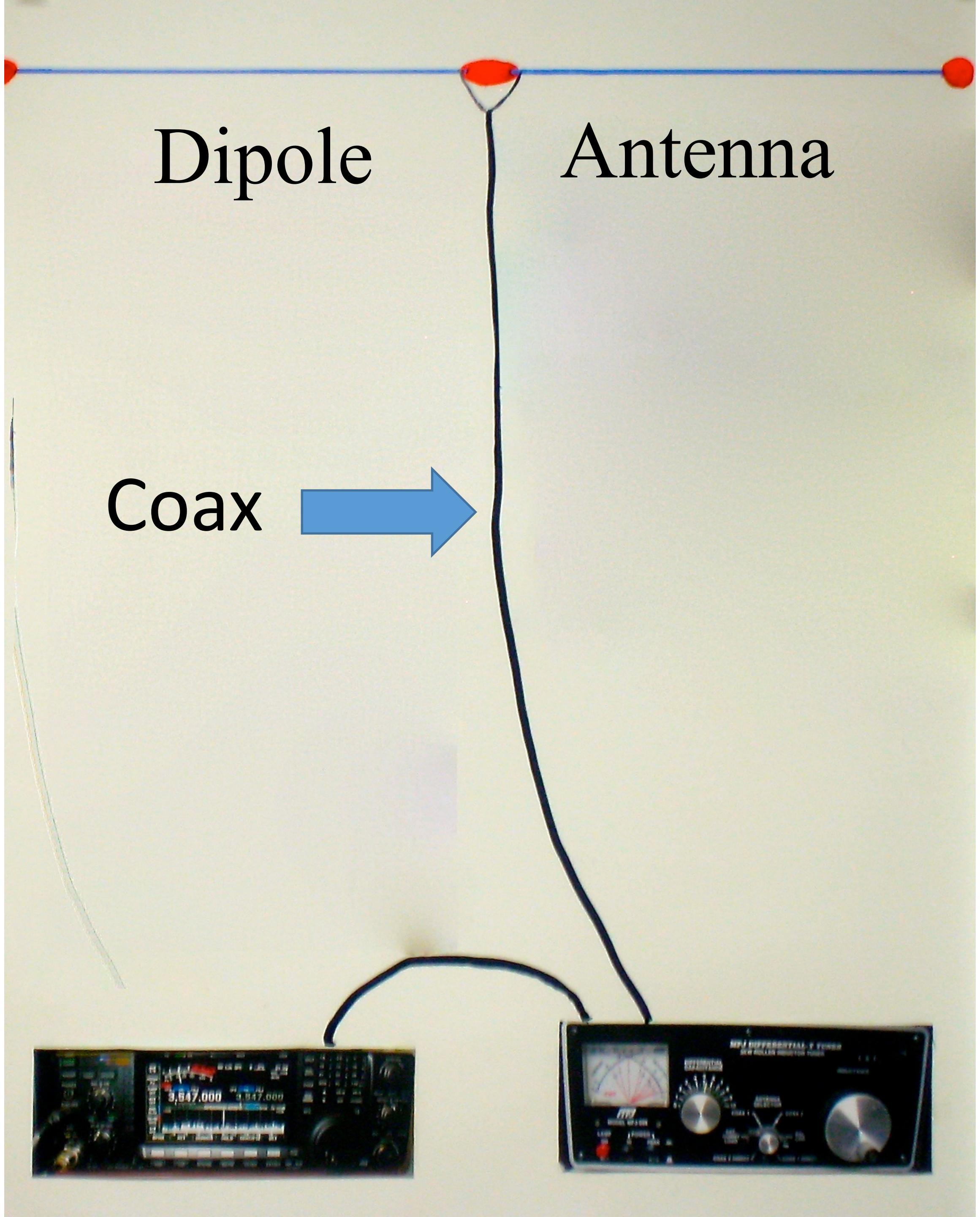
Antenna Tuners

Impedance Matching

Transmission Lines


Dipole
Antenna
Coax

When the antenna is 50 ohms, and the transmission line is 50 ohms, the impedance of the transmission line will be 50 ohms anywhere along the line and you have a good match. No antenna tuner would be needed.

