MHz per 100 feet. You are using only 50 feet of cable, so your loss when matched at the transmitter is 1.15 dB at 146 MHz.

   Go to Figure 3 and find the 1 dB loss line which curves up and to the right.

   Now assume you are using the MFJ-208 and find that the lowest SWR you can get on your antenna is 1.5:1.

   Follow the 1 dB (1.15 dB is for all practical purposes the same as 1.0 dB) curve down to the point it reads 1.5:1 on the horizontal axis (SWR at transmitter).

   Looking at the vertical axis we can see that the point corresponds to an SWR of 1.8:1 on the vertical axis.

   Reading this chart correctly tells us that with 50 feet of RG-8/U that has a loss of 2.3 dB per 100 feet at 146 Mhz and a line input SWR of 1.5:1, the SWR at the antenna is 1.8:1.

   By the way, the 1.8:1 SWR at the load only adds about .2 dB of loss to the already matched 1.15 dB of loss for a total loss of 1.35 dB. (See ARRL Antenna Book.)

APPENDIX D

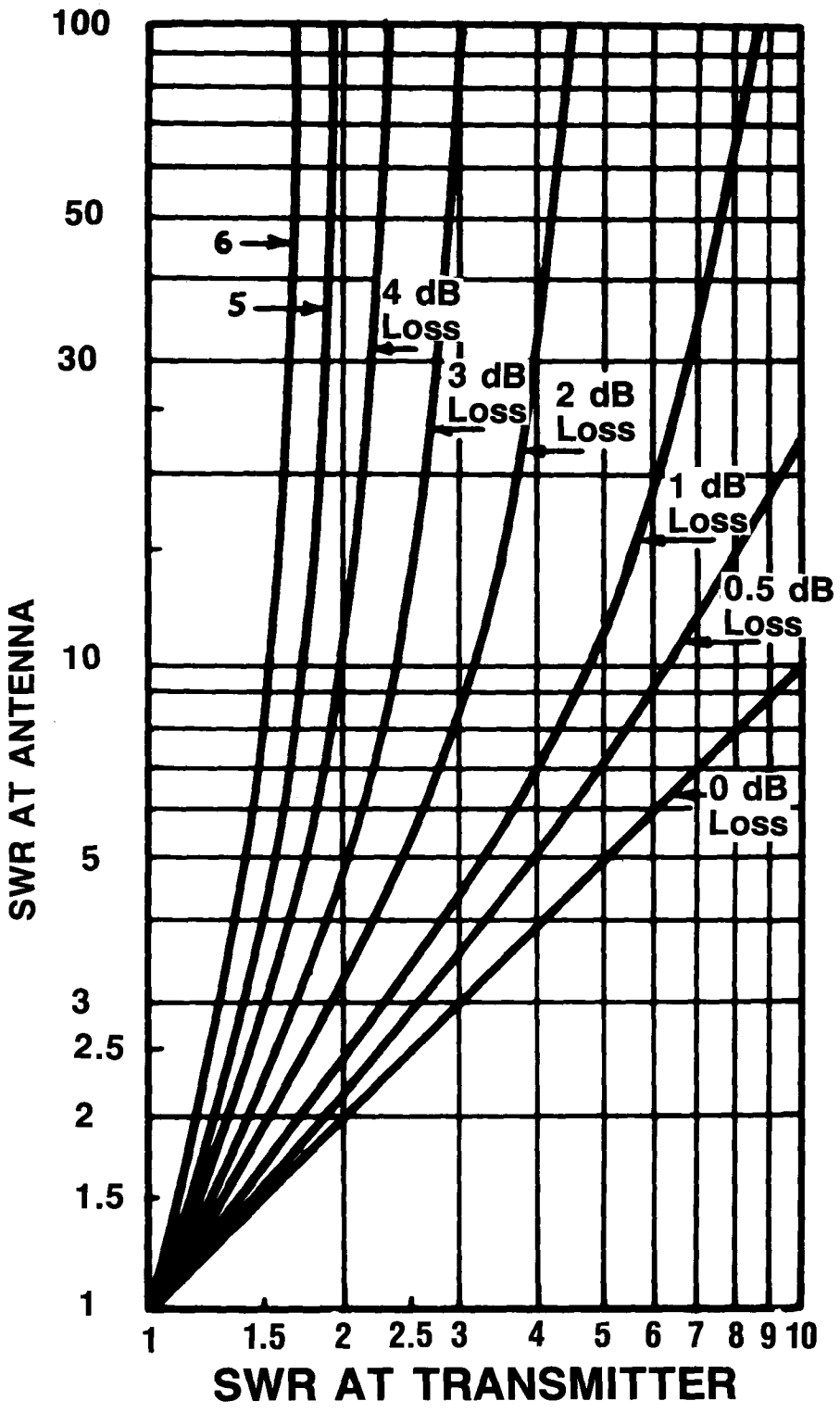


Figure 3 - SWR at Transmitter versus SWR at Antenna chart.