A reactive load will not absorb or radiate RF energy. Only the resistive load will radiate power. The reactive load will present a mismatch and part of the power will be reflected back down the transmission line.

A mismatch at the antenna creates standing waves due to the reflected power.

Even at resonance, with a purely resistive load, we can have a mismatch when the impedance of the antenna does not match the impedance of the transmission line.

There is absolutely NOTHING you can do at the input of the transmission line to change the SWR or the impedance at the antenna.

Let me repeat that again!

There is absolutely NOTHING you can do at the input of the transmission line to change the SWR or the impedance at the antenna.

Some people think they can change the SWR by changing the length of the transmission line. The SWR does NOT change but the impedance can change DRASTICALLY by adding or subtracting a section of transmission line.

You could find a point that the radio would see a good load and transfer maximum power by changing the line length, but it is much easier with an antenna tuner. The tuner will match the 50 ohm radio to a rather large or small impedance looking into the transmission line.

The impedance of an antenna depends on several factors. The design, the feed point, the conductor size and length, and the method of feed.

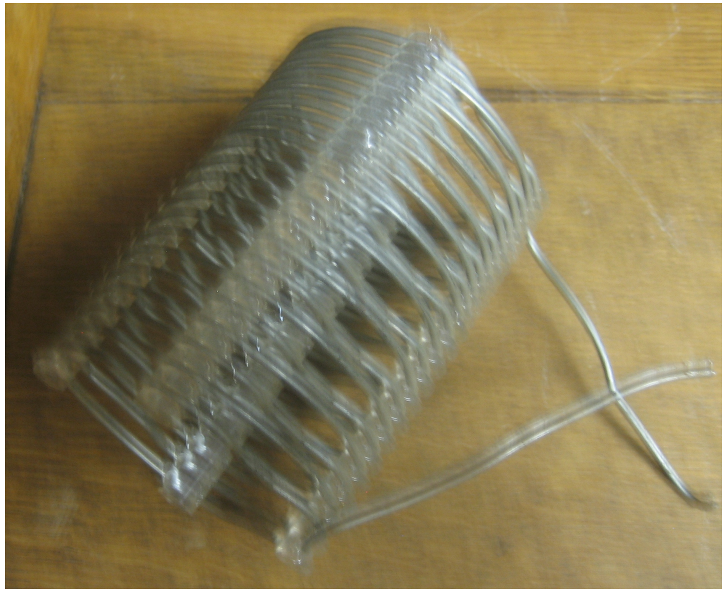
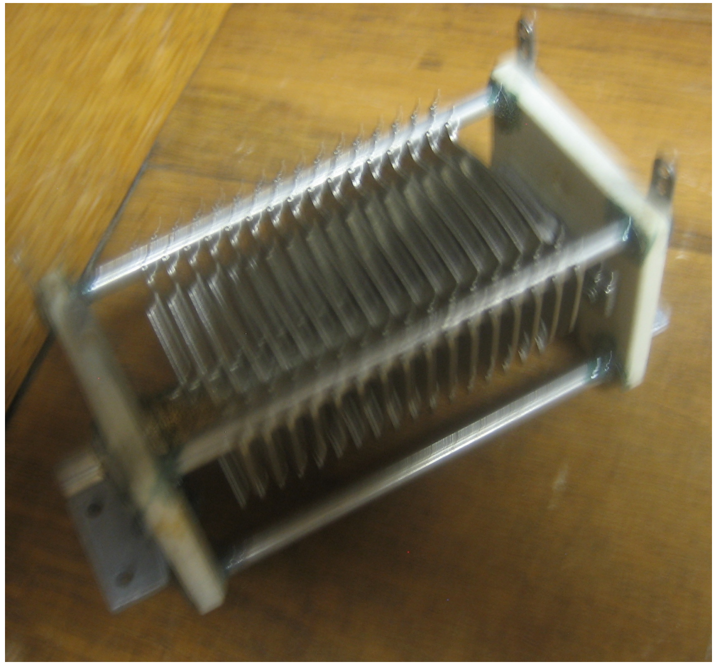
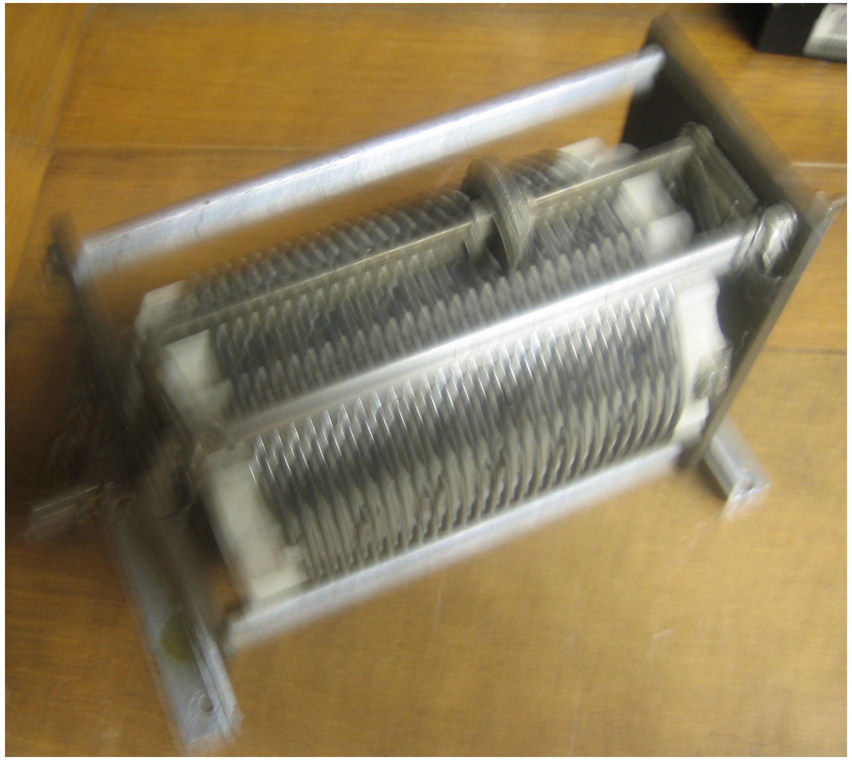
The impedance will also vary as the frequency is moved away from the resonant frequency. At resonance, we should see a purely resistive load, but as the frequency is changed higher or lower, we will see Inductive or Capacitive Reactance introduced along with the resistive load.

Most modern day radios have a built in protection circuit that will reduce the power output when the load seen by the radio does not match the output impedance of the radio, which is normally about 50 ohms. The power is reduced to protect the radio from over heating.

When the radio “Sees” a 50 ohm load, it will deliver maximum power out to that load; therefore we sometimes have to trick the radio into thinking it is working into a good antenna system by inserting an Antenna Tuner.

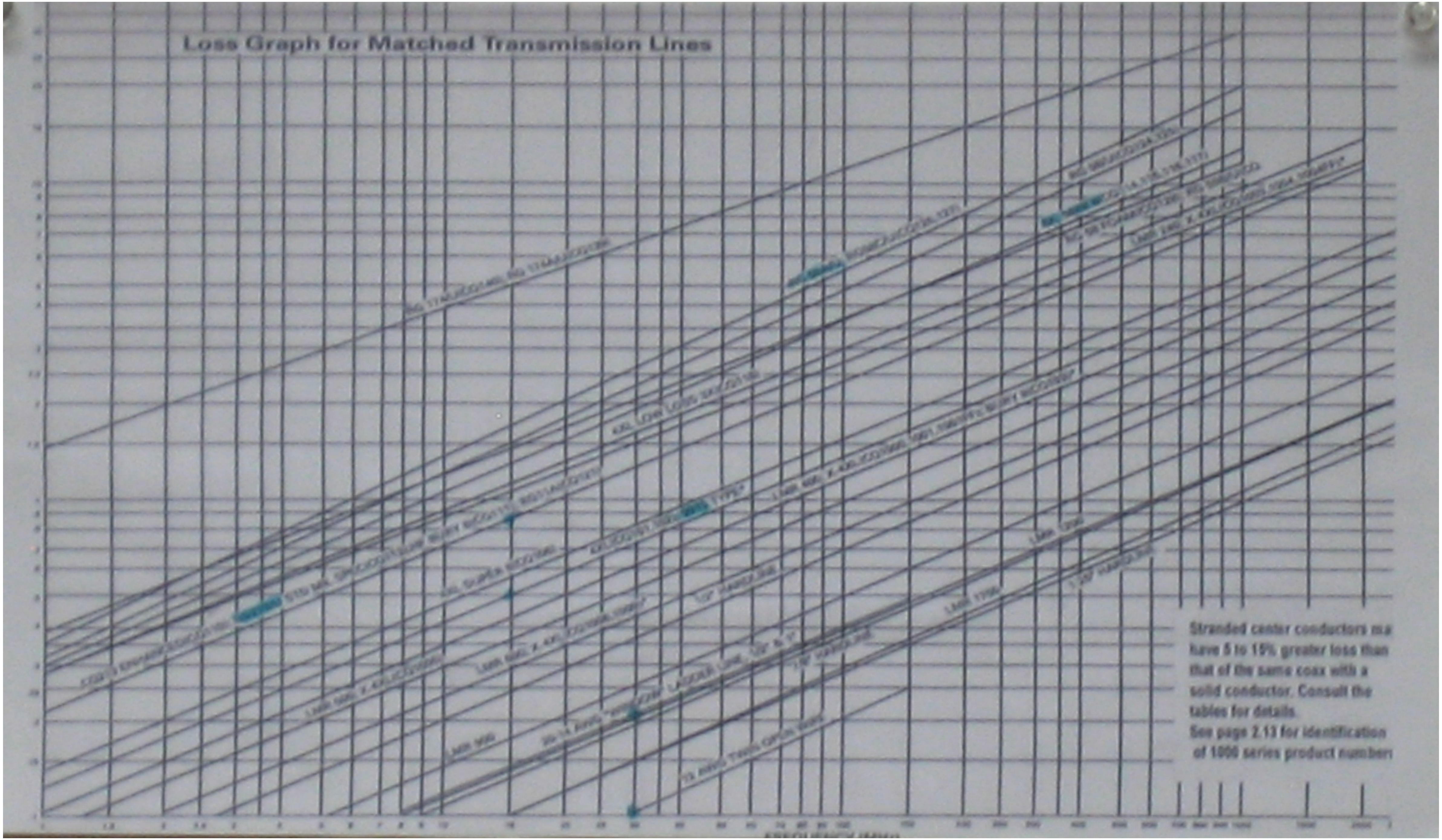
The antenna tuner is capable of offsetting the mismatch by creating a reverse mismatch and let the radio see a good load.

By the use of switched or variable inductors, and variable capacitors, we can match the 50 ohms from the radio to the unknown impedance of the transmission line.

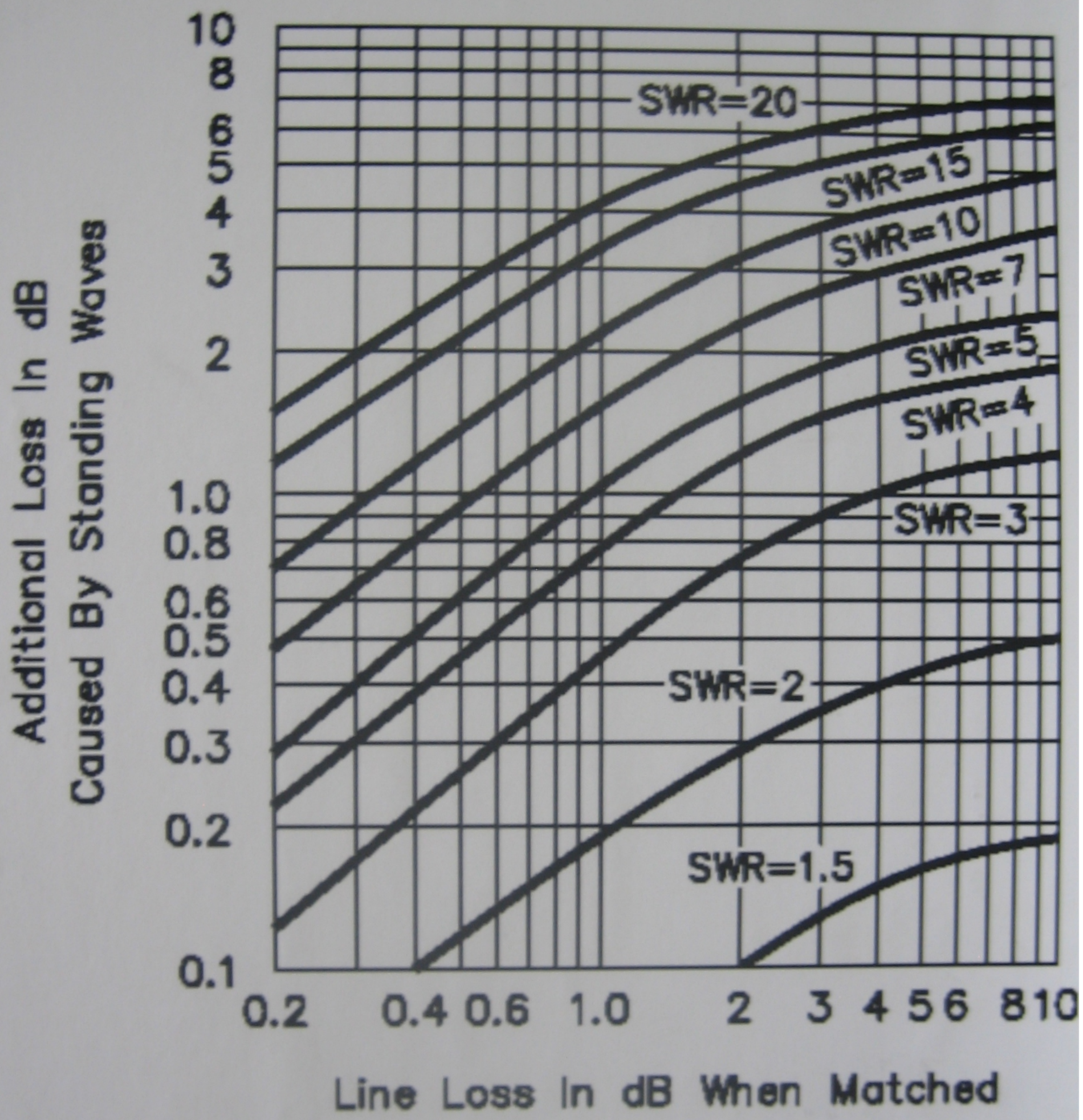
So, now the radio “Sees” a good load and we are putting out a full power level of 100 watts……. But how much is actually being radiated?

Every transmission line has loss, and some lines have a lot more than others. When the power starts up the transmission line, there is some loss, and when some of the power is reflected, there is more loss, and when the reflected power is re-reflected by the antenna tuner, there is more loss again.


Loss Graph for Matched Transmission Lines
Stranded center conductors may have 5 to 15% greater loss than that of the same coax with a solid conductor. Consult the tables for details.
See page 2.13 for identification of 1000 series product numbers

Copied From RF Parts

.1 dB	= 2.2 %	Power Loss
.2 dB	= 4.5 %	Power Loss
.3 dB	= 6.6 %	Power Loss
.4 dB	= 8.7 %	Power Loss
.5 dB	= 10.8 %	Power Loss
.6 dB	= 12.9 %	Power Loss
.7 dB	= 15 %	Power Loss
.8 dB	= 16.8 %	Power Loss
.9 dB	= 18.7 %	Power Loss
1 dB	= 20 %	Power Loss
2 dB	= 36 %	Power Loss
3 dB	= 50 %	Power Loss
4 dB	= 60 %	Power Loss
5 dB	= 68 %	Power Loss
6 dB	= 75 %	Power Loss
8 dB	= 84 %	Power Loss
9 dB	= 87.5 %	Power Loss
10 dB	= 90 %	Power Loss



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